United States
Department of
Agriculture

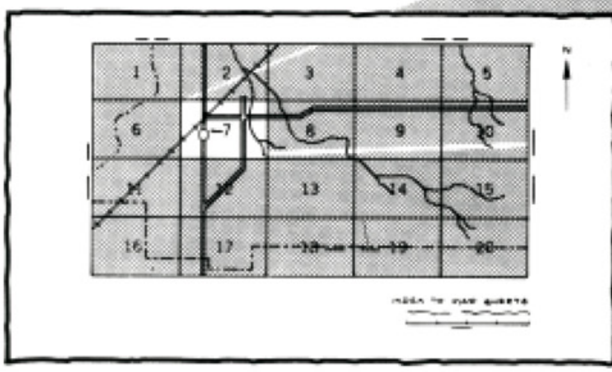
Soil
Conservation
Service

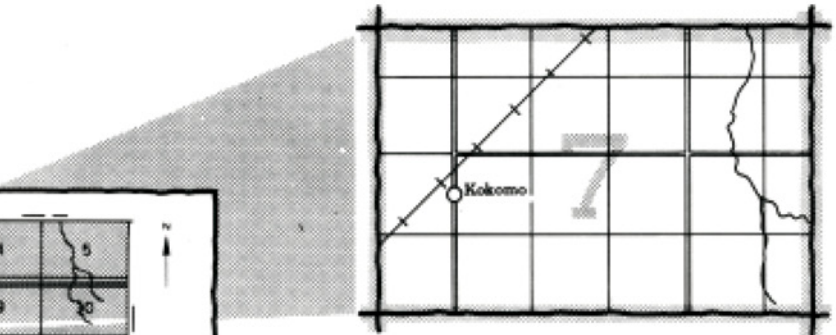
In cooperation with
United States Department of
Agriculture, Forest Service;
Purdue University
Agricultural Experiment
Station; and
the Indiana Department
of Natural Resources,
Soil and Water
Conservation Committee

Soil Survey of Orange County Indiana

HOW TO USE

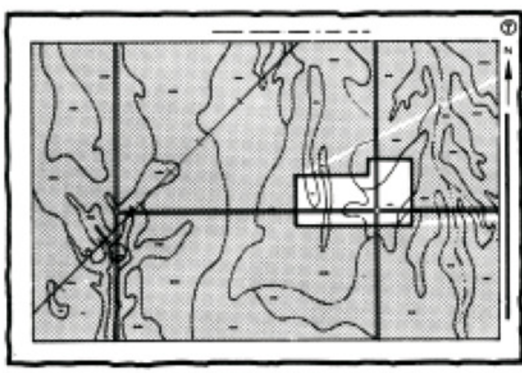
1. Locate your area of interest on the "Index to Map Sheets"

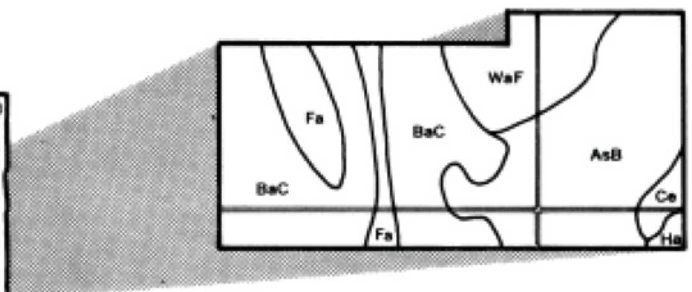




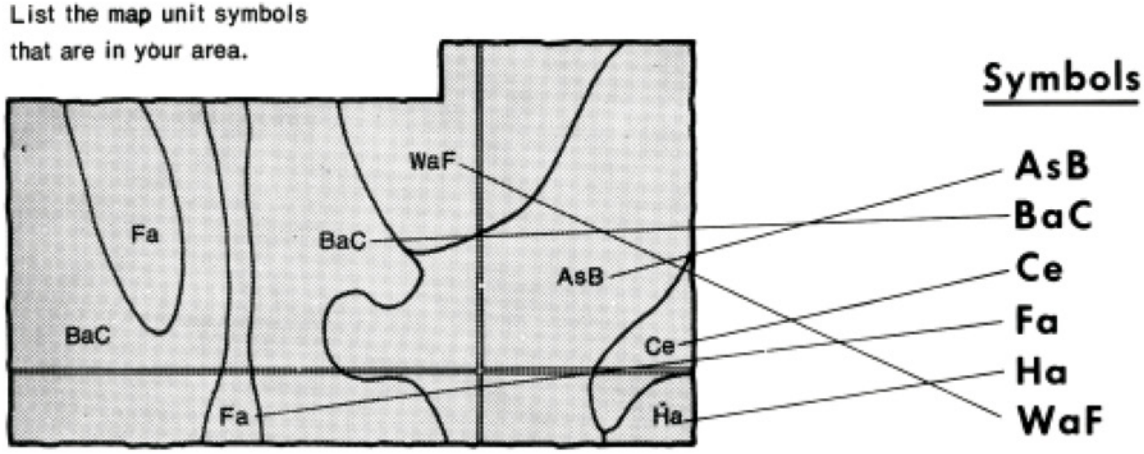
2. Note the number of the map sheet and turn to that sheet.

3. Locate your area of interest on the map sheet.



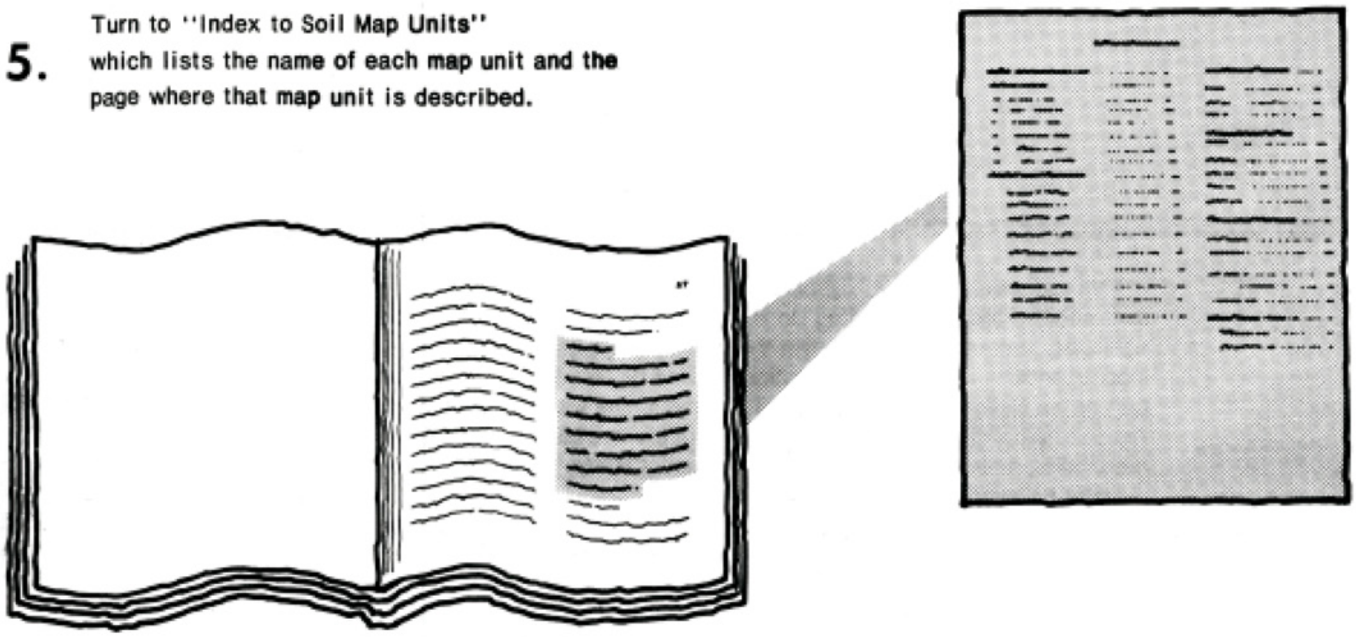


4. List the map unit symbols that are in your area.

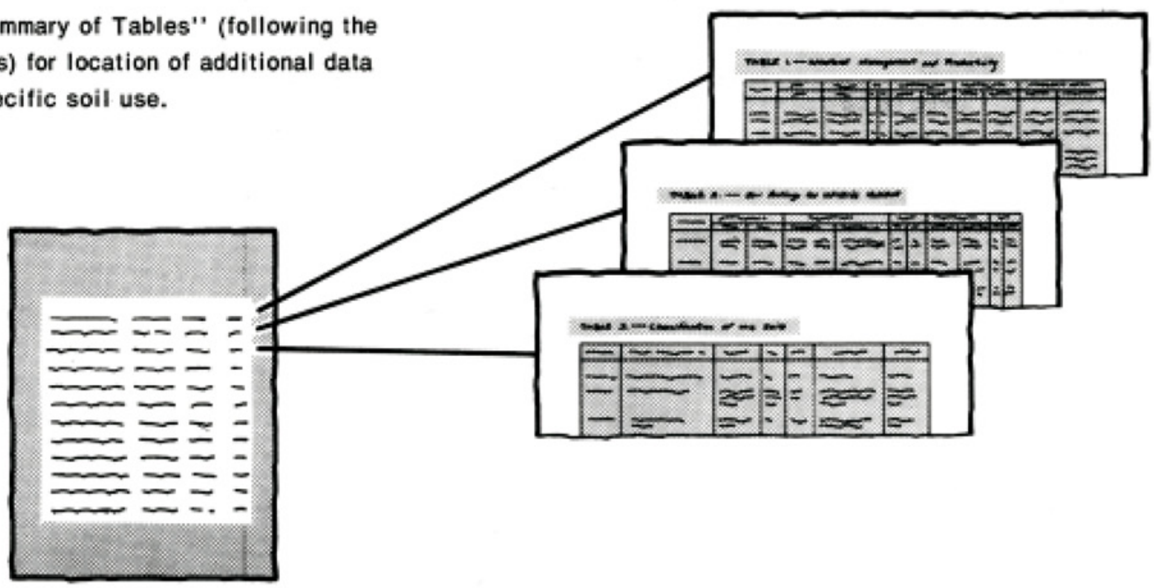


THIS SOIL SURVEY

5. Turn to "Index to Soil Map Units" which lists the name of each map unit and the page where that map 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; to 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 by the Soil Conservation Service in cooperation with Purdue University Agricultural Experiment Station; the Indiana Department of Natural Resources, Soil and Water Conservation Committee; and the U.S. Department of Agriculture, Forest Service. It is part of the technical assistance furnished to the Orange County Soil and Water Conservation District. The Board of County Commissioners of Orange County provided financial assistance for this survey.

Major fieldwork for this soil survey was completed in 1980. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980.

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.

Cover: Wellston silt loam, 6 to 12 percent slopes, eroded, is used mainly for hay and pasture. In some areas, it is used for cultivated crops.

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Soil Series

Issued May 1984

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Summary of Tables

Foreword

This soil survey contains information that can be used in land-planning programs in Orange County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, 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.

Robert L. Eddleman

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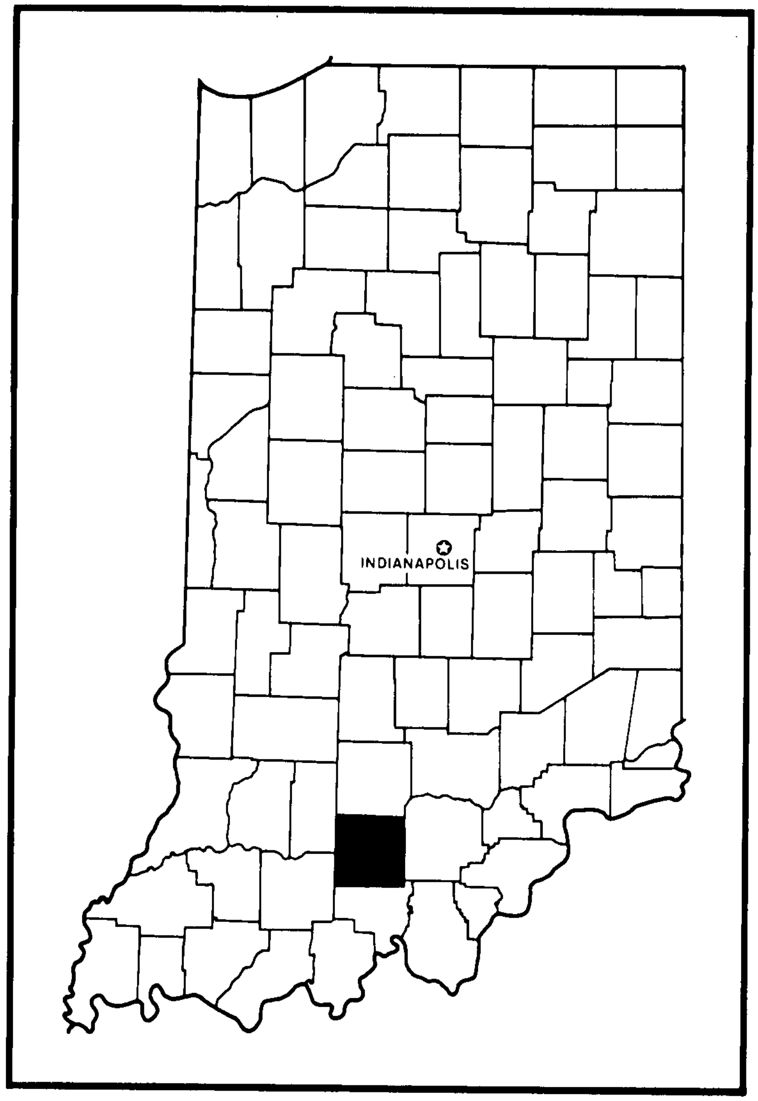
State Conservationist
Soil Conservation Service



Location of Orange County in Indiana.

Soil Survey of Orange County, Indiana

By Robert C. Wingard, Jr., Soil Conservation Service

Fieldwork by Robert C. Wingard, Jr., Soil Conservation Service,
and J. Russell Boulding, Gary L. Hudson, and Robert S. Guthrie,
Indiana Department of Natural Resources,
Soil and Water Conservation Committee

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

ORANGE COUNTY is in the south-central part of Indiana. It has an area of 259,200 acres, or about 405 square miles. The county extends about 20 miles from north to south and about 20 miles from west to east. Paoli, the county seat, is near the center of the county. The population of the county in 1980 was 18,677.

Orange County was established on December 26, 1815, from parts of Washington, Gibson, and Knox Counties. It was named after Orange County, North Carolina, which had been the home of one of the founders.

Most of the soils in Orange County are suited to use as cropland, pasture, or woodland. In the northeastern part of the county, the soils are mainly nearly level to moderately sloping and are dominantly somewhat poorly drained to well drained. If properly managed, these soils are well suited to crops and pasture. In the rest of the county, the soils are mainly moderately sloping to very steep and are dominantly well drained. These soils are suited to pasture and trees.

General Nature of the County

In this section the climate; physiography, relief, and drainage; transportation facilities; and natural resources of the county are described.

Climate

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

Table 1 gives data on temperature and precipitation for the survey area as recorded at Paoli, 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 32 degrees F, and the average daily minimum temperature is 21 degrees. The lowest temperature on record, which occurred at Paoli on January 28, 1963, is -27 degrees. In summer the average temperature is 73 degrees, and the average daily maximum temperature is 86 degrees. The highest recorded temperature, which occurred at Paoli on July 15, 1954, is 107 degrees. In summer the temperature in the valleys is slightly higher than the temperature at the higher elevations.

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 (50 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 45 inches. Of this, 24 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 21 inches. The heaviest 1-day rainfall during the period of record was 5.73 inches at Paoli on July 21, 1973. Thunderstorms occur on about 45 days each year, and most occur in summer.

The average seasonal snowfall is 17 inches. The greatest snow depth at any one time during the period of record was 12 inches. On an average of 3 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 75 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the south-southwest. Average windspeed is highest, 10 miles per hour, in March.

Physiography, Relief, and Drainage

Orange County has two distinct physiographic areas. The northeastern part of the county lies on the Mitchell Plain, a rolling upland area underlain by limestone. Karst topography is a distinctive feature of the plain. Further east, a thick mantle of clay creates a gently rolling landscape that includes many somewhat poorly drained and poorly drained low areas. The southern and western parts of the county lie within the Crawford Upland and are underlain by interbedded sandstone, siltstone, shale, and limestone. This area is characterized by rugged topography and high relief.

The highest elevation, about 970 feet above sea level, is in the southeastern part of the county about 1.5 miles southwest of Rego. The lowest elevation, about 470 feet above sea level, is at the point where the Lost River flows westward into Martin County.

Orange County is dissected by many small streams that empty into either the Patoka River, in the southern part of the county, or the Lost River, in the northern part of the county. Sinkholes are abundant in the area around Orleans, and an underground drainage system has developed. Part of this system flows into the Lost River, and part of it flows into the East Fork White River, north of the county. Small areas of the northeastern and northwestern parts of the county are drained by streams that empty into the East Fork White River. A small area in the southeastern part of the county is drained by streams that empty into the Blue River.

The Lost River drainage system is unique in that a large part of it flows underground. The Lost River originates in Washington County and flows westward, fed by tributary streams that form a normal dendritic pattern. There are few sinkholes in the area drained by the first section of the Lost River. About 5 or 6 miles from the Orange-Washington County line, however, the Lost River and its tributary streams begin to disappear into a series of sinks or swallow holes. Most of the surface water in the area also drains into sinkholes. From the place where the Lost River disappears to where it reappears, there is a dry-bed channel that contains water only in periods of excessive rainfall. Most of the time, the water flows in an underground stream to a place south of Orangeville where it resurfaces.

Transportation Facilities

State Road 37 is the main road that traverses the county from north to south, and U.S. Highway 150 and State Road 56 are the main roads that traverse the county from east to west. State Roads 145, 337, and 60 also serve parts of the county, and there are about 650 miles of county roads. Three airports in the county accommodate light planes. The L&N Railroad also serves the county.

Natural Resources

Soil is the most important natural resource in the county. Crops and livestock raised in the county are marketable commodities that are derived from the soil. A large part of the county is in woodland, and timber is another important product.

Limestone is also an important natural resource. Limestone quarries produce limestone aggregate and agricultural lime. In the past, sandstone was also quarried for use as building stone. The whetstone business, at one time, was the largest in the country. Stones were quarried and polished and shipped as far as New York and England.

Farming

Farming in Orange County is based mainly on growing grain and raising hogs and cattle. Corn, soybeans, and wheat are the main crops. Meadow crops provide hay and pasture for livestock. Most pastures consist of a mixture of timothy, fescue, alfalfa, and red clover.

According to the Census of Agriculture (*6, 7*), between 1964 and 1978 the number of farms decreased from 1,102 to 726. The average size of a farm increased from 145 acres in 1964 to 181 acres in 1978.

In 1978, 61 percent of farm income came from the sale of livestock and livestock products. The number of cattle and hogs increased between 1964 and 1978.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biologic activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, the landforms, relief, climate, and the natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, acidity, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpreted the data from these analyses and tests as well as the field-observed characteristics and the soil properties in terms of expected behavior of the soils under different uses. Interpretations for all of the soils were field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and new interpretations sometimes are developed to meet local needs. Data were assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management were assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can state with a fairly high degree of probability that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by several kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. These latter soils are called inclusions or included soils.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed, and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

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, pasture and hayland, woodland, urban uses,* and *recreation areas*. Cultivated crops are those grown extensively in the survey area. Pasture and hayland refers to land used as pasture for livestock or used for the production of hay. 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.

Some of the boundaries on the general soil map of Orange County do not match those on the soil maps of adjacent counties, and some of the soil names and descriptions do not fully agree. The differences are a result of improvements in the classification of soils, particularly modification or refinements in soil series concepts. Also, there may be differences in the intensity of mapping or in the extent of the soils within the survey area.

Soil Descriptions

1. Bedford-Bromer

Nearly level and gently sloping, deep, moderately well drained and somewhat poorly drained soils that formed in loess or in silty and clayey sediment and in the underlying residuum of limestone

These soils are on broad, slightly dissected, loess-covered uplands (fig. 1).

This map unit makes up about 6 percent of the county. It is about 55 percent Bedford soils, 30 percent Bromer soils, and 15 percent minor soils.

Bedford soils are nearly level and gently sloping, and they are moderately well drained. The soils are on broad ridges and in the slightly higher positions on the landscape. The surface layer is dark yellowish brown silt loam about 10 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part of the subsoil is strong brown and yellowish brown silt loam; the middle part is a yellowish brown, strong brown, and light brownish gray silt loam and silty clay loam fragipan; and the lower part is strong brown and dark red clay.

Bromer soils are nearly level and are somewhat poorly drained. They are in slight depressions. The surface layer is grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part of the subsoil is yellowish brown, mottled silt loam; the middle part is light gray, strong brown, and yellowish brown, mottled silty clay loam; and the lower part is strong brown cherty clay.

The minor soils are Crider, Peoga, Montgomery, Haymond, and Wakeland soils. The well drained Crider soils are on side slopes adjacent to drainageways and on small knolls. The poorly drained Peoga soils and the very poorly drained Montgomery soils are in depressions. The well drained Haymond soils and the somewhat poorly drained Wakeland soils are on bottom lands adjacent to drainageways.

The soils in this map unit are used mainly for cultivated crops. In some areas that are not adequately drained, they are used for hay or pasture. In a few small areas they are used as woodland. Wetness is the main limitation. Erosion is a hazard in the sloping areas.

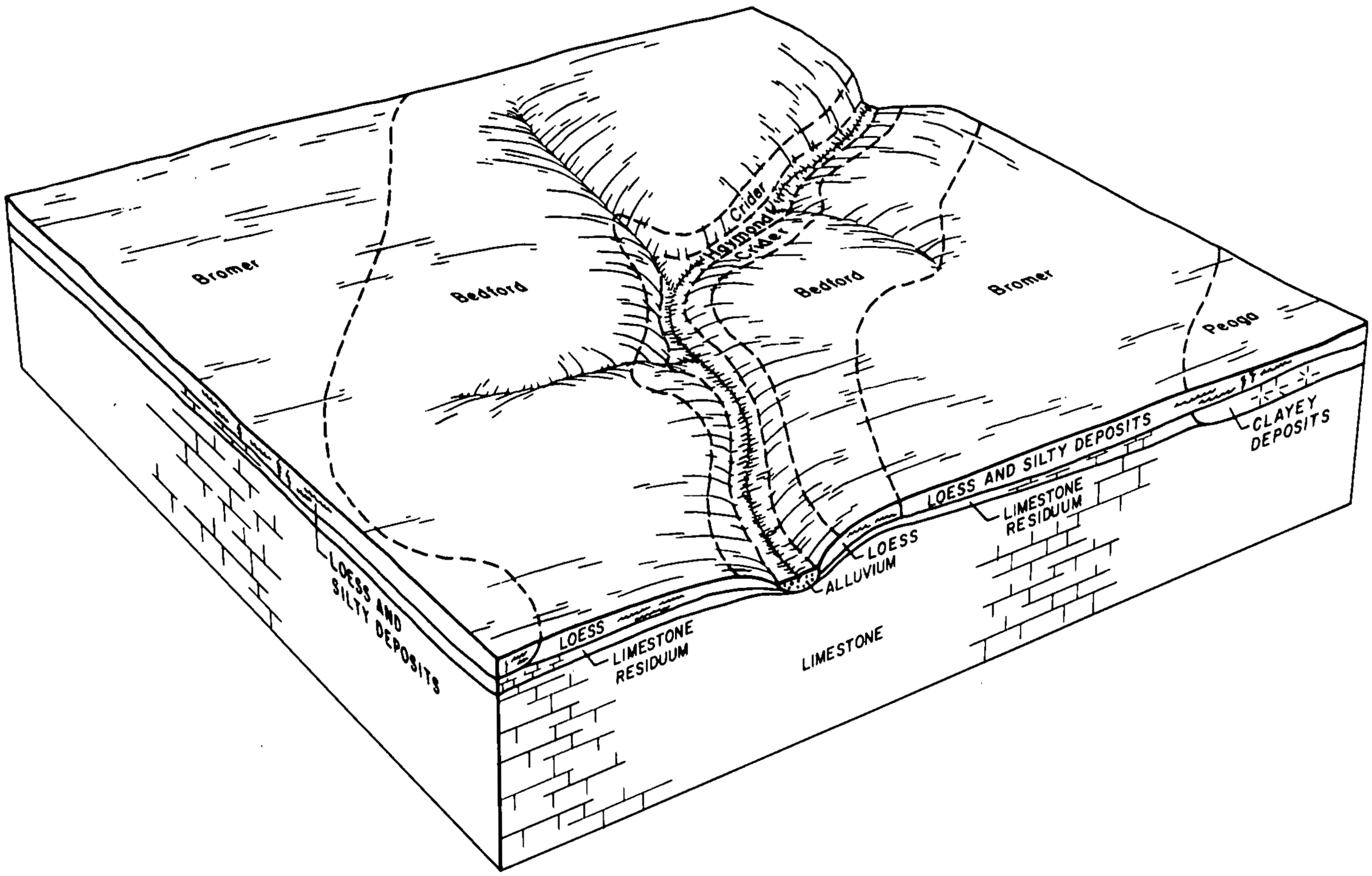


Figure 1.—Pattern of soils, topography, and underlying material in the Bedford-Bromer map unit.

These soils are well suited to cultivated crops, pasture, and hay and to use as woodland. They are poorly suited to urban and intensive recreation uses because of wetness.

2. Crider-Caneyville-Frederick

Gently sloping to very steep, deep and moderately deep, well drained soils that formed in loess and in the underlying residuum of limestone

These soils are on slightly dissected, loess-covered uplands that are characterized by numerous sinkholes.

This map unit makes up about 23 percent of the county. It is about 65 percent Crider soils, 10 percent Caneyville soils, 5 percent Frederick soils, and 20 percent minor soils.

Crider soils are gently sloping to moderately steep, and they are well drained. The soils are on ridges and side slopes adjacent to drainageways and sinkholes. The surface layer is dark brown silty loam about 9 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown silt loam; the middle part is strong brown, yellowish red, and red silty clay loam; and the lower part is red clay.

Caneyville soils are strongly sloping to very steep, and they are well drained. They are on side slopes adjacent to drainageways and some sinkholes. The surface layer is dark yellowish brown silt loam about 6 inches thick. The subsoil is about 30 inches thick. The upper part is strong brown silty clay loam, and the lower part is yellowish red and red clay. Limestone bedrock is at a depth of about 36 inches.

Frederick soils are gently sloping to very steep, and they are well drained. They are on the lower part of side slopes adjacent to drainageways and sinkholes. The surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown and yellowish red silty clay loam and silty clay, and the lower part is red clay.

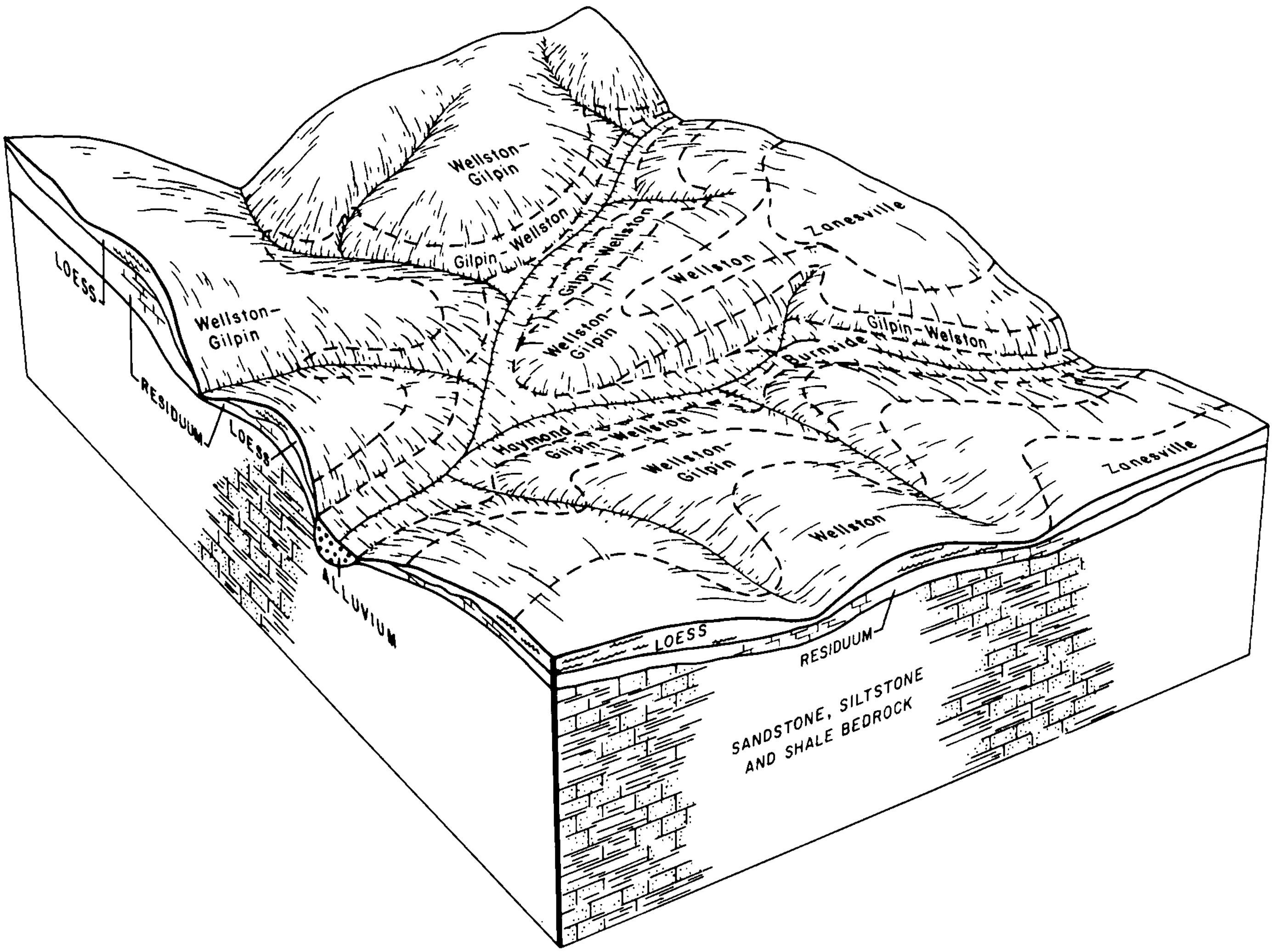


Figure 2.—Pattern of soils, topography, and underlying material in the Wellston-Gilpin-Zanesville map unit.

The minor soils are Haymond, Wilbur, Wakeland, Elkinsville, Pekin, Bartle, and Bedford soils. The well drained Haymond soils, the moderately well drained Wilbur soils, and the somewhat poorly drained Wakeland soils are on bottom lands adjacent to drainageways and in the bottom of some sinkholes. The well drained Elkinsville soils, the moderately well drained Pekin soils, and the somewhat poorly drained Bartle soils are on terrace benches adjacent to the bottom lands. The moderately well drained Bedford soils are on broad ridgetops on the uplands.

The soils making up this map unit are used for cultivated crops and for pasture or hay. In a few areas they are used as woodland. Slope is the main limitation, and erosion is a hazard.

The soils are well suited to use as pasture and hayland and as woodland. They are suited to cultivated crops, to urban uses, and to intensive recreation uses.

3. Wellston-Gilpin-Zanesville

Nearly level to very steep, deep and moderately deep, well drained and moderately well drained soils that formed in loess and in the underlying residuum of sandstone, siltstone, and shale

These soils are on highly dissected, loess-covered uplands (fig. 2).

This map unit makes up about 71 percent of the county. It is about 35 percent Wellston soils, 25 percent Gilpin soils, 8 percent Zanesville soils, and 32 percent minor soils.

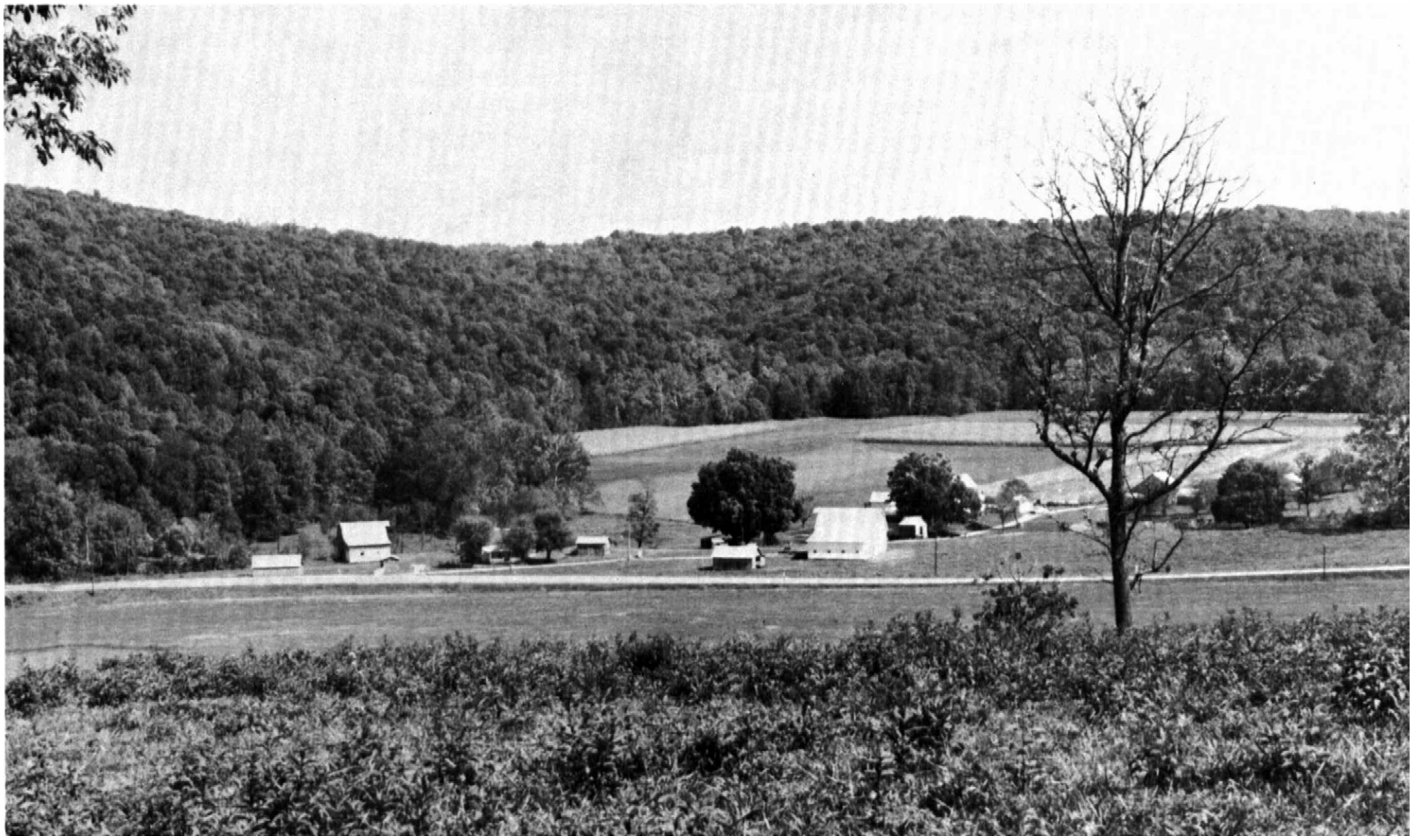


Figure 3.—An area of the Wellston-Gilpin-Zanesville map unit. The steeper soils are used as woodland, and the less sloping soils are used for crops, pasture, or hay.

Wellston soils are moderately sloping to very steep and are well drained. They are on narrow ridgetops, benchlike areas on hillsides, and side slopes adjacent to the ridgetops. The surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 65 inches thick. The upper part is strong brown silty clay loam and silt loam, the middle part is strong brown clay loam, and the lower part is channery and very channery sandy clay loam. Sandstone bedrock is at a depth of about 72 inches.

Gilpin soils are strongly sloping to very steep and are well drained. They are on hillsides adjacent to drainageways. The surface layer is dark yellowish brown silt loam about 4 inches thick. The subsoil is about 24 inches thick. It is strong brown silty clay loam, channery silt loam, and channery loam. Sandstone bedrock is at a depth of about 28 inches.

Zanesville soils are nearly level to moderately sloping, and they are well drained and moderately well drained. Zanesville soils are on ridgetops and on wide benches. The surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown silt loam and silty clay loam; the middle part is a strong brown and yellowish brown, mottled, silty clay loam and silt loam fragipan; and the lower part of the subsoil is strong brown channery clay. The underlying material is strong brown, mottled channery clay. Sandstone bedrock is at a depth of about 56 inches.

The minor soils are Haymond, Burnside, Wilbur, Wakeland, Elkinsville, Pekin, and Bartle soils. The well drained Haymond and Burnside soils, the moderately well drained Wilbur soils, and the somewhat poorly drained Wakeland soils are on bottom lands adjacent to drainageways. The well drained Elkinsville soils, the moderately well drained Pekin soils, and the somewhat poorly drained Bartle soils are on terrace benches adjacent to the bottom lands.

The soils in this map unit are used mainly as woodland and for pasture or hay. In a few small areas, mainly on the ridgetops and narrow bottom lands, they are used for cultivated crops. Slope is the main limitation, and erosion is a hazard on these soils.

These soils are well suited to use as woodland. They are suited to pasture or hay. Because of the slope, they are poorly suited to cultivated crops, urban uses, and intensive recreation uses.

Broad Land Use Considerations

The soils in Orange County vary widely in their potential for major land uses. Approximately 25 percent of the county is used for crops, mainly corn and soybeans.

Cropland is scattered throughout the county but is concentrated in the Bedford-Bromer and Crider-Caneyville-Frederick map units. Soils in the Bedford-Bromer map unit have a seasonal high water table that delays planting in spring. Wetness is the major limitation to use of these soils for crops. Erosion is the main limitation on Crider soils, which are the main soils in the Crider-Caneyville-Frederick map unit that are used for crops.

Approximately 20 percent of the county is pasture. The soils in the Bedford-Bromer and Crider-Caneyville-Frederick map units have high potential for grasses and legumes. Wetness is a limitation on the soils in the Bedford-Bromer map unit, and water-tolerant grasses and legumes should be grown. Slope and the hazard of erosion are the main limitations on the soils in the Crider-Caneyville-Frederick map unit. The soils in the Wellston-Gilpin-Zanesville map unit have fair potential for grasses and legumes; slope and rock outcrops are limitations. The Bedford soils and the Zanesville soils are not suited to deep-rooted legumes because they have a fragipan in the subsoil.

Approximately 45 percent of the county is woodland. The soils in all three general map units have good potential for use as woodland (fig. 3). Commercially valuable trees are not common in areas of the Bedford-Bromer map unit and generally do not grow rapidly on the wetter soils. Trees do not grow rapidly on the soils that have a fragipan or on moderately deep soils.

The soils in a large part of the county have poor potential for urban development; however, the nearly level to moderately sloping Crider soils, the nearly level and gently sloping Bedford soils, the moderately sloping Wellston soils, and the nearly level and gently sloping Zanesville soils have fair potential for urban development. The major limitations are slope, wetness, depth to rock, and low strength.

The potential for recreation uses ranges from poor to good depending on the intensity of the anticipated use and the properties of the soil. The slope of the soils in the Crider-Caneyville-Frederick and Wellston-Gilpin-Zanesville map units and wetness of the soils in the Bedford-Bromer map unit limit most of these soils for intensive recreation uses such as playgrounds and camp areas. Small areas that are suitable for intensive development, however, are generally available. All the map units have areas that are suitable for extensive recreation uses such as hiking trails. The major limitation is the hazard of erosion on steep slopes.

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, Crider silt loam, 2 to 6 percent slopes, is one of several phases in the Crider 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 in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Caneyville-Crider complex, 12 to 18 percent slopes, severely eroded, 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. The included soils are identified in each map unit description. Some small areas of strongly contrasting soils are identified by a special symbol on the soil maps.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarry is an example. Miscellaneous areas are shown on the soil maps. Some that are too small to be shown 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

Ba—Bartle silt loam. This is a nearly level, deep, somewhat poorly drained soil on low alluvial terraces adjacent to bottom lands. The areas of this soil are irregularly shaped and are dominantly 5 to 15 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 9 inches thick. The subsoil is about 35 inches thick. The upper part is pale brown, mottled, friable silt loam; the middle part is light brownish gray, mottled, friable silt loam; and the lower part is a light brownish gray, mottled, very firm and brittle silt loam and silty clay loam fragipan. The underlying material to a depth of 60 inches is yellowish brown, mottled silt loam. In some places, the slope is more than 2 percent. In some areas, the subsoil is more gray.

Included with this soil in mapping are small areas of moderately well drained Pekin soils, somewhat poorly drained Wakeland soils, and well drained Haymond soils. Pekin soils are near terrace breaks, and Wakeland and Haymond soils are on bottom lands that are slightly lower than the Bartle soils. Also included are small areas of poorly drained soils in depressions. The included soils make up about 12 percent of the map unit.

This soil has a moderate available water capacity. It is moderately permeable above the fragipan and very slowly permeable in the fragipan. Runoff is slow. The surface layer is moderate in organic matter content and is friable and easily tilled. A seasonal high water table is at a depth of 1 foot to 2 feet in winter and early in spring. The fragipan, which is at a depth of 24 to 36 inches, limits the rooting depth.

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

This soil is well suited to corn, soybeans, and small grains if it is adequately drained. Wetness is the major limitation. Excess water can be removed using open ditches, surface drains, subsurface drains, or a combination of these. Because the fragipan restricts water movement, this soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, cover crops, and green manure crops help maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to alfalfa and other deep-rooted legumes because the soil is wet and root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by site preparation and by spraying, cutting, or girdling unwanted trees and shrubs. Prolonged seasonal wetness hinders harvesting and logging and the planting of seedlings.

This soil is severely limited for building site development because of wetness. On this soil, buildings should be built without basements, and foundation drains should be installed to help overcome wetness. This soil is severely limited for use as septic tank absorption fields because of wetness and the very slow permeability. Increasing the size of the absorption field helps overcome these limitations. This soil is severely limited for local roads and streets because of the potential frost action and low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. Adequate drainage along roads decreases the possibility of frost action.

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

BdA—Bedford silt loam, 0 to 2 percent slopes. This is a nearly level, deep, moderately well drained soil on broad ridgetops on loess-capped uplands. The areas of this soil are irregularly shaped and are dominantly 5 to 30 acres in size.

Typically, the surface layer is brown silt loam about 8 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is yellowish brown, friable silt loam; the part below that is yellowish brown, firm silty clay loam; and the next part is a yellowish brown, very firm silt loam fragipan. The lower part of the subsoil is red and dark red, firm silty clay and clay. In some places, the loess is more than 40 inches thick. In some areas the slope is more than 2 percent, and in some areas the content of chert fragments is as much as 50 percent in a layer of soil at the base of the loess.

Included with this soil in mapping are small areas of well drained Crider soils, mainly near drainageways and sinkholes, and small areas of somewhat poorly drained Bromer soils in slight depressions. The included soils make up about 10 percent of the map unit.

This soil has a moderate available water capacity. It is moderately permeable above the fragipan and very slowly permeable in the fragipan. Runoff is slow. The surface layer is low in organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 2 to 4 feet in winter and early in spring. The very firm and brittle fragipan, which is at a depth of 20 to 36 inches, limits the rooting depth.

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

This soil is well suited to corn, soybeans, and small grains. Because the fragipan restricts water movement, this soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, cover crops, and green manure crops help improve or maintain the organic matter content and tilth.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to alfalfa and other deep-rooted legumes because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. The rooting zone is limited mainly to the area above the fragipan. Competing vegetation can be controlled by proper site preparation and by cutting, spraying, or girdling the unwanted trees and shrubs.

The soil is moderately limited for dwellings without basements and is severely limited for dwellings with basements because of wetness and the moderate shrink-swell potential. On this soil, buildings should be built without basements, and foundation drains should be installed to help lower the water table. Foundations and footings should be strengthened. Backfilling with a coarse material helps prevent structural damage from the shrinking and swelling of the soil.

This soil is severely limited for use as septic tank absorption fields because of wetness and the very slow permeability in the fragipan. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of frost action and low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. Adequate drainage along roads decreases the possibility of frost action.

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

BdB—Bedford silt loam, 2 to 6 percent slopes. This is a gently sloping, deep, moderately well drained soil on ridgetops on loess-capped uplands. The areas of this soil are irregularly shaped and are dominantly 5 to 40 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 10 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown and yellowish brown, friable silt loam; the middle part is a yellowish brown, strong brown, and light brownish gray, very firm and brittle silt loam and silty clay loam fragipan; the lower part is strong brown and dark red, firm silty clay and clay. In some places the loess is more than 40 inches thick, and in some places the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of well drained Crider soils mainly near drainageways and sinkholes, somewhat poorly drained Bromer soils in depressions, and alluvial soils at the base of drainageways. Also included are soils in some areas where most of the surface layer has been removed by erosion. The included soils make up about 15 percent of the map unit.

This soil has a moderate available water capacity. It is moderately permeable above the fragipan and very slowly permeable in the fragipan. Runoff is medium. The surface layer is low in organic matter content and is easily tilled. Depth to a seasonal high water table ranges from 2 to 4 feet in winter and early in spring. The fragipan, which is at a depth of 20 to 36 inches, limits the rooting depth.

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

This soil is well suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is cultivated. Conservation tillage, which leaves protective amounts of crop residue on the surface, contour farming, crop rotation, terraces, and grassed waterways help prevent erosion. Because the fragipan restricts water movement, the soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Crop residue management, cover crops, and green manure crops help maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to alfalfa and other deep-rooted legumes because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. If the pastures are overgrazed, runoff and erosion are hazards. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. The rooting zone is limited mainly to the area above the fragipan. Plant competition is the main concern in management. Competing vegetation can be controlled by cutting, spraying, or girdling.

This soil is moderately limited for dwellings without basements and severely limited for dwellings with basements because of wetness and the shrink-swell potential. On this soil, buildings should be built without basements, and foundation drains should be installed to help lower the water table. Foundations and footings should be strengthened. Backfilling with a coarse material helps prevent structural damage from the shrinking and swelling of the soil.

This soil is severely limited for use as septic tank absorption fields because of wetness and the very slow permeability. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of the potential frost action and low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. Adequate drainage along roads decreases the possibility of frost action.

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

Br—Bromer silt loam. This is a nearly level, deep, somewhat poorly drained soil in slight depressions and along small drainageways on the uplands. The areas of this soil are irregularly shaped and are dominantly 5 to 15 acres in size.

Typically, the surface layer is grayish brown silt loam about 9 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is yellowish brown, mottled, friable silt loam; the part below that is light gray and yellowish brown, mottled, friable silty clay loam; and the next part is yellowish brown, mottled, very firm and brittle silty clay loam. The lower part of the subsoil is strong brown, firm cherty clay.

Included with this soil in mapping are a few small areas of poorly drained Peoga soils mainly in slight depressions, moderately well drained Bedford soils in areas that are slightly higher than the Bromer soils, and soils that have a weak fragipan. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is slowly permeable. Runoff is slow. The surface layer is moderate in organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 1 foot to 3 feet in winter and early in spring.

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

If adequately drained, this soil is suited to corn, soybeans, and small grains. Excess water can be removed by installing open ditches or surface drains. A subsurface drainage system can be used if a suitable outlet is available. If drained and properly managed, this soil is suited to intensive row cropping. Conservation practices such as conservation tillage, which leaves protective amounts of crop residue on the surface, and crop residue management help maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. It is not suited to alfalfa and other deep-rooted legumes because of the seasonal high water table. Drainage is necessary to obtain high yields of forage and to maintain the condition of the pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Seedlings survive and grow well if competing vegetation is controlled by site preparation and by spraying, cutting, or girdling. The high water table hinders harvesting and logging and the planting of seedlings.

This soil is severely limited for building site development because of wetness. On this soil, buildings should be built without basements, and foundation drains should be installed. This soil is severely limited for use as septic tank absorption fields because of wetness and the slow permeability. Increasing the size of the absorption field and installing drains to lower the water table help overcome these limitations. This soil is severely limited for local roads and streets because of the potential frost action and low strength. Adequate drainage along roads decreases the possibility of frost action. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

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

Bu—Burnside silt loam, occasionally flooded. This is a nearly level, deep, well drained soil on bottom lands. This soil is subject to flooding. The areas are irregularly shaped and are dominantly 3 to 15 acres in size.

Typically, the surface layer is dark brown and dark yellowish brown silt loam about 12 inches thick. The underlying material to a depth of about 64 inches is dark yellowish brown channery loam and very channery sandy loam. In a few small areas, the slope is about 3 percent. In some areas, the underlying material is slightly acid. In some areas, the soils are frequently flooded, and in other areas, they are rarely flooded.

Included with this soil in mapping are well drained Haymond soils in a few broad areas on flood plains, small areas where the soils are less than 40 inches deep to bedrock, and areas, mainly near the upper end of drains, of soils that have a channery surface layer. The included soils make up about 15 percent of the map unit.

This soil has a low available water capacity and is moderately permeable. Runoff is slow. The surface layer is low in organic matter content and is friable. It is easily tilled except where rock fragments are common on the surface. Depth to a seasonal water table ranges from 3 to 5 feet in winter and early in spring.

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

This soil is well suited to corn, soybeans, and small grains. Stoniness and the low available water capacity are limitations to the use of this soil for crops, and occasional flooding is a hazard. However, flooding normally occurs before the major crops are planted. Some areas between streams are too narrow to crop. Planting early-maturing varieties helps overcome droughtiness. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, and cover crops help maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. The grasses and legumes, however, could be severely damaged by flooding. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Occasional flooding in winter is a hazard, and logging may be delayed. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling unwanted trees and shrubs. Species tolerant of wetness should be planted.

Because of the hazard of flooding, the soil, in most areas, is not suited to building site development or to use as septic tank absorption fields. It is severely limited for local roads and streets because of flooding. Constructing roads on raised, compacted fill material and providing adequate side-ditch drainage and culverts help protect roads from flood damage.

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

CaD3—Caneyville-Crider complex, 12 to 18 percent slopes, severely eroded. The soils making up this complex are strongly sloping, moderately deep and deep, and well drained. Caneyville soils are on side slopes along drainageways, and Crider soils are on ridgetops between drainageways. The areas of these soils are so intermingled that it was not practical to map the soils separately. The mapped areas are irregularly shaped and are dominantly 5 to 40 acres in size. Each area consists of about 50 percent Caneyville soils and 35 percent Crider soils.

Typically, the surface layer of the Caneyville soils is yellowish red silty clay loam that contains brown soil material. It is about 2 inches thick. The subsoil is about 22 inches thick. It is yellowish red and red, firm clay. Limestone bedrock is at a depth of 24 inches. In some areas, the depth to bedrock is more than 40 inches. In some places, the slope is more than 18 percent.

Typically, the surface layer of the Crider soils is dark brown silt loam mixed with strong brown silt loam. It is about 4 inches thick. The subsoil is about 58 inches thick. The upper part is strong brown and yellowish red, friable silty clay loam, and the lower part is yellowish red and red, firm clay. Limestone bedrock is at a depth of 62 inches. In some areas, the surface layer is silty clay loam, and in some areas, the depth to bedrock is less than 60 inches. In some places, the slope is less than 12 percent.

Included with the soils in mapping are areas of soils that have a stony silty clay loam surface layer, areas where most of the soil material has been lost through erosion exposing bedrock on hillsides and at the bottom of gullies, and small areas of alluvial soils along drainageways. There are numerous sinkholes in some areas. Also included are areas of soils that developed over sandstone and shale, and soils that developed in colluvium, which may contain many coarse fragments. The included areas make up about 15 percent of the map unit.

Caneyville soils have a low available water capacity and are moderately slowly permeable. Crider soils have a high available water capacity and are moderately permeable. Runoff is very rapid. The surface layer of these soils is low in organic matter content, and because of the numerous gullies and rock fragments, tilling the soils is difficult.

In most areas, the soils are idle or are used for pasture. In a few areas, they are used as woodland, and in a few small areas, they are used for cultivated crops.

In most areas, the soils are not suited to cultivated crops. Further erosion is a major hazard if the soils are used as cropland. In some areas, gullies, rock outcrops, and stones on the surface restrict tillage.

The soils are poorly suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soils are wet causes surface compaction, poor tilth, excessive runoff, and additional erosion and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soils.

The soils are suited to trees. Erosion is a hazard, and the use of equipment is limited. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. The slope makes the use of equipment difficult in logging and planting. Specialized equipment and careful planning of logging and planting may help overcome this problem.

The soils are severely limited for building site development—the Caneyville soils because of slope and depth to rock and the Crider soils because of slope. On these soils, buildings should be built without basements, and the building design should accommodate the slope.

The soils are severely limited for use as septic tank absorption fields—the Caneyville soils because of slope, depth to rock, and moderately slow permeability and the Crider soils because of slope. Because they are deeper, the Crider soils should be used as absorption fields, if possible. Nevertheless, the absorption fields should be installed on the contour to help overcome the limitations.

The soils are severely limited for local roads and streets because of slope and low strength. Cuts and fills are needed, and roads should be built on the contour. The road design should accommodate the depth to rock, or the rock may have to be excavated. If these soils are to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

The soils are in capability subclass VIe; Caneyville soils are in woodland suitability subclass 2c, and Crider soils are in woodland suitability subclass 1r.

CaE—Caneyville-Crider silt loams, 18 to 25 percent slopes. The soils making up this complex are moderately steep, moderately deep and deep, and well drained. Caneyville soils are on side slopes along drainageways, and Crider soils are on ridges between drainageways. The areas of these soils are so intermingled that it was not practical to map the soils separately. The mapped areas are irregularly shaped and are dominantly 5 to 50 acres in size. Each area consists of about 50 percent Caneyville soils and 35 percent Crider soils.

Typically, the surface layer of the Caneyville soils is dark brown and dark yellowish brown silt loam about 10 inches thick. The subsoil is about 19 inches thick. The upper part is strong brown, friable silt loam; the middle part is yellowish red, friable silty clay loam; and the lower part is yellowish red, firm clay. Limestone bedrock is at a depth of 29 inches. In places, the depth to bedrock is more than 40 inches.

Typically, the surface layer of the Crider soils is very dark grayish brown and dark yellowish brown silt loam about 13 inches thick. The subsoil is about 50 inches thick. The upper part is strong brown, friable silt loam and silty clay loam, and the lower part is yellowish red and red, firm clay. Limestone bedrock is at a depth of 63 inches. In places, the depth to bedrock is less than 60 inches.

Included with these soils in mapping are small areas of soils that formed in alluvium along drainageways; soils that formed in colluvium, mainly on low slopes; and rock outcrops. Also included are soils that developed over sandstone and shale mainly at the higher elevations, and soils in small, cleared areas where part or all of the surface layer has been lost through erosion. The included areas make up about 15 percent of the map unit.

Caneyville soils have a low available water capacity and are moderately slowly permeable. Crider soils have a high available water capacity and are moderately permeable. Runoff is very rapid. The content of organic matter is moderate. The surface layer of these soils is friable, but because of the moderately steep slopes, tillage is difficult.

In most areas, the soils are used as woodland, and in a few areas, they are used as pasture.

The soils generally are not suited to corn and soybeans. Erosion is a major hazard if the soils are used for cultivated crops. The moderately steep slopes make the use of equipment difficult.

The soils are suited to grasses and legumes for pasture. Overgrazing or grazing when the soils are wet causes surface compaction, poor tilth, and excessive runoff and erosion. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soils. The moderately steep slopes make the use of equipment difficult.

The soils are suited to trees, and in many areas, there are stands of native hardwoods. Erosion is a hazard, and the use of equipment is restricted. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. The slope makes the use of equipment difficult in logging and planting. Specialized equipment and careful planning of logging and planting help overcome this problem.

The soils are severely limited for building site development—the Caneyville soils because of slope and depth to rock and the Crider soils because of slope. On these soils, buildings should be built without basements, and the building design should accommodate the slope.

The soils are severely limited for septic tank absorption fields—the Caneyville soils because of slope, depth to rock, and permeability and the Crider soils because of slope. Because they are deeper, the Crider soils should be used as absorption fields, if possible. Nevertheless, the absorption fields should be installed on the contour to help overcome the limitations.

The soils are severely limited for local roads and streets because of slope and low strength. Cuts and fills are needed, and roads should be built on the contour. The road design should accommodate the depth to rock, or the rock may have to be excavated. If the soils are to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

The soils are in capability subclass VIe; Caneyville soils are in woodland suitability subclass 2c, and Crider soils are in woodland suitability subclass 1r.

CdF—Caneyville-Rock outcrop complex, 18 to 70 percent slopes. This complex consists of moderately steep to very steep, moderately deep, well drained Caneyville soils and Rock outcrop on hillsides on the uplands. The Caneyville soils are generally in benchlike areas between the rock outcrops. The soil areas and the rock outcrops are so intermingled that it was not practical to map them separately. The mapped areas are irregularly shaped and are dominantly 10 to 30 acres in size. Each area consists of about 55 percent Caneyville soils and 30 percent Rock outcrop.

Typically, the surface layer of the Caneyville soils is dark brown stony silt loam about 5 inches thick. The subsoil is about 21 inches thick. The upper part is yellowish red, firm clay, and the lower part is strong brown, firm clay. Limestone fragments make up as much as 20 percent of the subsoil. Limestone bedrock is at a depth of 27 inches.

Rock outcrop consists of limestone outcrops and limestone boulders that are as much as 4 feet in diameter.

Included in mapping this complex are small areas of deep soils that formed in colluvium on narrow benches and near the base of slopes, areas of soils that formed in alluvium along drainageways, and a few small areas of deep soils in cracks and crevices in the limestone bedrock. Also included are soils in a few cleared areas where most or all of the surface layer has been lost through erosion. The included soils make up about 15 percent of the complex.

Caneyville soils have a low available water capacity and are moderately slowly permeable. Runoff is very rapid. The content of organic matter is moderate. The surface layer is friable, but because of the moderately steep to very steep slopes and the stones and boulders on the surface, tillage is impossible.

The soils are used mainly as woodland. In a few small areas they are used for pasture. The areas of pasture are primarily on the less sloping included soils.

The soils, in most areas, are not suited to use as cropland because of the moderately steep to very steep slopes, the stones and boulders on the surface, and the outcrops of rock.

The soils are poorly suited to grasses and legumes for pasture. Pastures can be established on the less sloping, less stony included soils, but management is difficult because of the small size of the areas and poor accessibility.

The soils are poorly suited to use as woodland mainly because erosion is a hazard and the use of equipment is limited. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. The equipment limitations are severe because of the slope and the rock outcrops. Specialized equipment and careful planning of logging operations help overcome this problem.

Because of slope, the soils, in most areas, are not suited to building site development or to use as septic tank absorption fields. They are severely limited for roads because of slope and low strength. Road design should accommodate the slope, or roads can be constructed on the less sloping, less stony included soils. An alternate site on more suitable soils should be considered.

This complex is in capability subclass VIIe; Caneyville soils are in woodland suitability subclass 2x. Rock outcrop was not assigned to a woodland suitability class.

CrB—Crider silt loam, 2 to 6 percent slopes. This is a gently sloping, deep, well drained soil on ridges and side slopes on loess-capped uplands. The areas of this soil are broad and irregularly shaped and are dominantly 20 to 50 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown, friable silt loam; the middle part is strong brown and yellowish red, firm silty clay loam; and the lower part is red, firm silty clay loam and clay. In some areas, the loess is more than 45 inches thick. In some places, the slope is less than 2 percent or more than 6 percent. In some areas, the content of chert fragments is as much as 50 percent in a layer of soil at the base of the loess. In places, most of the surface layer has been lost through erosion.

Included with this soil in mapping are small areas of soils that formed in alluvium at the bottom of sinkholes and along drainageways and moderately well drained Bedford soils in broad, level areas. Small areas of soils that are less than 60 inches deep to bedrock are also included. The included soils make up about 10 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is medium. The surface layer is moderate in organic matter content and is friable and easily tilled.

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

This soil is well suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is used for cultivated crops. Conservation practices such as crop rotation, terraces, contour farming, grassed waterways, and conservation tillage, which leaves protective amounts of crop residue on the surface, help prevent excessive erosion. Crop residue management and cover crops also help control erosion and maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the quality of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by cutting, spraying, or girdling unwanted trees and shrubs.

This soil is suitable for building site development and for use as septic tank absorption fields. It is severely limited for local roads and streets because of low strength. If the soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

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

CrC2—Crider silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, well drained soil on narrow ridges and side slopes of drainageways on loess-capped uplands. The areas of this soil are irregular in shape and are dominantly 5 to 20 acres in size.

Typically, the surface layer is dark yellowish brown silt loam that contains some strong brown soil material. It is about 8 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown and yellowish red, friable silty clay loam, and the lower part is red, firm clay. In some areas, the content of chert fragments is as much as 50 percent in a layer of soil at the base of the loess. In some places, the slope is less than 6 percent or more than 12 percent. In some places, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silty clay loam and silt loam.

Included with this soil in mapping are small areas of moderately well drained Bedford soils mainly at the upper end of drainageways and on broad ridgetops, alluvial soils at the bottom of drainageways, and well drained Frederick and Caneyville soils on side slopes of sinkholes and along drainageways. Small areas of soils that are less than 60 inches deep to bedrock are also included. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is medium. The surface layer is moderate in organic matter content and is friable and easily tilled.

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

This soil is suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is used for cultivated crops. Crop rotation, tillage that leaves protective amounts of crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures can be used to control runoff and erosion. Crop residue management and cover crops also help control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

This soil is moderately limited for building site development because of slope. The slope can be modified by grading to overcome this limitation, or the building design can accommodate the slope.

This soil is moderately limited for use as septic tank absorption fields because of slope. Installing septic tank absorption fields on the contour or modifying the slope will help in overcoming this limitation.

This soil is severely limited for local roads and streets because of low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

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

CrC3—Crider silt loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping, deep, well drained soil on narrow ridges and hillsides on uplands. The areas of this soil are irregularly shaped and are dominantly 5 to 15 acres in size.

Typically, the surface layer is dark brown silt loam mixed with strong brown silt loam. It is about 3 inches thick. The subsoil is about 63 inches thick. The upper part is strong brown, friable silty clay loam; the part below that is yellowish red, friable silty clay loam; and the next part is yellowish red, firm clay. The lower part of the subsoil is red, firm clay. Limestone bedrock is at a depth of 66 inches. In some areas, the surface layer is strong brown silty clay loam. In some places, the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are small areas of soils that formed in alluvium adjacent to drainageways, well drained Frederick and Caneyville soils, and gullied soils, mainly on the upper part of side slopes. Small areas of soils that are less than 60 inches deep to bedrock are also included. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is rapid. The surface layer is low in organic matter content. Tillage generally is difficult because part of the subsoil has been mixed with the surface layer.

This soil is used for hay or pasture, or it is idle. In some areas, it is used for cultivated crops. In a few small areas, it is used as woodland.

This soil is poorly suited to corn, soybeans, and small grains. It can be used occasionally for row crops. Conservation practices are needed to control runoff and erosion. Crop rotation, tillage that leaves protective amounts of crop residue on the surface, diversions, contour farming, and grassed waterways can be used to control runoff and erosion. Crop residue management and cover crops also help control erosion, and they improve tilth and increase the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help to maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

This soil is moderately limited for building site development because of slope. The slope can be modified by grading to overcome this limitation, or the building design can accommodate the slope. This soil is moderately limited for use as septic tank absorption fields because of slope. Installing septic tank absorption fields on the contour or modifying the slope helps overcome this limitation. This soil is severely limited for local roads and streets because of low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

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

CuD2—Crider-Caneyville silt loams, 12 to 18 percent slopes, eroded. The soils making up this complex are strongly sloping, deep and moderately deep, and well drained. Crider soils are on ridgetops between drainageways. Caneyville soils are on side slopes along drainageways. The areas of these soils are so intermingled that it was not practical to map the soils separately. The mapped areas are irregularly shaped and are dominantly 10 to 40 acres in size. Each area consists of about 50 percent Crider soils and 35 percent Caneyville soils.

Typically, the surface layer of the Crider soils is dark yellowish brown silt loam that contains some strong brown soil material. It is about 6 inches thick. The subsoil is about 64 inches thick. The upper part is strong brown, friable silty clay loam, and the lower part is yellowish red and red, firm clay. Limestone bedrock is at a depth of 70 inches. In some areas where the surface layer has been lost through erosion, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silty clay loam. In some areas, the soil is less than 60 inches deep to bedrock.

Typically, the surface layer of the Caneyville soils is dark yellowish brown silt loam that contains some strong brown soil material. It is about 6 inches thick. The subsoil is about 30 inches thick. The upper part is strong brown, friable silty clay loam, and the lower part is yellowish red and red, firm clay. Limestone bedrock is at a depth of 36 inches. In some areas where the surface layer has been lost through erosion, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silty clay loam. In some areas the soil is more than 40 inches deep to bedrock.

Included with these soils in mapping are a few small areas of soils that formed in alluvium along drainageways, some areas of soils that formed in colluvium and may contain many coarse fragments, and severely eroded soils, some of which have eroded to bedrock. There are numerous sinkholes in some areas. Also included are areas of soils that developed over sandstone and shale and areas of rock outcrops. The included areas make up about 15 percent of the map unit.

Caneyville soils have a low available water capacity and are moderately slowly permeable. Crider soils have a high available water capacity and are moderately permeable. Runoff is rapid. The surface layer of these soils is moderate in organic matter content and is friable and easily tilled.

The soils are used mainly as pasture or woodland. In some areas, they are used for cultivated crops.

The soils are poorly suited to corn, soybeans, and small grains. They can be used occasionally for row crops. Conservation practices are necessary to control runoff and erosion. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop rotation, diversions, contour farming, and grassed waterways can be used to control runoff and erosion. Crop residue management and cover crops also help control erosion, and they improve tilth and increase the content of organic matter.

The soils are suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, poor tilth, and excessive runoff and erosion and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

The soils are suited to trees, and in some areas, there are stands of native hardwoods. Erosion is a hazard, and the use of equipment is limited. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. The slope makes the use of equipment difficult in logging and planting. Specialized equipment and careful planning of logging and planting help overcome this problem.

These soils are severely limited for building site development—the Caneyville soils because of slope and depth to rock and the Crider soils because of slope. The building design should accommodate the slope.

The soils are severely limited for use as septic tank absorption fields—the Caneyville soils because of slope, depth to rock, and permeability and the Crider soils because of slope. Because they are deeper, the Crider soils should be used as absorption fields, if possible. Nevertheless, the absorption fields should be installed on the contour to help overcome the limitations.

The soils are severely limited for local roads and streets because of slope and low strength. Cuts and fills are needed, and roads should be built on the contour. Road design should accommodate the depth to rock, or the rock must be excavated. If the soils are to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

The soils are in capability subclass IVe; the Crider soils are in woodland suitability subclass 1r, and the Caneyville soils are in woodland suitability subclass 2c.

CxC2—Crider-Frederick-Caneyville silt loams, karst, 2 to 12 percent slopes, eroded. The soils making up this complex are gently sloping and moderately sloping, deep and moderately deep, and well drained. Crider soils are on ridgetops between sinkholes. Frederick soils are on the upper slopes of the sinkholes, and Caneyville soils are on the lower slopes of the sinkholes. The areas of these soils are so intermingled that it was not practical to map the soils separately. The mapped areas are irregularly shaped and are dominantly 30 to 1,000 acres in size. Each area consists of about 50 percent Crider soils, 20 percent Frederick soils, and 15 percent Caneyville soils.

Typically, the surface layer of the Crider soils is dark yellowish brown silt loam that contains some strong brown soil material. It is about 9 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown, firm silty clay loam; the middle part is strong brown, firm cherty silty clay loam; and the lower part is red, firm clay. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silty clay loam and silt loam. In places, the slope is less than 2 percent or more than 12 percent.

Typically, the surface layer of the Frederick soils is dark brown silt loam that contains some yellowish brown soil material. It is about 6 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown, friable silty clay loam; the middle part is yellowish red, firm silty clay loam; and the lower part is red, firm clay. In many areas, plowing has mixed the upper part of the subsoil with the original surface layer,

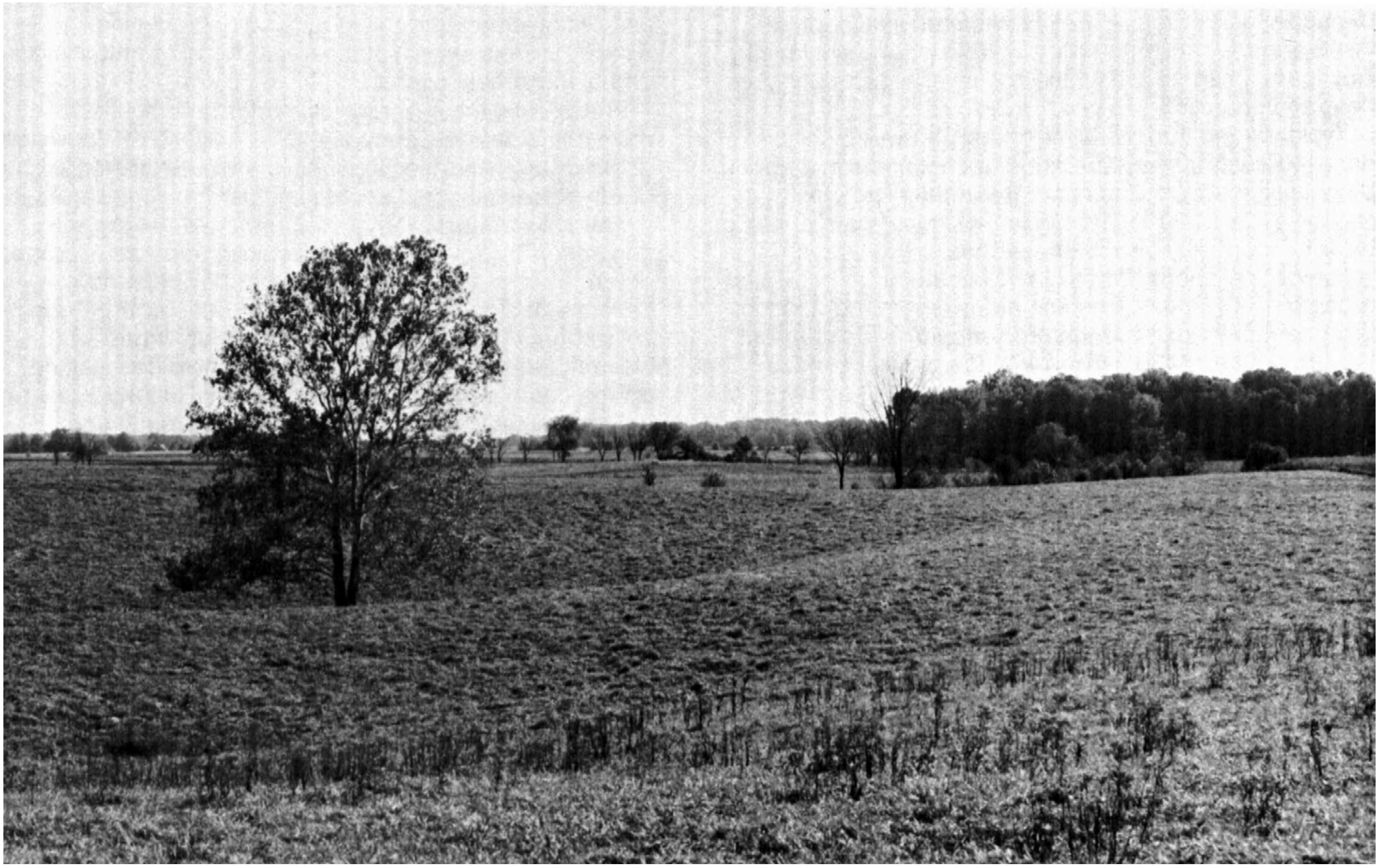


Figure 4.—An area of Crider-Frederick-Caneyville silt loams, karst, 2 to 12 percent slopes, eroded.

and the present surface layer is strong brown silty clay loam. In some areas, the surface layer is cherty. In places, the slope is more than 12 percent.

Typically, the surface layer of the Caneyville soils is dark brown silt loam that contains some yellowish red soil material. It is about 4 inches thick. The subsoil is about 28 inches thick. The upper part is yellowish red, firm silty clay loam, and the lower part is red, firm silty clay and clay. Limestone bedrock is at a depth of 32 inches. In many areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is yellowish red silty clay loam. In places, the slope is more than 12 percent.

Included with these soils in mapping are small areas of well drained Haymond soils, moderately well drained Wilbur soils, thin deposits of alluvial material at the bottom of sinkholes, and moderately well drained Bedford soils, mainly on wide ridges between the sinkholes. Also included are limestone outcrops on side slopes of the sinkholes. The included areas make up about 15 percent of the map unit.

Crider and Frederick soils have a high available water capacity and are moderately permeable. Caneyville soils have a low available water capacity and are moderately slowly permeable. Runoff is medium or rapid. The surface layer of these soils is moderate in organic matter content and is friable and easily tilled.

The soils are used mainly for hay or pasture (fig. 4). In some areas, they are used for cultivated crops, and in a few small areas, they are used as woodland.

The soils are suited to corn, soybeans, and small grains. Erosion is a major hazard if the soils are cultivated. Because of the karstic topography, it is difficult to use conservation practices such as contour farming, terraces, diversions, and grassed waterways to control runoff and erosion. However, conservation tillage, which leaves protective amounts of crop residue on the surface, crop rotation, and crop residue management can be used to help control runoff and erosion, increase the content of organic matter, and maintain tilth.

The soils are suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

The soils are suited to trees. Plant competition and seedling mortality are the main concerns in management, and the use of equipment is limited. Seedlings survive and grow well if competing vegetation is controlled by proper site preparation and by spraying, cutting, or girdling unwanted trees and shrubs. Harvesting during dry periods prevents erosion and compaction of the clayey subsoil.. Replanting seedling stock may be necessary.

Where they are gently sloping, the Crider soils are suitable for building site development, and where they are moderately sloping, the soils are moderately limited for building site development. The Frederick soils are moderately limited for buildings without basements because of the shrink-swell potential and slope, and they are severely limited for dwellings with basements because of the shrink-swell potential. The Caneyville soils are moderately limited for buildings without basements because of the shrink-swell potential, slope, and depth to rock, and they are severely limited for buildings with basements because of depth to rock. The building design should accommodate the slope. Foundations, footings, and basement walls should be strengthened. Backfilling with coarse material helps prevent structural damage caused by the shrinking and swelling of the soil.

Where they are moderately sloping, the Crider soils are moderately limited for use as septic tank absorption fields because of slope. The Frederick soils are moderately limited for this use because of slope and the moderate permeability, and the Caneyville soils are severely limited because of depth to rock and the moderately slow permeability. Because they are deeper, the Crider and Frederick soils should be used as absorption fields, if possible. Nevertheless, the absorption fields should be installed on the contour to help overcome the limitations.

The soils are severely limited for local roads and streets because of low strength. If the soils are to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. Cuts and fills are needed, and roads should be built on the contour if possible.

The soils are in capability subclass IIIe; Crider soils are in woodland suitability subclass 1o; Frederick soils are in woodland suitability subclass 2c; and Caneyville soils are in woodland suitability subclass 3c.

ElA—Elkinsville silt loam, 0 to 2 percent slopes. This is a nearly level, deep, well drained soil on low alluvial terraces. The areas of this soil are irregularly shaped and are dominantly 5 to 15 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is about 49 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is yellowish brown, firm silty clay loam. The underlying material is light gray, mottled silty clay loam with strata of silt loam. In some areas, there is more sand in the surface layer and subsoil, and in a few areas, the slope is more than 2 percent.

Included with this soil in mapping are small areas of moderately well drained Pekin soils and somewhat poorly drained Bartle soils, mainly in slight depressions. Also included are small areas of soils on short steep slopes on terrace breaks. The included soils make up about 10 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is slow. The surface layer is low in organic matter content and is friable and easily tilled.

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

This soil is well suited to corn, soybeans, and small grains. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, and green manure crops help increase the content of organic matter and maintain or improve tilth.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees, and in some small areas, there are stands of native hardwoods. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

This soil is moderately limited for building site development because of the shrink-swell potential. Foundations and footings should be strengthened. Backfilling with coarse material helps prevent structural damage caused by the shrinking and swelling of the soil.

The soil is suited to use as septic tank absorption fields.

This soil is severely limited for local roads and streets because of potential frost action and low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. Adequate drainage along roads decreases the possibility of frost action.

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

ElB—Elkinsville silt loam, 2 to 6 percent slopes. This is a gently sloping, deep, well drained soil on low alluvial terraces. The areas of this soil are irregularly shaped and are dominantly 5 to 20 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil is about 49 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is yellowish brown, firm silty clay loam; and the lower part is light yellowish brown and brownish yellow, firm silty clay loam. The underlying material to a depth of 80 inches is brownish yellow, mottled silty clay loam. In a few areas, there is more sand in the surface layer and subsoil. In places, the slope is less than 2 percent or more than 6 percent.

Included with this soil in mapping are small areas of moderately well drained Pekin soils, mainly on broad terrace benches, and somewhat poorly drained Bartle soils, mainly in level areas or at the head of drainageways. Also included are soils near the top of slopes where most of the surface layer has been lost through erosion and small areas of soils on short steep slopes on terrace breaks. The included soils make up about 12 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is medium. The surface layer is low in organic matter content and is friable and easily tilled.

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

This soil is well suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is cultivated. Crop rotation, conservation tillage, which leaves protective amounts of crop residue on the surface, terraces, contour farming, and grassed waterways help prevent excessive erosion. Crop residue management and cover crops also help control erosion and improve or maintain tilth and the content of organic matter.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by cutting, spraying, or girdling unwanted trees and shrubs.

This soil is moderately limited for building site development because of the shrink-swell potential. Foundations and footings should be strengthened. Backfilling with coarse material helps prevent structural damage from the shrinking and swelling of the soil.

This soil is suited to septic tank absorption fields.

This soil is severely limited for local roads and streets because of low strength and potential frost action. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. Adequate drainage along roads decreases the possibility of frost action.

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

ElC2—Elkinsville silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, well drained soil on low, alluvial terraces. The areas of this soil are irregularly shaped and are dominantly 5 to 15 acres in size.

Typically, the surface layer is dark yellowish brown silt loam that contains some yellowish brown soil material. It is about 6 inches thick. The subsoil is about 59 inches thick. It is strong brown and yellowish brown, friable silty clay loam. The underlying material is light yellowish brown, stratified silt loam, loam, and fine sandy loam. In a few small areas, there is more sand in the surface layer and subsoil. In places, the slope is less than 6 percent or more than 12 percent. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silty clay loam.

Included with this soil in mapping are small areas of moderately well drained Pekin soils on side slopes, soils that formed in alluvium adjacent to drainageways, and soils that formed in colluvium, mainly at the base of steeper slopes. The included soils make up about 10 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is rapid. The surface layer is low in organic matter content and is friable and easily tilled.

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

This soil is suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is cultivated. Crop rotation, conservation tillage, which leaves protective amounts of crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help control runoff and erosion. Crop residue management and cover crops also help control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by cutting, spraying, or girdling unwanted trees and shrubs.

This soil is moderately limited for building site development because of the shrink-swell potential and slope. Foundations and footings should be strengthened. Backfilling with coarse material helps prevent structural damage from the shrinking and swelling of the soil. The slope should be modified by grading, or the building design should accommodate the slope.

This soil is moderately limited for use as septic tank absorption fields because of slope. Installing the absorption field on the contour helps overcome this limitation.

This soil is severely limited for local roads and streets because of low strength and potential frost action. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. Adequate drainage along roads decreases the possibility of frost action.

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

FrD2—Frederick silt loam, 12 to 18 percent slopes, eroded. This is a strongly sloping, deep, well drained soil on side slopes on uplands. The areas of this soil are narrow and irregularly shaped and are dominantly 5 to 20 acres in size.

Typically, the surface layer is dark brown silt loam that contains some strong brown soil material. It is about 6 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is strong brown, friable silt loam; the part below that is yellowish red, friable silty clay loam; and the next part is yellowish red, firm silty clay. The lower part of the subsoil is red, firm clay. In places, the slope is less than 12 percent or more than 18 percent. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silt loam and silty clay loam.

Included with this soil in mapping are small areas of well drained Crider soils, mainly on the upper part of slopes, well drained Caneyville soils on the lower part of slopes, and soils that formed in alluvium adjacent to drainageways. In small areas, the soil is less than 60 inches deep to bedrock. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is rapid. The surface layer is moderate in organic matter content and is friable and easily tilled.

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

This soil is poorly suited to corn, soybeans, and small grains. It can be used occasionally for row crops. Erosion is the major hazard if this soil is cultivated. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop rotation, diversions, contour farming, and grassed waterways help control runoff and erosion. Crop residue management and cover crops also help control erosion and maintain tilth and the organic matter content.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, poor tilth, and excessive runoff and erosion and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is suited to trees, and in some areas there are stands of native hardwoods. Erosion is a hazard, and the use of equipment is limited. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory as possible help control erosion. The slope makes the use of equipment difficult in logging and planting. Specialized equipment and careful planning of logging and planting help overcome this problem.

Because of slope, the soil is severely limited for building site development and for use as septic tank absorption fields. The building design should accommodate the slope, and absorption fields should be installed on the contour.

This soil is severely limited for local roads and streets because of slope and low strength. Constructing roads on the contour and shaping the land help overcome the limitation of slope. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

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

FrF—Frederick silt loam, 18 to 50 percent slopes. This is a moderately steep to very steep, deep, well drained soil on side slopes on uplands. The areas of this soil are narrow and irregularly shaped and are dominantly 10 to 30 acres in size.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is yellowish red, friable silt loam and silty clay loam, and the lower part is red, firm clay. In some areas that have been cleared, some or all of the surface layer has been lost through erosion.

Included with this soil in mapping are small areas of alluvial soils adjacent to drainageways, well drained Crider soils, mainly on the upper part of slopes and on narrow ridgetops, and well drained Caneyville soils, mainly near the base of the slopes. In some areas, bedrock is exposed at the base of the slopes. The included areas make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. The organic matter content of the surface layer is moderate, and runoff is very rapid. The surface layer is friable; however, tillage is difficult or impossible because of the moderately steep to very steep slopes.

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

This soil is generally not suited to use as cropland because the steepness of the slopes limits the use of equipment.

This soil is poorly suited to grasses and legumes for pasture because of the slope. Pasture can be established on the less sloping included soils.

This soil is suited to trees. Erosion is a hazard, and the use of equipment is limited. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Specialized equipment and careful planning of logging minimize the limitation of slope.

Because of slope, this soil, in most areas, is not suited to building site development or to use as septic tank absorption fields. It is severely limited for local roads and streets because of slope and low strength. Constructing roads on the contour and shaping the land help overcome the limitation of slope. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material. If possible, an alternate site on a more suitable soil should be considered.

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

GoF—Gilpin-Wellston silt loams, 18 to 50 percent slopes. The soils making up this complex are moderately steep to very steep, moderately deep and deep, and well drained. Gilpin soils are on side slopes along drainageways and in the steepest areas. Wellston soils are in benchlike areas and on ridgetops between drainageways. The areas of these soils are so intermingled that it was not practical to map the soils separately. The mapped areas are irregularly shaped and are dominantly 40 to 200 acres in size. Each area consists of about 55 percent Gilpin soils and 30 percent Wellston soils.

Typically, the surface layer of the Gilpin soils is dark grayish brown silt loam about 3 inches thick. The subsurface layer is dark yellowish brown silt loam about 4 inches thick. The subsoil is about 25 inches thick. The upper part is yellowish brown, friable silt loam, and the lower part is strong brown, friable channery silt loam. Sandstone and shale bedrock is at a depth of 32 inches. In places, the slope is less than 18 percent. In areas that have been cleared, some or all of the surface layer has been lost through erosion.

Typically, the surface layer of the Wellston soils is dark brown silt loam about 2 inches thick. The subsurface layer is dark yellowish brown silt loam about 3 inches thick. The subsoil is about 67 inches thick. The upper part is strong brown, friable silt loam; the part below that is yellowish brown, friable channery loam; and the next part is yellowish brown, firm channery clay loam. The lowermost part of the subsoil is light gray, mottled, firm clay. The underlying material is greenish gray, firm clay shale. On some narrow hillsides and benches and at the base of slopes, the slope is less than 18 percent. In areas that have been cleared, some or all of the surface layer has been lost through erosion.

Included with the soils in mapping are a few areas of shallow soils, areas where bedrock is exposed, areas of soils that have a clay subsoil overlying shale bedrock, areas of soils that developed in loess and limestone residuum, and areas of soils that formed in alluvium along drainageways. Limestone and sandstone escarpments are also included. The included areas make up about 15 percent of the map unit.

Gilpin soils have a low available water capacity, and Wellston soils have a high available water capacity. The soils are moderately permeable. Runoff is very rapid. The surface layer is moderate in organic matter content and is friable, but because of the moderately steep to very steep slopes and the stones on the surface, tillage is difficult or impossible.

The soils are used mainly as woodland, and in a few small areas, they are used for pasture. The areas of pasture are primarily on the less sloping included soils.

The soils are generally not suited to use as cropland because the steepness of the slopes limits the use of equipment. Stones on the surface and rock outcrops are limitations.

The soils are poorly suited to grasses and legumes for pasture because of slope and stoniness. Pasture can be established on the less sloping included soils, but access to the areas may be difficult.

The soils are suited to use as woodland. Erosion is a hazard, and the use of equipment is severely limited because of the moderately steep to very steep slopes. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. Specialized equipment and careful planning of logging help overcome the limitation of slope.

Because of slope, the soils, in most areas, are not suited to building site development or to use as septic tank absorption fields. Depth to rock also limits the soils for some uses. The soils are severely limited for local roads because of slope; frost action also limits the Wellston soils for this use. Constructing roads on the contour and shaping the land help overcome the limitation of slope. Adequate drainage along roads decreases the possibility of frost action. If possible, an alternate site on a more suitable soil should be considered.

The soils are in capability subclass VIIe and in woodland suitability subclass 2r.

Hd—Haymond silt loam, frequently flooded. This is a nearly level, deep, well drained soil on bottom lands. This soil is subject to flooding. The areas of this soil are irregularly shaped and are dominantly 20 to 60 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is dark brown and dark

Figure 5.—Row crops on Haymond silt loam, frequently flooded, and woodland on Gilpin-Wellston silt loams, 18 to 50 percent slopes.

yellowish brown, friable silt loam about 31 inches thick. The underlying material to a depth of 60 inches is dark brown silt loam with strata of loam. In some areas near streams, the soil has more sand in the surface layer and subsoil, and in some areas, 20 to 40 inches of recent alluvium overlie older acid alluvium. In a few areas, the soil is strongly acid or medium acid throughout. In places, the slope is more than 2 percent. Some areas of this soil are only occasionally flooded.

Included with this soil in mapping are small areas of somewhat poorly drained Wakeland soils, moderately well drained Wilbur soils, and well drained Burnside soils. Wakeland and Wilbur soils are in level areas, mainly near the base of uplands and in drainageways. Burnside soils finger into Haymond soils and are adjacent to drainageways at the base of steep hills. Small areas of moderately well drained Pekin and Elkinsville soils, mainly in slightly higher areas on the flood plains, are also included. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is slow. The surface layer is moderate in organic matter content and is friable and easily tilled.

This soil is used mainly for cultivated crops (fig. 5). In a few areas, it is used for hay and pasture or as woodland.

This soil is well suited to corn, soybeans, and small grains. Flooding is a hazard, but it normally occurs before the major crops are planted. Diversions commonly intercept runoff from higher ground. Crop residue management, cover crops, green manure crops, and conservation tillage, which leaves protective amounts of crop residue on the surface, help maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Fields of hay and pastures may be severely damaged by flooding. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

This soil, in most areas, is not suited to building site development or to use as septic tank absorption fields because of flooding. It is severely limited for local roads and streets because of frost action and flooding. Constructing roads on raised, well compacted fill material and providing adequate side-ditch drainage and culverts help protect the roads from flooding and frost damage.

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

Mo—Montgomery silty clay loam. This is a nearly level, deep, very poorly drained soil in slight depressions on uplands. Runoff from higher adjoining areas ponds on this soil. The areas of this soil are irregularly shaped and are dominantly 20 to 40 acres in size.

Typically, the surface layer is very dark gray silty clay loam about 10 inches thick. The subsurface layer is very dark gray, mottled silty clay loam about 9 inches thick. The subsoil is about 50 inches thick. The upper part is dark grayish brown, mottled, firm silty clay loam, and the lower part is yellowish brown, mottled, firm silty clay loam and silty clay. The underlying material to a depth of 80 inches is yellowish red, mottled clay. In some areas, the surface layer is brown silty loam overwash.

Included with this soil in mapping are somewhat poorly drained Bromer soils and poorly drained Peoga soils in areas that are slightly higher than areas of the Montgomery soil. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is slowly permeable or very slowly permeable. Runoff is ponded or very slow. A seasonal high water table is near or above the surface in winter and early in spring. The surface layer is high in organic matter content and is difficult to work. If tilled when it is too wet or too dry, the soil becomes cloddy, and seedbed preparation is difficult.

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

If adequately drained, this soil is suited to corn, soybeans, and small grains. Wetness is the major limitation. Excess water can be removed by open ditches or subsurface drains. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, cover crops, and green manure crops help maintain the organic matter content and tilth.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because of excessive wetness in winter and early in spring. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is suited to trees. Use of equipment is limited, and windthrow is a hazard. Seedling mortality and plant competition are concerns in management. Unwanted trees and shrubs can be controlled or removed by proper site preparation or by spraying, cutting, or girdling. Species tolerant of wetness should be planted. Seasonal wetness hinders harvesting and logging and the planting of seedlings.

This soil, in most areas, is not suited to building site development or to use as septic tank absorption fields because of ponding. It is severely limited for local roads and streets because of ponding, the shrink-swell potential, and low strength. The base material should be strengthened or replaced with a more suitable material to overcome the shrink-swell potential and low strength. Constructing roads on raised, well compacted fill material and providing adequate side-ditch drainage and culverts help protect the roads from ponding.

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

PeB—Pekin silt loam, 2 to 6 percent slopes. This is a gently sloping, deep, moderately well drained soil on low alluvial terraces. The areas of this soil are irregularly shaped and are dominantly 10 to 15 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The subsoil is about 41 inches thick. The upper part is yellowish brown, mottled, friable silt loam and silty clay loam; the part below that is light yellowish brown, mottled, friable silt loam; and the next part is a light brownish gray, mottled, very firm silty clay loam fragipan. The lowermost part of the subsoil is yellowish brown, mottled, friable silt loam. The underlying material to a depth of 82 inches is yellowish brown, mottled, stratified silt loam and silty clay loam. In some areas, the soil has more sand in the subsoil. In places, the slope is less than 2 percent or more than 6 percent. In some areas, some or all of the surface layer has been lost through erosion.

Included with this soil in mapping are small areas of well drained Elkinsville soils, mainly on narrow ridges and near terrace breaks; somewhat poorly drained Bartle soils, mainly in level areas or at the head of drainageways; and soils that formed in alluvium along drainageways. The included soils make up about 15 percent of the map unit.

This soil has a moderate available water capacity and is moderately permeable above the fragipan and very slowly permeable in the fragipan. Runoff is medium. The surface layer is moderate in organic matter content and is friable and easily tilled. A seasonal high water table is at a depth of 2 to 6 feet in winter and early in spring. The very firm and brittle fragipan, which is at a depth of 20 to 36 inches, limits the rooting depth.

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

This soil is well suited to corn, soybeans, and small grains. Conservation practices are needed to control runoff and erosion if the soil is cultivated. Because the fragipan restricts water movement, this soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Crop rotation, conservation tillage, which leaves protective amounts of crop residue on the surface, terraces, contour farming, and grassed waterways help prevent excessive erosion. Crop residue management, cover crops, and green manure crops help control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. The rooting zone is limited mainly to the area above the fragipan. Unwanted trees and shrubs can be controlled or removed by spraying, cutting, or girdling.

Because of wetness, this soil is moderately limited for dwellings without basements and is severely limited for dwellings with basements. On this soil, buildings should be built without basements, and foundation drains should be installed to help overcome wetness.

This soil is severely limited for use as septic tank absorption fields because of wetness and the very slow permeability in the fragipan. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of low strength and frost action. Adequate drainage along roads decreases the possibility of frost action. The base material should be strengthened or replaced with a more suitable material to overcome the low strength.

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

PeC2—Pekin silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, moderately well drained soil on low alluvial terraces. The areas of this soil are irregularly shaped and are dominantly 5 to 10 acres in size.

Typically, the surface layer is dark brown silt loam with yellowish brown pockets. It is about 7 inches thick. The subsoil is about 36 inches thick. The upper part is yellowish brown, mottled, friable silt loam, and the lower part is a very firm and brittle fragipan of light brownish gray, mottled silty clay loam. The underlying material to a depth of 60 inches is light brownish gray, mottled, stratified loam and silty clay loam. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is yellowish brown silt loam. In places, the slope is less than 6 percent or more than 12 percent. In some areas, there is more sand in the subsoil.

Included with this soil in mapping are small areas of well drained Elkinsville soils, mainly on side slopes of terrace breaks and drainageways, and alluvial soils along drainageways. The included soils make up about 15 percent of the map unit.

This soil has a moderate available water capacity and is moderately permeable above the fragipan and very slowly permeable in the fragipan. Runoff is medium. The surface layer is moderate in organic matter content and is friable and easily tilled. A seasonal high water table is at a depth of 2 to 6 feet in winter and early in spring. The fragipan, which is at a depth of 20 to 36 inches, limits the rooting depth.

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

This soil is suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is cultivated. Because the fragipan restricts water movement, the soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Crop rotation, tillage that leaves protective amounts of crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help control runoff and erosion. Crop residue management and cover crops also help control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. The rooting zone is limited mainly to the area above the fragipan. Unwanted trees and shrubs can be controlled or removed by spraying, cutting, or girdling.

This soil is moderately limited for dwellings without basements because of wetness and slope. It is severely limited for dwellings with basements because of wetness. The building design should accommodate the slope. On this soil, buildings should be built without basements, and foundation drains should be installed to help overcome wetness.

This soil is severely limited for use as septic tank absorption fields because of wetness and the very slow permeability in the fragipan. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of low strength and frost action. Adequate drainage along roads decreases the possibility of frost action. The base material should be strengthened or

Figure 6.—An area of Peoga soil, which is used mainly for hay and pasture because it is poorly drained.

replaced with a more suitable material to overcome the low strength.

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

Po—Peoga silt loam, clayey substratum. This is a nearly level, deep, poorly drained soil in slight depressions on the uplands. The areas of this soil are irregularly shaped and are dominantly 5 to 10 acres in size.

Typically, the surface layer is dark gray silt loam about 7 inches thick. The subsoil extends to a depth of 80 inches or more. The upper part is gray, mottled, friable silt loam and silty clay loam; the part below that is gray, mottled, firm silty clay loam; and the next part is dark gray, mottled, firm silty clay and cherty clay. The lowermost part of the subsoil is brownish yellow, mottled, firm silty clay. In some areas, the surface layer is silty clay, and in some areas, there is less clay in the subsoil.

Included with this soil in mapping are a few small areas of somewhat poorly drained Bromer soils, mainly near the edge of the depressions and on slightly higher knolls, very poorly drained Montgomery soils in low depressions, and soils in small areas of marsh. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is slowly permeable. Runoff is ponded or very slow. A seasonal high water table is at or near the surface in winter and early in spring. The surface layer is moderate in organic matter content and is friable and easy to till.

This soil is used mainly for hay or pasture (fig. 6). In some areas, it is used for cultivated crops or as woodland.

If adequately drained, this soil is suited to corn, soybeans, and small grains. Wetness is a limitation, and excess water can be removed by installing open ditches or surface drains. Subsurface drains can be used if a suitable outlet is available. If drained and properly managed, this soil is suited to intensive row cropping. Practices such as conservation tillage, which leaves protective amounts of crop residue on the surface, and crop residue management help maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to alfalfa and other deep-rooted legumes because of the seasonal high water table. Drainage is necessary to obtain high yields of forage and to maintain the condition of the pasture. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is suited to trees. The use of equipment is limited, and windthrow is a hazard. Seedling mortality and plant competition are concerns in management. The high water table hinders harvesting and logging and the planting of seedlings. Competing vegetation can be controlled by proper site preparation or by spraying, cutting, or girdling unwanted trees and shrubs. Species tolerant of wetness should be planted.

This soil is severely limited for building site development because of wetness. On this soil, buildings should be built without basements, and foundation drains should be installed to help lower the water table. Foundations and footings should be strengthened. Backfilling with coarse material helps prevent structural damage from the shrinking and swelling of the soil. This soil is severely limited for use as septic tank absorption fields because of wetness and slow permeability. Increasing the size of the absorption field helps overcome these limitations. This soil is severely limited for local roads and streets because of wetness, frost action, and low strength. The base material should be strengthened or replaced with a more suitable material to overcome the low strength. Constructing roads on well compacted fill material and providing drainage along the roads help decrease the possibility of frost action.

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

Pt—Pits, quarry. This map unit consists of areas where limestone bedrock has been surface-mined for construction or agricultural purposes. The quarries commonly are on the uplands and are dominantly 5 to 75 acres in size.

Included in mapping are well drained Caneyville and Crider soils in small areas interfingered through the spoil areas; well drained Gilpin and Wellston soils, mainly on the upper part of slopes adjacent to the pits that have been cut into the hillsides; and areas of soils that were mixed with rock fragments in removing the overburden prior to mining. The included soils make up about 10 percent of the map unit.

Actively mined quarries are continually being enlarged. Most quarries have a high wall on one or more sides. The soils in the quarries support little or no vegetation.

A capability class and woodland suitability class were not assigned.

Ud—Udorthents, loamy. These are gently sloping to strongly sloping soils on the uplands. These soils are in areas where refuse has been deposited and covered with soil material. The areas are irregularly shaped and range from 3 to 35 acres in size.

These soils are quite variable, but in a representative area the surface layer is yellowish brown or strong brown channery silt loam or channery silty clay loam. The underlying material consists of solid waste and thin layers of soil material. In some areas, refuse is mixed into the surface layer.

Included in mapping are small areas of well drained Gilpin and Wellston soils. These soils are mainly between the pits in which the refuse is buried. The included soils make up about 10 percent of the map unit.

Udorthents, loamy, have a low or moderate available water capacity and are moderately permeable to very slowly permeable. Runoff is rapid or very rapid. The surface layer is low in organic matter content.

In most areas, landfill operations have been completed. Weeds and grasses grow in these areas. In some areas, landfill operations continue.

The soils generally are not suited to corn, soybeans, or small grains because erosion is a hazard and because of the rock fragments on the surface.

The soils are suited to grasses, which provide cover and protection from erosion. After the fill material has settled, some species of shrubs and trees can be planted.

In most areas, the soils are not suited to use as sites for buildings, septic tank absorption fields, and local roads and streets because of low strength and the hazard of settling. The buried refuse contains large amounts of natural gas, which is a building hazard. An alternate site should be found for these uses. The soils can be used for recreation purposes that do not require structures or buildings.

These soils were not assigned to a capability class or to a woodland suitability class.

Wa—Wakeland silt loam, frequently flooded. This is a nearly level, deep, somewhat poorly drained soil on flood plains. The areas of this soil are irregularly shaped and are dominantly 5 to 10 acres in size.

Typically, the surface layer is dark brown silt loam about 9 inches thick. The underlying material is brown, mottled, friable silt loam to a depth of 16 inches. To a depth of 60 inches, it is light brownish gray, mottled silt loam. In some areas, the soil contains more sand, and in some areas, the soil contains more clay. In some areas, the soil is strongly acid or very strongly acid throughout. Some areas of this soil are only occasionally flooded. In places, there are 20 to 40 inches of recent alluvium overlying older acid alluvium.

Included with this soil in mapping are moderately well drained Wilbur soils and well drained Haymond soils in small areas that are slightly higher than areas of the Wakeland soil. Also included are poorly drained soils, mainly near the center of slight depressions, and somewhat poorly drained Bartle soils, mainly in slightly higher areas. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is slow. The surface layer is moderate in organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 1 foot to 3 feet in winter and early in spring.

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

If adequately drained, this soil is well suited to corn, soybeans, and some small grains. Wetness is a limitation. Frequent flooding is a hazard; however, flooding normally occurs before the major crops are planted. Subsurface drains and open ditches can be used to lower the water table. Flooding can be controlled in some areas by levees and diversions that intercept runoff from higher ground. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, cover crops, and green manure crops help maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to alfalfa and other deep-rooted legumes because of the high water table. Fields of hay and pasture may be severely damaged during flooding. Drainage and protection from flooding are necessary to obtain large yields of grasses and legumes. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling unwanted trees and shrubs. The seasonal high water table may delay planting and harvesting until the soil is dry or is frozen.

In most areas, this soil is not suited to use as sites for buildings and septic tank absorption fields because of wetness and flooding. This soil is severely limited for local roads and streets because of frost action and flooding. Constructing roads on raised, well compacted fill material and providing adequate side-ditch drainage and culverts help protect the roads from flooding and frost damage.

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

WeC2—Wellston silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, well drained soil on narrow ridgetops and side slopes along drainageways on the uplands. Most areas of this soil are narrow and irregularly shaped and are 10 to 50 acres in size.

Typically, the surface layer is dark brown silt loam that contains yellowish brown soil material. It is about 8 inches thick. The subsoil is about 38 inches thick. The upper part is strong brown, friable silt loam and silty clay loam, and the lower part is strong brown, firm clay loam. The underlying material is strong brown loam. Sandstone bedrock is at a depth of about 50 inches. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is yellowish brown silt loam. In places, the slope is less than 6 percent or more than 12 percent. In some places, the soil is silty clay or clay in the lower part of the subsoil and overlies shale bedrock. In some areas, depth to bedrock is less than 40 inches or more than 72 inches.

Included with this soil in mapping are small areas of well drained Zanesville soils, mainly on wide ridgetops, alluvial soils along the drainageways, and soils that developed in loess and the underlying residuum of limestone. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is medium. The surface layer is moderate in organic matter content and is friable and easily tilled.

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

This soil is suited to corn, soybeans, and small grains. Conservation measures are necessary to control runoff and erosion if the soil is cultivated. Crop rotation, tillage that leaves protective amounts of crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help control runoff and erosion. Crop residue management and cover crops also help control erosion, and they maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth and reduces the density of plants. Proper stocking and rotation grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees, and high yields can be obtained. Plant competition is the main concern in management. Unwanted trees and shrubs can be controlled by site preparation and by spraying, cutting, or girdling.

This soil is moderately limited for building site development because of slope and depth to rock. Building design should accommodate the depth to rock and the slope. This soil is moderately limited for septic tank absorption fields because of slope, permeability, and depth to rock. Installing the absorption field on the contour and increasing the size of the absorption field help overcome the limitations of slope and permeability. This soil is severely limited for local roads and streets because of frost action. Adequate drainage along roads decreases the possibility of frost action.

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

WeC3—Wellston silt loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping, deep, well drained soil on narrow ridgetops and on side slopes along natural drainageways. Most areas of this soil are narrow and irregularly shaped and are 10 to 15 acres in size.

Typically, the surface layer is dark yellowish brown silt loam that contains some yellowish brown soil material. It is about 3 inches thick. The subsoil is about 42 inches thick. The upper part is yellowish brown, friable silt loam; the middle part is strong brown, friable silty clay loam; and the lower part is yellowish brown, friable loam. Sandstone bedrock is at a depth of 45 inches. In many areas, the surface layer is yellowish brown silt loam and silty clay loam. In some areas, the slope is more than 12 percent. In some areas the lower part of the subsoil is silty clay or clay and overlies shale bedrock. In some areas, depth to bedrock is less than 40 inches or more than 72 inches.

Included with this soil in mapping are small areas of well drained Zanesville soils, mainly on wider ridgetops. Also included are soils in small gullied areas, mainly on the upper part of slopes, small areas of soils that formed in alluvium along drainageways, and soils that developed in loess and the underlying residuum of limestone. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is rapid. The surface layer is low in organic matter content. Tillage generally is difficult because part of the subsoil has been mixed with the surface layer.

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

This soil is poorly suited to corn, soybeans, and small grains. It can be used occasionally for row crops, but the risk of further erosion is very high. Conservation practices are necessary to control runoff and erosion. Crop rotation, conservation tillage, which leaves protective amounts of crop residue on the surface, diversions, contour farming, and grassed waterways help control runoff and erosion. Crop residue management and cover crops also help control erosion, and they improve tilth and increase the content of organic matter.

This soil is suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soil is wet causes surface compaction, poor tilth, and excessive runoff and erosion and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Unwanted trees and shrubs can be controlled by site preparation and by spraying, cutting, or girdling.

This soil is moderately limited for building site development because of the depth to rock and the slope. Building design should accommodate the depth to rock and the slope. This soil is moderately limited for use as septic tank absorption fields because of the slope, permeability, and depth to bedrock. Installing the absorption field on the contour and increasing the size of the absorption field help overcome the limitations of slope and permeability. This soil is severely limited for local roads and streets because of potential frost action. Adequate drainage along roads decreases the possibility of frost action.

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

WfD3—Wellston-Ebal-Gilpin complex, 12 to 18 percent slopes, severely eroded. The soils making up this complex are strongly sloping, deep and moderately deep, and well drained and moderately well drained. Wellston soils are on narrow ridgetops between drainageways and in benchlike areas on side slopes. Ebal and Gilpin soils are on side slopes of drainageways. The areas of these soils are so intermingled that it was not practical to map the soils separately. The mapped areas are irregularly shaped and are dominantly 5 to 20 acres in size. Each area consists of about 36 percent Wellston soils, 34 percent Ebal soils, and 20 percent Gilpin soils.

Typically, the surface layer of the Wellston soils is brown silt loam about 1 inch thick. The subsoil is about 43 inches thick. The upper part is strong brown, friable silty clay loam, and the lower part is strong brown, friable channery silty clay loam and channery loam. Sandstone bedrock is at a depth of 44 inches. In many areas, the present surface layer is strong brown silty clay loam because the original surface layer has been lost through erosion. In places, the slope is less than 12 percent.

Typically, the surface layer of the Ebal soils is yellowish brown silty clay loam about 1 inch thick. The subsoil is about 57 inches thick. The upper part is yellowish brown, friable silty clay loam; the middle part is yellowish brown, firm silty clay; and the lower part is strong brown and brownish yellow, firm clay. Soft shale bedrock is at a depth of 58 inches.

Typically, the surface layer of the Gilpin soils is strong brown silt loam about 1 inch thick. The subsoil is about 21 inches thick. The upper part is strong brown, friable channery silty clay loam, and the lower part is strong brown, friable channery loam. Sandstone bedrock is at a depth of about 22 inches. In places the present surface layer is strong brown silty clay loam because the original surface layer has been lost through erosion.

Included with these soils in mapping are a few small areas of soils that developed in material that weathered from limestone; soils that formed in colluvium, mainly at the foot of slopes, and that are more than 60 inches deep to bedrock; soils that formed in alluvium along drainageways; and well drained Zanesville soils, mainly on the upper part of slopes. Also included are a few small rock outcrops, bedrock escarpments, soils in gullied areas, some of which have eroded to bedrock, and soils on short steep slopes. The included areas make up about 10 percent of the map unit.

Wellston soils have a high available water capacity and are moderately permeable. Gilpin soils have a low available water capacity and are moderately permeable. Ebal soils have a moderate available water capacity and are moderately permeable in the upper part of the subsoil and very slowly permeable in the lower part. Runoff is very rapid. The surface layer is low in organic matter content. Tillage generally is difficult because part of the subsoil has been mixed with the surface layer.

In most areas, the soils are idle or are in pasture or hay. In a few areas, they are cropped to corn, soybeans, or small grains, and in some areas, they are used as woodland.

The soils generally are not suited to corn and soybeans because further erosion is a major hazard if the soils are cultivated.

The soils are poorly suited to grasses and legumes for pasture. Overgrazing or grazing when the soil is wet causes surface compaction, poor tilth, and excessive runoff and erosion and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

The soils are suited to trees. Erosion is a hazard, and the use of equipment is limited. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. The slope makes the use of some equipment difficult in logging and planting. Specialized equipment and careful planning of logging and planting help overcome the problem of slope.

These soils are severely limited for building site development—the Wellston and Gilpin soils because of slope and the Ebal soils because of slope and the shrink-swell potential. The building design should accommodate the slope. Foundations, footings, and basement walls should be strengthened. Backfilling with coarse material helps prevent structural damage from the shrinking and swelling of the soil.

These soils are severely limited for use as septic tank absorption fields—the Wellston soils because of slope, the Ebal soils because of slope and permeability, and the Gilpin soils because of slope and depth to rock. Installing the absorption field on the contour and increasing the size of the absorption field help overcome the limitations of slope and permeability.

These soils are severely limited for local roads and streets—the Wellston soils because of slope and frost action, the Ebal soils because of slope, low strength, and the shrink-swell potential, and the Gilpin soils because of slope. Cuts and fills are needed, and roads should be built on the contour if possible. The base material should be replaced with a more suitable material to overcome the shrink-swell potential and low strength. Adequate drainage along roads decreases the possibility of frost action.

These soils are in capability subclass VIe; the Wellston and Gilpin soils are in woodland suitability subclass 2r, and the Ebal soils are in woodland suitability subclass 2c.

WgD2—Wellston-Gilpin-Ebal silt loams, 12 to 18 percent slopes, eroded. The soils making up this complex are strongly sloping, deep and moderately deep, and well drained and moderately well drained. Wellston soils are on narrow ridgetops between drainageways and on benchlike areas on side slopes. Gilpin and Ebal soils are on side slopes along drainageways. The areas of these soils are so intermingled that it was not practical to map the soils separately. The mapped areas are irregularly shaped and are dominantly 10 to 100 acres in size. Each area consists of about 40 percent Wellston soils, 30 percent Gilpin soils, and 20 percent Ebal soils.

Typically, the surface layer of the Wellston soils is dark brown silt loam that contains some strong brown soil material. It is about 7 inches thick. The subsoil is about 65 inches thick. The upper part is strong brown, friable silty clay loam and silt loam; the middle part is strong brown, friable clay loam; and the lower part is strong brown, friable channery and very channery sandy clay loam. Rippable sandstone bedrock is at a depth of 72 inches. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silt loam and silty clay loam. In places, the slope is less than 12 percent.

Typically, the surface layer of the Gilpin soils is dark yellowish brown silt loam that contains some strong brown soil material. It is about 4 inches thick. The subsoil is about 24 inches thick. The upper part is strong brown, friable silty clay loam; the middle part is strong brown, friable channery silt loam; and the lower part is strong brown, friable channery loam. Sandstone bedrock is at a depth of 28 inches. In places, the subsoil is more than 24 inches thick. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silt loam and silty clay loam.

Typically, the surface layer of the Ebal soils is dark yellowish brown silt loam that contains some yellowish brown soil material. It is about 6 inches thick. The subsoil is about 69 inches thick. The upper part is yellowish brown, friable silty clay loam; the part below that is yellowish brown, firm clay; the next part is brownish yellow, mottled, firm clay; and the lowermost part is yellowish brown, mottled, firm silty clay.

Figure 7.—An area of Wellston-Gilpin-Ebal silt loams, 12 to 18 percent slopes, eroded.

Sandstone bedrock is at a depth of 75 inches. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is yellowish brown silt loam and silty clay loam.

Included with these soils in mapping are a few small areas of soils that formed in material that weathered from limestone, soils that formed in alluvium along drainageways, and small areas of rock outcrop. The rock is mostly sandstone, but in places there are thin layers of limestone. Also included are small bedrock escarpments, soils that have short, steep slopes, well drained Zanesville soils on the upper part of slopes, and soils that formed in colluvium, mainly at the foot of slopes, and that are more than 60 inches deep to bedrock. The included areas make up about 10 percent of the map unit.

Wellston soils have a high available water capacity and are moderately permeable. Gilpin soils have a low available water capacity and are moderately permeable. Ebal soils have a moderate available water capacity and are moderately permeable in the upper part of the subsoil and very slowly permeable in the lower part. Runoff is rapid. The surface layer of these soils is moderate in organic matter content and is friable and easily tilled.

These soils are used mainly for pasture and hay or as woodland (fig. 7). In some areas they are used for cultivated crops.

These soils are poorly suited to corn, soybeans, and small grains. They can be used occasionally for row crops; however, runoff and erosion are major hazards. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop rotation, crop residue management, diversions, and grassed waterways help control runoff and erosion, and they increase the content of organic matter and help maintain or improve tilth.

These soils are suited to grasses and legumes for hay and pasture. Overgrazing or grazing when the soils are wet causes surface compaction, poor tilth, and excessive runoff and erosion and reduces the density of the plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soils.

These soils are suited to trees, and in some areas there are stands of native hardwoods. Erosion is a hazard, however, and there are limitations to the use of equipment. Selective cutting rather than clear cutting, constructing haul roads on the contour, and preserving as much understory vegetation as possible help control erosion. The slope makes the use of equipment difficult in logging and planting. Specialized equipment and careful planning of logging and planting help overcome this problem.

These soils are severely limited for building site development—the Wellston and Gilpin soils because of slope and the Ebal soils because of slope and the shrink-swell potential. The building design should accommodate the slope. Foundations, footings, and basement walls should be strengthened. Backfilling with coarse material helps prevent structural damage from the shrinking and swelling of the soil.

These soils are severely limited for use as septic tank absorption fields—the Wellston soils because of slope, the Gilpin soils because of slope and depth to bedrock, and the Ebal soils because of slope and permeability. Installing the absorption field on the contour and increasing the size of the absorption field help overcome the limitations of slope and permeability.

These soils are severely limited for local roads and streets—the Wellston soils because of slope and frost action, the Gilpin soils because of slope, and the Ebal soils because of slope, low strength, and the shrink-swell potential. Cuts and fills are needed, and roads should be built on the contour if possible. The base material should be replaced with a more suitable material to overcome the shrink-swell potential and low strength. Adequate drainage along the roads decreases the possibility of frost action.

These soils are in capability subclass IVe; the Wellston and Gilpin soils are in woodland suitability subclass 2r, and the Ebal soils are in woodland suitability subclass 2c.

Wr—Wilbur silt loam, frequently flooded. This is a nearly level, deep, moderately well drained soil on bottom lands that are subject to flooding. The areas of this soil are irregularly shaped and are dominantly 20 to 60 acres in size.

Typically, the surface layer is dark brown silt loam about 8 inches thick. The underlying material is brown, yellowish brown, and pale brown, mottled silt loam to a depth of 60 inches. In some places the surface layer is lighter in color. In some areas, there is more sand in the surface layer and subsoil. In some areas, the soil is strongly acid throughout. In some areas, the soil is only occasionally flooded, and in places, the slope is more than 2 percent. In some areas, recent alluvium overlies older acid alluvium.

Included with this soil in mapping are small areas of somewhat poorly drained Wakeland soils and well drained Haymond soils. Wakeland soils are in flat areas or depressions, and Haymond soils are slightly higher on the landscape than the Wilbur soil or are adjacent to drainageways. The included soils make up about 15 percent of the map unit.

This soil has a high available water capacity and is moderately permeable. Runoff is slow. The surface layer is moderate in organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 3 to 6 feet in winter and early in spring.

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

This soil is well suited to corn, soybeans, and some small grains. Frequent flooding is a hazard; however, flooding normally occurs before the major crops are planted. Flooding can be controlled in some areas by levees and diversions that intercept runoff from higher ground. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, cover crops, and green manure crops help maintain or improve tilth and the organic matter content.

This soil is well suited to grasses and legumes for hay and pasture. Fields of hay and pastures may be severely damaged by flooding. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by proper site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

In most areas, this soil is not suited to use as sites for buildings and septic tank absorption fields because of wetness and flooding. This soil is severely limited for local roads and streets because of frost action potential and flooding. Constructing roads on raised, well compacted fill material and providing adequate side-ditch drainage and culverts help protect the roads from flooding and frost damage.

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

ZaA—Zanesville silt loam, 0 to 2 percent slopes. This is a nearly level, deep, moderately well drained soil on ridgetops on the uplands. The areas of this soil are irregularly shaped and are dominantly 5 to 15 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The subsoil is about 50 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam; the middle part is a yellowish brown, mottled, very firm, silty clay loam fragipan; and the lower part is yellowish brown, mottled, friable silt loam. Sandstone bedrock is at a depth of 57 inches. In places, the slope is more than 2 percent. In some areas, the lower part of the subsoil and the underlying material are more clayey and overlie shale.

Included with this soil in mapping, and making up about 8 percent of the map unit, are small areas of somewhat poorly drained soils in slight depressions.

This soil has a moderate available water capacity and is slowly permeable. Runoff is slow. The surface layer is moderate in organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 2 to 3 feet in winter and early in spring. The very firm and brittle fragipan, which is at a depth of 20 to 28 inches, restricts the rooting depth.

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

This soil is well suited to corn, soybeans, and small grains. Because the fragipan restricts water movement, this soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Conservation tillage, which leaves protective amounts of crop residue on the surface, crop residue management, cover crops, and green manure crops help maintain or improve the organic matter content and tilth.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

This soil is moderately limited for dwellings without basements and is severely limited for dwellings with basements because of wetness. On this soil, buildings should be built without basements and foundation drains should be installed to help overcome wetness.

This soil is severely limited for use as septic tank absorption fields because of wetness and the slow permeability. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

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

ZaB—Zanesville silt loam, 2 to 6 percent slopes. This is a gently sloping, deep, moderately well drained soil on ridgetops on the uplands. The areas of this soil are irregularly shaped and are dominantly 25 to 35 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil is about 43 inches thick. The upper part is yellowish brown, friable silt loam and silty clay loam; the middle part is a strong brown and yellowish brown, mottled, very firm, silty clay loam and silt loam fragipan; and the lower part is strong brown, firm channery clay. The underlying material is strong brown channery clay. Sandstone bedrock is at a depth of 56 inches. In places, the slope is less than 2 percent or more than 6 percent. In some areas, part or all of the surface layer has been lost through erosion.

Included with this soil in mapping are a few small areas of somewhat poorly drained soils in level areas or in slight depressions and well drained Wellston soils, mainly on narrow ridges. The included soils make up about 10 percent of map unit.

This soil has a moderate available water capacity and is slowly permeable. Runoff is medium. The surface layer is moderate in organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 2 to 3 feet in winter and early in spring. The very firm and brittle fragipan, which is at a depth of 20 to 28 inches, restricts the rooting depth.

This soil is used mainly for cultivated crops (fig. 8). In many areas, it is used for hay and pasture. In some areas, it is used as woodland.

This soil is well suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is cultivated. Crop rotation, tillage that leaves protective amounts of crop residue on the surface, terraces, contour farming, and grassed waterways help prevent excessive erosion. Because the fragipan restricts water movement, the soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Crop residue management, cover crops, and green manure crops help control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

This soil is moderately limited for dwellings without basements and is severely limited for dwellings with basements because of wetness. On this soil, buildings should be constructed without basements, and foundation drains should be installed to help overcome wetness.

This soil is severely limited for use as septic tank absorption fields because of wetness and slow permeability. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

Figure 8.—Zanesville silt loam, 2 to 6 percent slopes, is used mainly for cultivated crops.

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

ZaC2—Zanesville silt loam, 6 to 12 percent slopes, eroded. This is a moderately sloping, deep, well drained soil on ridgetops and on the upper part of side slopes along drainageways on the uplands. The areas of this soil are long and irregularly shaped and are dominantly 5 to 40 acres in size.

Typically, the surface layer is brown silt loam that contains some strong brown soil material. It is about 9 inches thick. The subsoil is about 49 inches thick. The upper part is strong brown and yellowish brown, friable silty clay loam and silt loam; the middle part is a strong brown and yellowish brown, mottled, very firm and brittle, silty clay loam fragipan; and the lower part is red, mottled, firm silty clay. Red, soft clay shale is at a depth of 58 inches. In some areas, the soil is less clayey in the lower part of the subsoil and overlies sandstone bedrock. In some areas, plowing has mixed the upper part of the subsoil with the original surface layer, and the present surface layer is strong brown silty clay loam and silt loam. In places, the slope is less than 6 percent or more than 12 percent.

Included with the soil in mapping are a few small areas of well drained Gilpin soils along drainageways, well drained Wellston soils along ridgetops, and soils that formed in alluvium along drainageways. The included soils make up about 15 percent of the map unit.

This soil has a moderate available water capacity and is slowly permeable. Runoff is medium. The surface layer is moderate in organic matter content and is friable and easily tilled. Depth to a seasonal high water table ranges from 2 to 3 feet in winter and early in spring. The fragipan, which is at a depth of 24 to 36 inches, restricts the rooting depth.

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

This soil is suited to corn, soybeans, and small grains. Conservation practices are necessary to control runoff and erosion if the soil is cultivated. Crop rotation, tillage that leaves protective amounts of crop residue on the surface, terraces, diversions, contour farming, grassed waterways, and grade stabilization structures help control runoff and erosion. Because the fragipan restricts water movement, this soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Crop residue management and cover crops also help control erosion and maintain tilth and the organic matter content.

This soil is well suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because root growth is restricted by the fragipan. Overgrazing or grazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth and reduces the density of plants. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is well suited to trees. Plant competition is the main concern in management. Competing vegetation can be controlled by site preparation and by spraying, cutting, or girdling unwanted trees and shrubs.

This soil is moderately limited for dwellings without basements because of slope and wetness. It is severely limited for dwellings with basements because of wetness. To help overcome these limitations, the slope can be modified by grading, the building design can accommodate the slope, foundation drains can be installed, and buildings can be constructed without basements.

This soil is severely limited for use as septic tank absorption fields because of wetness and slow permeability. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

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

ZaC3—Zanesville silt loam, 6 to 12 percent slopes, severely eroded. This is a moderately sloping, deep, well drained soil on ridgetops and on the upper part of side slopes along drainageways on the uplands. The areas of this soil are irregularly shaped and are dominantly 10 to 20 acres in size.

Typically, the surface layer is dark yellowish brown and yellowish brown silt loam about 2 inches thick. The subsoil is about 53 inches thick. The upper part is strong brown and yellowish brown, friable silt loam; the part below that is a yellowish brown, mottled, very firm and brittle, silt loam fragipan; and the next part is light yellowish brown and brownish yellow, friable loam. The lowermost part of the subsoil is yellowish brown, firm silty clay. Sandstone bedrock is at a depth of 55 inches. In some areas, there is less clay in the lower part of the subsoil. In many areas, the surface layer is strong brown silt loam and silty clay loam because the surface layer has been lost through erosion. In places, the slope is less than 6 percent or more than 12 percent.

Included with this soil in mapping are a few areas of well drained Gilpin soils along drainageways, well drained Wellston soils along ridgetops, soils that formed in alluvium along drainageways, and soils that have a thicker surface layer, mainly on the lower part of the slopes. Soils in gullied areas, mainly on the upper part of slopes, are also included. The included soils make up about 15 percent of the map unit.

This soil has a moderate available water capacity and is slowly permeable. Runoff is rapid. The surface layer is low in organic matter content. Tillage generally is difficult because part of the subsoil has been mixed with the surface layer. Depth to a seasonal high water table ranges from 2 to 3 feet in winter and early in spring. The fragipan, which is at a depth of 24 to 36 inches, restricts the rooting depth.

This soil is used mainly for hay and pasture. Some areas are idle. In some areas, the soil is used for cultivated crops or as woodland.

This soil is poorly suited to corn, soybeans, and small grains. It can be used occasionally for row crops, but the risk of further erosion is very high. Conservation practices are necessary to control runoff and erosion. Crop rotation, conservation tillage, which leaves protective amounts of crop residue on the surface, diversions, contour farming, and grassed waterways help control runoff and erosion. Because the fragipan restricts water movement, this soil is often saturated in winter and spring, and farming operations may be delayed. This soil is somewhat droughty for long periods in summer. Crop residue management and cover crops help control erosion and maintain tilth and the organic matter content.

This soil is suited to grasses and shallow-rooted legumes for hay and pasture. It is not suited to deep-rooted legumes such as alfalfa because root growth is restricted by the fragipan. Overgrazing when the soil is wet causes surface compaction, excessive runoff and erosion, and poor tilth. Proper stocking, rotation grazing, and timely deferment of grazing help maintain the condition of the pasture and soil.

This soil is suited to trees. Seedling mortality is the main concern in management. Seedlings survive and grow well if competing vegetation is controlled. Competing vegetation can be controlled by site preparation and by spraying, cutting, and girdling unwanted trees and shrubs.

This soil is moderately limited for dwellings without basements because of slope and wetness. It is severely limited for dwellings with basements because of wetness. To help overcome these limitations, the slope can be modified by grading, the building design can accommodate the slope, foundation drains can be installed, and buildings can be constructed without basements.

This soil is severely limited for use as septic tank absorption fields because of wetness and slow permeability. Increasing the size of the absorption field helps overcome these limitations.

This soil is severely limited for local roads and streets because of low strength. If this soil is to support vehicular traffic, the base material must be strengthened or replaced with a more suitable material.

This soil is in capability subclass IVe and in woodland suitability subclass 4d.

Prime Farmland

In this section, prime farmland is defined and discussed, and the prime farmland soils in Orange County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. Such soils have properties that are favorable for the economic production of sustained high yields of crops. The soils need only to be treated and managed using acceptable farming methods. The moisture supply, of course, must be adequate, and the growing season has to be sufficiently long. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may presently be in use as cropland, pasture, or woodland, or they may be in other uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not subject to frequent flooding during the growing season. The slope ranges mainly from 0 to 6 percent.

Soils that have a high water table, are subject to flooding, or are droughty may qualify as prime farmland soils if the limitations or hazards are overcome by drainage, flood control, or irrigation. Onsite evaluation is necessary to determine the effectiveness of corrective measures. More information on the criteria for prime farmland soils can be obtained at the local office of the Soil Conservation Service.

About 48,739 acres in Orange County, or nearly 19 percent of the county, is prime farmland. Areas are scattered throughout the county, but most are in the northeastern part, mainly in map units 1 and 2 on the general soil map. Approximately 23,672 acres of prime farmland in Orange County is used for crops.

A recent trend in land use in some parts of the county has been the conversion of some prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are wet, more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

The following map units, or soils, make up prime farmland in Orange County. If a soil is considered to be prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 5. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Ba	Bartle silt loam (where drained)
BdA	Bedford silt loam, 0 to 2 percent slopes
BdB	Bedford silt loam, 2 to 6 percent slopes
Br	Bromer silt loam (where drained)
Bu	Burnside silt loam, occasionally flooded
CrB	Crider silt loam, 2 to 6 percent slopes
EIA	Elkinsville silt loam, 0 to 2 percent slopes
EIB	Elkinsville silt loam, 2 to 6 percent slopes
Mo	Montgomery silty clay loam (where drained)
PeB	Pekin silt loam, 2 to 6 percent slopes
Po	Peoga silt loam, clayey substratum (where drained)
ZaA	Zanesville silt loam, 0 to 2 percent slopes
ZaB	Zanesville silt loam, 2 to 6 percent slopes

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

Thomas A. Montgomery, district conservationist, Soil Conservation Service, helped to 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.

According to the 1968 Conservation Needs Inventory (*3*), 118,254 acres was used for crops and pasture in Orange County in 1967. Of this total, 53,951 acres was used for permanent pasture; 25,204 acres for row crops, mainly corn and soybeans; 4,414 acres for close-growing crops, mainly wheat; 16,196 acres for rotation hay and for pasture and hayland; 15,448 acres for conservation practices; and the rest was idle.

The potential of the soils in Orange County for increased food production is good. In Orange County, food production could be increased considerably by using the latest crop production technology on all cropland.

Soil erosion is the major problem on about 80 percent of the cropland and pasture in Orange County. Soils that have slopes of more than 2 percent are susceptible to erosion (fig. 9). Crider, Elkinsville, and Pekin soils, in some places, have slopes of 6 to 12 percent, and each has an eroded phase.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced because nutrients are lost and tilth is diminished as plowing mixes part of the subsoil into the surface layer. Loss of the surface layer is especially damaging on soils that have a layer in or below the subsoil that limits the depth of the root zone. The layer may be a fragipan, as in Bedford, Pekin, and Zanesville soils, or bedrock, as in Gilpin and Caneyville soils. As erosion removes the surface layer, it reduces the depth of the root zone. Second, soil erosion produces sediment that enters streams. Controlling erosion reduces the pollution of streams by sediment and maintains the quality of the water for municipal use, for recreation, and for fish and wildlife.

On many sloping soils, preparing a good seedbed and tilling are difficult because the original friable surface layer has been eroded away. Poor tilth is common in areas of the severely eroded Wellston and Zanesville soils.

Figure 9.—Corn is rotated with small grains and hay or pasture to control erosion in areas of the Crider-Frederick-Caneyville map unit.

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 to an amount that does not impair 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. Rotation grazing, proper stocking, and restricted use during wet periods help maintain a good cover of plants and reduce runoff and erosion.

Minimum tillage and crop residue left on the surface help increase infiltration and reduce runoff and erosion. These practices can be adapted to most soils in Orange County. The acreage in no-till for corn is increasing. No tillage reduces erosion on sloping soils and can be adapted to most soils that are used as cropland in Orange County.

Terraces and diversions reduce the length of slopes and help reduce runoff and erosion. These measures are most practical on deep, well-drained soils such as Wellston and Crider soils, which have slopes of less than 12 percent. Terraces and diversions are less suited to soils that are strongly sloping, that have a fragipan which would be exposed in terrace channels, or that have bedrock at a depth of less than 40 inches.

Contouring and contour stripcropping help control erosion and are suited to the soils in Orange County. They are most suitable on soils that have smooth, uniform slopes, such as Bedford, Wellston, and Zanesville soils.

Grassed waterways are used throughout the survey area to control erosion. They are most suitable on deep, well drained soils such as Wellston and Crider soils.

In most areas of Crider-Frederick-Caneyville silt loams, karst, 2 to 12 percent slopes, eroded, the slopes are so short and irregular that contour stripcropping and terracing are not practical. On these soils, a cropping system that provides substantial vegetative cover is necessary to control erosion unless conservation tillage, which leaves protective amounts of crop residue on the surface, is used.

Information about erosion control in Orange County is available at the local office of the Soil Conservation Service.

Soil drainage is the major problem on about 10 percent of the cropland and pasture in Orange County. In some areas, the soils are so wet that crops commonly grown in the area cannot be grown unless the soils are artificially drained. Examples are the poorly drained Peoga soils and the very poorly drained Montgomery soils. The somewhat poorly drained soils are so wet that crops are damaged in most years unless the soils are artificially drained. Examples are Bartle, Bromer, and Wakeland soils.

In most areas of somewhat poorly drained, poorly drained, and very poorly drained soils, a combination of surface and subsurface drainage is needed if the soil is used for intensive row cropping. Subsurface drains need to be spaced more closely in slowly permeable soils than in the more permeable soils. Drainage is very slow in Bartle and Montgomery soils. In many areas of Peoga soils, it is difficult to find an adequate drainage outlet.

Soil fertility is naturally low in most soils on the uplands and terraces. Soils on the uplands and terraces, except Montgomery soils, are naturally acid. Montgomery soils are neutral and moderately alkaline. Some of the soils on flood plains, such as Haymond, Wilbur, and Wakeland soils, are medium acid to mildly alkaline. They are naturally higher in plant nutrients than most soils on uplands and terraces. Other soils on flood plains, such as Burnside soils, are strongly acid or very strongly acid.

Soils that are acid 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 potassium 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.

Some of the soils that are used for crops have a surface layer of silt loam that is light in color and is low in content of organic matter. Generally, the structure of these soils is weak, and heavy rainfall causes a crust to form on the surface. 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.

Conservation tillage is needed on the light-colored soils that have a surface layer of silt loam. When these soils are fall-plowed, a crust forms in winter and spring. About 70 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in the fall by moldboard equipment.

The nearly level, dark-colored, clayey Montgomery soils often stay wet until late in spring. If the soils are plowed when wet, they tend to be very cloddy when dry, and a good seedbed is difficult to prepare. Plowing these soils in fall generally results in good tilth in the spring.

Most of the soils in the survey area have a surface layer of silt loam that is easily compacted. Overgrazing or grazing when the soil is wet compacts the surface and causes poor tilth. Surface compaction reduces infiltration and increases runoff. Timely deferment of grazing and restricted use during wet periods help maintain tilth.

Field crops suited to the soils and climate include many that are not now commonly grown. Corn and soybeans are the main row crops. Grain sorghum, sugar beets, potatoes, and some other crops can be grown if economic conditions are favorable.

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

Forage crops for pasture that are commonly grown are fescue, timothy, alfalfa, and red clover. Other plants suited to the soils in Orange County are bluegrass, orchardgrass, reed canarygrass, ladino clover, and lespedeza. Alfalfa and other deep-rooted legumes are not suited to soils that have a seasonal high water table, such as Bromer, Peoga, and Wakeland soils, unless the soil is adequately drained. Alfalfa also is not suited to soils that have a fragipan, such as Bartle, Pekin, Zanesville, and Bedford soils, because root growth is restricted.

Specialty crops are not grown extensively in Orange County. There are soils, however, that have potential for specialty crops such as vegetables, grapes, apples, and peaches.

Deep soils that have slopes of less than 6 percent and that have good natural drainage are well suited to many vegetables and small fruits. Crider and Elkinsville soils that have slopes of less than 6 percent are well suited.

Information and suggestions on growing specialty 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 for those crops.

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 few limitations that restrict their use.

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

Class III soils have severe limitations that reduce the choice of plants 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

Mitchell G. Hassler, forester, Soil Conservation Service, helped prepare this section.

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 symbol (woodland suitability) 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 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 few trees may be blown down by strong 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 ensure 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 landscape and natural resources of Orange County are well suited to the development of recreation facilities such as picnic areas, camping areas, golf courses, and areas for aquatic sports. The Pioneer Mothers Memorial Forest and Springs Valley State Fish and Game Area are examples of existing recreation facilities. The Patoka Reservoir is used for boating, fishing, swimming, and other water-based recreation. In some areas, the well drained soils on uplands are well suited to use as picnic areas, intensive play areas, and sites for tents and camping trailers.

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 and horseback riding 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

James D. McCall, wildlife biologist, Soil Conservation Service, helped prepare this section.

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, soybeans, sunflowers, and barley.

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, orchardgrass, lespedeza, bromegrass, 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 goldenrod, beggarweed, lambsquarters, pokeweed, ragweed, and wheatgrass.

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, wild cherry, sweetgum, apple, hawthorn, dogwood, hickory, persimmon, sassafras, and sumac. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are autumn-olive, crabapple, blackberry, and shrub dogwood.

Coniferous plants furnish browse and seeds. 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, 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, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, arrowhead, buttonbush, willow, duckweed, 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 quail, dove, meadowlark, field sparrow, killdeer, woodchuck, cottontail, red fox, and coyote.

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.

Edge habitat is the transition zone between one primary land use or cover type and another. Edge habitat is not rated in table 11; nevertheless, it is of prime importance to birds and mammals, from the smallest songbird to Indiana's largest surviving animal, the white-tailed deer. Many animals that inhabit openland or woodland also frequent edge habitat, and the variety of plant species in areas of edge habitat is disproportionately large. Edge habitat is consistently used by more wildlife than is an area of equal size in the center of a large tract of woodland or cropland. An example of edge habitat that is particularly favorable to wildlife is the border between a no-till field of corn and the outer edge of dense woodland. An irregular or deeply indented border, for example, one between woodland and meadow, is even more favorable to wildlife.

Engineering

Max L. Evans, state conservation engineer, Soil Conservation Service, helped prepare this section.

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 must 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 or ponding. 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 filter the effluent effectively. 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 trenches, 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 plant growth. Material from the surface layer, therefore, 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, 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.

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 the content of particles coarser than sand is as much as 15 percent, 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 ovendry 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.

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.

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 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 the average, no more than once in 2 years; and *frequent* that it occurs, on the average, 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 are 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 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 excavation.

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 (*5*). 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. Table 19 shows the classification of the soils in the survey area. 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 *sol*. An example is Alfisol.

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 Alfisol).

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 *udalfs*, the suborder of the Alfisols that have an 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 (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*5*). 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."

Bartle Series

The Bartle series consists of deep, somewhat poorly drained soils on stream terraces. The soils have a fragipan. Permeability is moderate above the fragipan and very slow within the fragipan. Bartle soils formed in silty alluvium from loess-covered uplands. The slopes range from 0 to 2 percent.

The base saturation of Bartle soils in Orange County and the clay content in the argillic horizon are lower than the limits defined as the range for the Bartle series. These differences, however, do not affect the use or behavior of the soils.

Bartle soils are commonly adjacent to Haymond and Pekin soils. Haymond soils have less clay in the subsoil and have no fragipan or gray mottles. They are on lower flood plains. Pekin soils do not have gray mottles in the upper part of the subsoil and are near terrace breaks.

Typical pedon of Bartle silt loam, in a cultivated field, 1,400 feet west and 1,700 feet north of the southeast corner of sec. 31, T. 1 N., R. 2 W.

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) silt loam, very pale brown (10YR 7/3) dry; many fine and medium faint dark brown (10YR 4/3) mottles; moderate medium granular structure; friable; common fine and very fine roots; medium acid; abrupt smooth boundary.

Bt1—9 to 13 inches; pale brown (10YR 6/3) silt loam; many medium distinct yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; common very fine roots; thin patchy yellowish brown (10YR 5/8) and light brownish gray (10YR 6/2) clay films on faces of peds; few fine accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid; clear wavy boundary.

Bt2—13 to 25 inches; light brownish gray (10YR 6/2) silt loam; many medium and coarse distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few very fine roots; thin discontinuous yellowish brown (10YR 5/8) clay films on faces of peds; thick discontinuous light gray (10YR 7/2) silt coatings on faces of peds; few accumulations of dark gray (10YR 4/1) soft iron and manganese oxide; very strongly acid; clear wavy boundary.

Btx1—25 to 36 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; few very fine roots between prisms; common very fine and fine discontinuous oblique inped vesicular pores; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of prisms; thin patchy light gray (10YR 7/2) silt coatings on faces of prisms; common accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid; clear wavy boundary.

Btx2—36 to 44 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct pale brown (10YR 6/3) and yellowish brown (10YR 5/8) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; common very fine and fine discontinuous oblique inped vesicular pores; thin and thick discontinuous light brownish gray (10YR 6/2) clay films on faces of prisms; thin patchy light gray (10YR 7/2) silt coatings on faces of prisms; few accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid; clear wavy boundary.

C—44 to 60 inches; yellowish brown (10YR 5/6) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; massive; firm; many accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. 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.

The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 4. The mottles have higher chroma. The Bt horizon is silt loam or silty clay loam. The Btx horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. The mottles have higher chroma.

The C horizon has hue of 10YR, value of 5 or 6, and chroma of 1 to 6. It is mottled. It is commonly silt loam or silty clay loam, but the range includes loam, fine sandy loam, and fine sand. In some places, the horizon is stratified.

Bedford Series

The Bedford series consists of deep, moderately well drained soils on loess-capped uplands. The soils have a fragipan. Permeability is moderate above the fragipan and very slow within the fragipan. Bedford soils formed in loess and in the underlying limestone residuum. The slopes range from 0 to 6 percent.

Bedford soils are similar to Zanesville soils and are adjacent to Bromer and Crider soils. Zanesville soils are not so red and have less clay in the lower part of the solum, which formed in sandstone residuum. Bromer soils have no fragipan and have gray mottles in the upper part of the solum. They are in depressions. Crider soils also do not have a fragipan, and they are more red in the upper part of the solum. Crider soils are near drainageways and sinkholes.

Typical pedon of Bedford silt loam, 2 to 6 percent slopes, in a cultivated field, 130 feet west and 1,910 feet north of the southeast corner of sec. 30, T. 3 N., R. 2 E.

Ap—0 to 10 inches; dark yellowish brown (10YR 4/4) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; neutral; abrupt smooth boundary.

Bt1—10 to 21 inches; strong brown (7.5YR 5/6) silt loam; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; thin continuous brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—21 to 29 inches; yellowish brown (10YR 5/4) silt loam; many medium distinct pale brown (10YR 6/3) and light brownish gray (10YR 6/2) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; thin patchy light yellowish brown (10YR 6/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Btx1—29 to 39 inches; yellowish brown (10YR 5/4) silt loam; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; thin continuous brown (7.5YR 5/4) clay films on faces of peds; thin light gray (10YR 7/2) silt films on faces of prisms; very strongly acid; clear wavy boundary.

2Btx2—39 to 53 inches; light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) silt loam tongues about 6 to 8 inches across; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; thin continuous pale brown (10YR 6/3) and patchy reddish brown (5YR 5/3) clay films on faces of peds; very strongly acid; clear wavy boundary.

2Btx3—53 to 65 inches; light brownish gray (10YR 6/2) and strong brown (7.5YR 5/6) silty clay loam tongues about 6 to 8 inches across; moderate very coarse prismatic structure parting to moderate coarse subangular blocky; very firm and brittle; thin patchy brown (7.5YR 5/4) clay films on faces of peds; thin patchy light brownish gray (10YR 6/2) and pale brown (10YR 6/3) clay films on faces of prisms and fillings between prisms; common accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid; clear wavy boundary.

3BC1—65 to 76 inches; strong brown (7.5YR 5/6) silty clay; many medium distinct dark red (2.5YR 3/6) mottles; weak coarse prismatic structure parting to moderate medium angular blocky; firm; thin patchy light brownish gray (10YR 6/2) and pale brown (10YR 6/3) clay films on faces of peds; 1 percent chert fragments; very strongly acid; clear wavy boundary.

3BC2—76 to 80 inches; dark red (2.5YR 3/6) clay; weak coarse prismatic structure parting to moderate medium angular blocky; firm; thin patchy yellowish brown (10YR 5/6) clay films on faces of peds; 5 percent chert fragments; very strongly acid.

The solum ranges from 50 to 96 inches or more in thickness. Depth to the fragipan ranges from 20 to 36 inches.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. The Bt 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 Btx and 2Btx horizons have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. They are silt loam or silty clay loam. The 3BC horizon has hue of 10YR to 2.5YR, value of 3 to 6, and chroma of 4 or 6. It is silty clay or clay.

Bromer Series

The Bromer series consists of deep, somewhat poorly drained, slowly permeable soils in upland depressions. Bromer soils formed in loess, silty and clayey sediment, and limestone residuum. The slopes range from 0 to 2 percent.

Bromer soils are commonly adjacent to Bedford and Peoga soils. Bedford soils are not gray in the upper part of the subsoil. Bedford soils have a fragipan, unlike Bromer soils, and are in higher areas. Peoga soils have more clay in the subsoil. They are dominantly gray and are in depressions.

Typical pedon of Bromer silt loam, in a cultivated field, 1,250 feet east and 450 feet south of the northwest corner of sec. 36, T. 3 N., R. 1 E.

Ap—0 to 9 inches; grayish brown (10YR 5/2) silt loam, light gray (10YR 7/2) dry; weak thick platy structure parting to moderate medium granular; friable; medium acid; abrupt smooth boundary.

BA—9 to 19 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; very strongly acid; clear wavy boundary.

Bt1—19 to 33 inches; light gray (10YR 7/1) silty clay loam; common medium distinct yellowish brown (10YR 5/8) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; thin continuous light brownish gray (10YR 6/2) clay films on faces of peds; very strongly acid; clear wavy boundary.

2Bt2—33 to 43 inches; strong brown (7.5YR 5/8) silty clay loam; many medium distinct gray (10YR 6/1) mottles; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm; thin continuous gray (N 6/0) clay films on faces of peds; tonguing of gray (10YR 6/1) friable silt loam, 2 to 4 inches across; very strongly acid; clear wavy boundary.

2Btx—43 to 56 inches; yellowish brown (10YR 5/8) silty clay loam; common medium distinct gray (10YR 6/1) mottles; moderate medium and coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; thin continuous gray (10YR 7/2) clay films on faces of peds; tonguing of light brownish gray (10YR 6/2) silt loam, 4 to 6 inches across; very strongly acid; clear wavy boundary.

3Btb1—56 to 68 inches; strong brown (7.5YR 5/8) cherty clay; many medium distinct strong brown (7.5YR 5/6) and brown (7.5YR 5/4) mottles; moderate medium angular blocky structure; firm; thin continuous dark gray (N 4/0) and gray (N 5/0) clay films on faces of peds; many accumulations of black

(10YR 2/1) soft iron and manganese oxide; 25 percent chert fragments; medium acid; clear wavy boundary.

3Btb2—68 to 80 inches; strong brown (7.5YR 5/8) cherty clay; moderate medium angular blocky structure; firm; thin continuous gray (N 5/0) clay films on faces of peds; light gray (N 6/0) clay fillings in old worm channels; 45 percent chert fragments; neutral.

The solum ranges from 80 to 100 inches or more in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The Bt and 2Bt horizons have hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 1 to 8. They are silt loam or silty clay loam. The 3Btb horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 to 8. It is silty clay, clay, or the cherty analogs.

Burnside Series

The Burnside series consists of deep, well drained, moderately permeable soils on bottom lands. Burnside soils formed in silty and loamy, channery alluvium over sandstone and siltstone. The slopes range from 0 to 2 percent.

Burnside soils are commonly adjacent to Haymond soils. Haymond soils have sand throughout the control section and do not have channers. They are in large areas of bottom lands.

Typical pedon of Burnside silt loam, occasionally flooded, in a cultivated field, 2,100 feet west and 1,200 feet south of the northeast corner of sec. 21, T. 1 S., R. 1 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, yellowish brown (10YR 5/4) dry; moderate medium granular structure; friable; many fine and very fine roots; very strongly acid; abrupt smooth boundary.

A—8 to 12 inches; dark yellowish brown (10YR 4/4) silt loam; moderate medium granular structure; friable; few very fine roots; strongly acid; clear wavy boundary.

2C1—12 to 18 inches; dark yellowish brown (10YR 4/4) channery loam; massive; friable; 40 percent sandstone fragments; medium acid; clear wavy boundary.

2C2—18 to 64 inches; dark yellowish brown (10YR 4/4) very channery sandy loam; massive; friable; 75 percent sandstone fragments; medium acid.

The depth to bedrock ranges from 40 to 70 inches.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. It is silt loam or loam.

The C horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is channery silt loam or channery loam in the upper part and very channery loam or very channery sandy loam in the lower part. Sandstone fragments make up 50 to 80 percent of the lower part of the horizon. The C horizon is medium acid to very strongly acid.

Caneyville Series

The Caneyville series consists of moderately deep, well drained, moderately slowly permeable soils on uplands. Caneyville soils formed in a thin layer of loess and in the underlying limestone residuum. The slopes range from 12 to 70 percent.

Caneyville soils are adjacent to Crider and Frederick soils. Crider soils formed in more than 20 inches of loess. They are more than 60 inches deep to limestone bedrock and are in less sloping areas. Frederick soils are more than 60 inches deep to bedrock and are near drainageways and sinkholes.

Typical pedon of Caneyville silt loam, in an area of Crider-Caneyville silt loams, 12 to 18 percent slopes, eroded, in a cultivated field, 1,180 feet west and 525 feet south of the northeast corner of sec. 29, T. 2 N., R. 1 W.

Ap—0 to 6 inches; dark yellowish brown (10YR 4/4) silt loam with pockets of strong brown (7.5YR 5/6) silt loam, very pale brown (10YR 7/3) dry; moderate medium granular structure; friable; many fine and medium roots; medium acid; abrupt smooth boundary.

Bt1—6 to 18 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; thin continuous yellowish red (5YR 4/6) clay films on faces of peds; dark yellowish brown (10YR 4/4) silt loam fillings in old worm and root channels; medium acid; clear wavy boundary.

2Bt2—18 to 25 inches; yellowish red (5YR 5/6) clay; moderate medium angular blocky structure; firm; thin continuous yellowish red (5YR 4/6) clay films on faces of peds; 7 percent limestone fragments; medium acid; clear wavy boundary.

2Bt3—25 to 36 inches; red (2.5YR 4/6) clay; moderate medium angular blocky structure; firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; common accumulations of black (10YR 2/1) soft iron and manganese oxide; 4 percent limestone fragments; medium acid; abrupt smooth boundary.

2R—36 inches; limestone bedrock.

The thickness of the solum and the depth to limestone bedrock range from 20 to 40 inches.

The Ap horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 5 or 6. It is silt loam or silty clay loam. The 2Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It is mainly silty clay or clay, but the range includes silty clay loam in the upper part of the horizon.

Crider Series

The Crider series consists of deep, well drained, moderately permeable soils on uplands. Crider soils formed in loess and in the underlying limestone residuum. The slopes range from 2 to 25 percent.

Crider soils are adjacent to Bedford, Caneyville, and Frederick soils. Bedford soils have a fragipan, unlike Crider soils, and are on broad ridges between drainageways. Frederick soils formed in less than 20 inches of loess and are near drainageways and sinkholes. Caneyville soils formed in less than 20 inches of loess and are 20 to 40 inches deep to bedrock. Caneyville soils are near drainageways and sinkholes.

Typical pedon of Crider silt loam, 2 to 6 percent slopes, in a cultivated field, 275 feet east and 275 feet south of the northwest corner of sec. 4, T. 2 N., R. 1 E.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium platy structure parting to moderate medium granular; friable; medium acid; abrupt smooth boundary.

Bt1—9 to 21 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; thin continuous dark brown (7.5YR 4/4) clay films on faces of peds; medium acid; clear wavy boundary.

Bt2—21 to 29 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; medium acid; gradual wavy boundary.

Bt3—29 to 36 inches; yellowish red (5YR 5/6) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous reddish brown (5YR 4/4) clay films on faces of peds; strongly acid; gradual wavy boundary.

2Bt4—36 to 45 inches; red (2.5YR 4/6) silty clay loam; moderate medium subangular blocky structure; firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; few accumulations of black (10YR 2/1) iron and manganese oxide; very strongly acid; gradual wavy boundary.

2Bt5—45 to 80 inches; red (2.5YR 4/6) clay; few medium distinct yellowish red (5YR 5/6) mottles; moderate medium angular blocky structure; very firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; very strongly acid.

The solum typically is 60 to 100 inches or more thick. The loess ranges from 20 to 45 inches in thickness.

The Ap horizon has hue of 10YR, value of 4, and chroma of 3 or 4.

The Bt horizon has hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 8. Reaction is slightly acid to strongly acid in the upper part and strongly acid or very strongly acid in the lower part.

The 2Bt horizon has hue of 5YR or 2.5YR, value of 3 to 5, and chroma of 6. It is silty clay loam, silty clay, or clay. Limestone fragments make up as much as 15 percent of the horizon.

Ebal series

The Ebal series consists of deep, moderately well drained soils on uplands. Permeability is moderate in the upper part of the solum and very slow in the lower part. Ebal soils formed in a thin silty layer and in the underlying shale residuum. The slope ranges from 12 to 18 percent.

Ebal soils are adjacent to Gilpin and Wellston soils. Gilpin soils formed in sandstone residuum. They are 20 to 40 inches deep to bedrock and are intermingled with Ebal soils. Wellston soils formed in loess and in the underlying sandstone residuum. They are 40 to 72 inches deep to bedrock and are on ridgetops and side slopes of drainageways.

Typical pedon of Ebal silty clay loam, in an area of Wellston-Ebal-Gilpin complex, 12 to 18 percent slopes, severely eroded, in an idle field, 1,175 feet east and 100 feet north of the southwest corner of sec. 3, T. 1 S., R. 1 E.

A—0 to 1 inch; yellowish brown (10YR 5/4) silty clay loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; very strongly acid; abrupt smooth boundary.

Bt1—1 inch to 9 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; thin continuous strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) clay films on faces of peds; 5 percent sandstone fragments; very strongly acid; clear wavy boundary.

2Bt2—9 to 19 inches; yellowish brown (10YR 5/6) silty clay; few fine prominent yellowish red (5YR 4/6) mottles; strong medium angular blocky structure; firm; thin patchy light yellowish brown (10YR 6/4) silt coatings on faces of some peds; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; 5 percent sandstone fragments; very strongly acid; clear wavy boundary.

2Bt3—19 to 28 inches; strong brown (7.5YR 5/8) clay; few fine prominent yellowish red (5YR 4/6) mottles; strong medium angular blocky structure; firm; thin continuous light brownish gray (10YR 6/2) and pale brown (10YR 6/3) clay films on faces of peds; few sandstone fragments; very strongly acid; clear wavy boundary.

2Bt4—28 to 36 inches; brownish yellow (10YR 6/8) clay; common medium distinct strong brown (7.5YR 5/6) mottles; strong medium angular blocky structure; firm; thin continuous light brownish gray (10YR 6/2) and pale brown (10YR 6/3) clay films on faces of peds; very strongly acid; clear wavy boundary.

2Bt5—36 to 44 inches; strong brown (7.5YR 5/6) clay; moderate medium angular blocky structure; firm; thin continuous pale brown (10YR 6/3) clay films on faces of peds; many fine accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid; clear wavy boundary.

2Bt6—44 to 58 inches; strong brown (7.5YR 5/8) clay; moderate medium angular blocky structure; firm; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

2Cr—58 to 68 inches; light olive brown (2.5Y 5/4) clayey shale; many medium distinct light brownish gray (10YR 6/2) and brownish yellow (10YR 6/6) mottles; strong medium platy structure; neutral.

The thickness of the solum and the depth to soft bedrock range from 50 to 80 inches or more. The depth to hard bedrock is 80 inches or more.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is silt loam or silty clay loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. It is silt loam, silty clay loam, silty clay, or the channery analogs.

The 2Bt horizon has hue of 10YR to 2.5YR, value of 4 to 6, and chroma of 3 to 8. It is silty clay loam, silty clay, clay, or the channery analogs.

Elkinsville Series

The Elkinsville series consists of deep, well drained, moderately permeable soils on alluvial terraces. Elkinsville soils formed in silty alluvium. The slopes range from 0 to 12 percent.

Elkinsville soils are commonly adjacent to Haymond and Pekin soils. Haymond soils have less clay in the subsoil than Elkinsville soils, and they are on low bottom lands. Pekin soils have mottles that have chroma of 2 in the upper 10 inches of the argillic horizon. Pekin soils have a fragipan, and they are near drainageways and on ridges between drainageways.

Typical pedon of Elkinsville silt loam, 0 to 2 percent slopes, in a cultivated field, 925 feet north and 1,050 feet east of the center of sec. 2, T. 2 N., R. 1 E.

Ap—0 to 10 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common very fine and fine roots; medium acid; abrupt smooth boundary.

BA—10 to 19 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common very fine roots; thin discontinuous dark yellowish brown (10YR 4/4) silt coatings on faces of peds; slightly acid; clear wavy boundary.

Bt1—19 to 28 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; few very fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—28 to 36 inches; yellowish brown (10YR 5/6) silt loam; few medium distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; thin discontinuous brown (7.5YR 5/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt3—36 to 59 inches; yellowish brown (10YR 5/6) silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; thin discontinuous light yellowish brown (10YR 6/4) clay films on faces of peds; very strongly acid; gradual wavy boundary.

C—59 to 80 inches; light gray (10YR 7/2) silty clay loam with strata of silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; thin discontinuous light brownish gray (10YR 6/2) clay films on faces of peds; very strongly acid.

The solum ranges from 40 to 70 inches in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. The C horizon has hue of 10YR, value of 5 to 7, and chroma of 2 to 6. It is silty clay loam, silt loam, loam, or sandy loam.

Frederick Series

The Frederick series consists of deep, well drained, moderately permeable soils on uplands. Frederick soils formed in thin loess and in the underlying limestone residuum. The slopes range from 2 to 50 percent.

Frederick soils are adjacent to Bedford, Caneyville, and Crider soils. Bedford soils formed in more than 20 inches of loess, and, unlike Frederick soils, they have a fragipan. Caneyville soils are 20 to 40 inches deep to bedrock. Crider soils formed in more than 20 inches of loess.

Typical pedon of Frederick silt loam, in an area of Crider-Frederick-Caneyville silt loams, karst, 2 to 12 percent slopes, eroded, in a cultivated field, 1,060 feet east and 2,250 feet south of the northwest corner of sec. 9, T. 2 N., R. 1 E.

Ap—0 to 6 inches; dark brown (10YR 4/3) silt loam with pockets of yellowish brown (10YR 5/6) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; common fine roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 13 inches; strong brown (7.5YR 5/6) silty clay loam, reddish yellow (7.5YR 6/6) dry; moderate medium subangular blocky structure; friable; few fine roots; thin continuous strong brown (7.5YR 4/6) clay films on faces of some peds; brown (10YR 5/3) silt loam fillings in old worm and root channels; medium acid; clear wavy boundary.

2Bt2—13 to 19 inches; yellowish red (5YR 5/8) silty clay loam, reddish yellow (5YR 6/6) dry; moderate medium subangular blocky structure; firm; few fine roots; thin continuous yellowish red (5YR 5/6) clay films on faces of peds; thin patchy light yellowish brown (10YR 6/4) silt coatings on faces of some peds; 10 percent chert fragments; strongly acid; clear wavy boundary.

3Btb1—19 to 25 inches; red (2.5YR 5/6) clay, red (2.5YR 5/8) dry; moderate medium angular blocky structure; firm; thin continuous red (2.5YR 4/8) clay films on faces of peds; thin patchy light yellowish brown (10YR 6/4) silt coatings on faces of some peds; strongly acid; clear wavy boundary.

3Btb2—25 to 52 inches; red (2.5YR 4/8) clay, red (2.5YR 4/8) dry; strong medium angular blocky structure; firm; thin continuous red (2.5YR 4/6) clay films on faces of peds; strongly acid; clear wavy boundary.

3Btb3—52 to 62 inches; red (2.5YR 4/8) clay, red (2.5YR 4/6) dry; strong medium angular blocky structure; firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; common accumulations of black (10YR 2/1) soft iron and manganese oxide; strongly acid; clear wavy boundary.

3Btb4—62 to 80 inches; red (2.5YR 4/8) clay, red (2.5YR 4/6) dry; strong medium angular blocky structure; firm; thin continuous dark red (2.5YR 3/6) clay films on faces of peds; strongly acid.

The solum ranges from 60 to 80 inches or more in thickness. The depth to bedrock is more than 6 feet.

The Ap horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6.

The Bt horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 8.

The 2Bt and 3Btb horizons have hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4 to 8. The 2Bt horizon ranges from silty clay loam to clay, and the 3Btb horizon is silty clay or clay. The horizons are up to 15 percent chert fragments.

Gilpin Series

The Gilpin series consists of moderately deep, well drained, moderately permeable soils on uplands. Gilpin soils formed in loamy material that weathered from sandstone, shale, and siltstone. The slopes range from 12 to 50 percent.

Gilpin soils are similar to Wellston soils and are commonly adjacent to Ebal and Zanesville soils. Wellston soils have a thicker solum than that of Gilpin soils, and they are deeper to bedrock. Ebal soils have a thicker solum, and it has more clay. Ebal soils are deeper to bedrock than the Gilpin soils; they are intermingled with the Gilpin soils. Zanesville soils are deeper to bedrock and have a very firm, brittle fragipan in the subsoil; they are on moderately sloping ridgetops.

Typical pedon of Gilpin silt loam, in an area of Wellston-Gilpin-Ebal silt loams, 12 to 18 percent slopes, eroded, in a cultivated field, 2,370 feet west and 590 feet north of the southeast corner of sec. 26, T. 1 S., R. 2 W.

Ap—0 to 4 inches; dark yellowish brown (10YR 4/4) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; few sandstone fragments; strongly acid; abrupt smooth boundary.

Bt1—4 to 10 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; thin discontinuous reddish brown (5YR 4/4) clay films on faces of peds; 5 percent sandstone fragments; strongly acid; clear wavy boundary.

Bt2—10 to 20 inches; strong brown (7.5YR 5/6) channery silt loam; moderate medium subangular blocky structure; friable; thin discontinuous dark brown (7.5YR 4/4) clay films on faces of peds; 20 percent sandstone fragments; strongly acid; clear wavy boundary.

BC—20 to 28 inches; strong brown (7.5YR 5/6) channery loam; weak medium subangular blocky structure; friable; thin patchy dark brown (7.5YR 4/4) clay films on faces of peds; 30 percent sandstone fragments; strongly acid; abrupt smooth boundary.

R—28 inches; rippable sandstone bedrock.

The solum ranges from 20 to 36 inches in thickness. The depth to bedrock is 20 to 40 inches.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. It is mainly silt loam, but in some places it is loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 6 or 8. It is loam, silt loam, silty clay loam, or the channery analogs. Sandstone and siltstone fragments make up 5 to 35 percent of the Bt horizon.

Haymond Series

The Haymond series consists of deep, well drained, moderately permeable soils on bottom lands. Haymond soils formed in silty alluvium derived from loess-covered uplands. The slopes range from 0 to 2 percent.

Haymond soils are commonly adjacent to Burnside, Wakeland, and Wilbur soils. Burnside soils have more sand than Haymond soils throughout the underlying material, and they have channers. Wakeland soils are dominantly gray within 20 inches of the surface and are in areas that are more level or in slight depressions. Wilbur soils have mottles that have chroma of 2 within a depth of 20 inches. They are in slight depressions near the base of uplands.

Typical pedon of Haymond silt loam, frequently flooded, in a cultivated field, 1,000 feet west and 2,300 feet south of the northeast corner of sec. 22, T. 1 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; common very fine roots; medium acid; abrupt smooth boundary.

Bw1—9 to 20 inches; dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable; medium acid; clear wavy boundary.

Bw2—20 to 40 inches; dark yellowish brown (10YR 4/4) silt loam; common medium faint yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; friable; neutral; clear wavy boundary.

C—40 to 60 inches; dark brown (10YR 4/3) silt loam and thin strata of loam; few medium faint yellowish brown (10YR 5/4) mottles; massive; friable; neutral.

The solum ranges from 35 to 60 inches in thickness. It generally is medium acid to neutral.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. The Bw and C horizons have hue of 10YR, value of 4 or 5, and chroma of 3 or 4. They are dominantly silt loam, but there are strata of loam and sandy loam in the C horizon.

Montgomery Series

The Montgomery series consists of deep, very poorly drained, slowly or very slowly permeable soils on uplands. Montgomery soils formed in silty and clayey sediment. The slopes range from 0 to 2 percent.

In Orange County, several characteristics of Montgomery soils are outside the range defined for the Montgomery series. The B horizon, for example, has higher chroma than the defined limits. The content of clay in the lower part of the control section is lower. The underlying material has a redder hue, and it has a higher content of clay. The differences, however, do not affect the use or behavior of the soils.

Montgomery soils are commonly adjacent to Bedford, Bromer, and Crider soils. Unlike Montgomery soils, Bedford soils do not have gray mottles in the upper 10 inches of the subsoil, and they do not have a thick, dark surface layer. They do have a well-expressed fragipan. Bromer soils also do not have a thick, dark surface layer. Crider soils do not have gray mottles in the solum and have brighter colors throughout the profile. These soils are all at slightly higher elevations.

Typical pedon of Montgomery silty clay loam, in a cultivated field, 2,230 feet west and 400 feet south of the northeast corner of sec. 32, T. 2 N., R. 2 E.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; moderate medium granular structure; friable; many medium and fine roots; few fine prominent reddish brown (5YR 4/4) iron stains adjacent to roots; neutral; abrupt smooth boundary.

A—10 to 19 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; common medium faint very dark grayish brown (2.5Y 3/2) mottles and common medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium granular structure; friable; few medium fine roots; neutral; gradual wavy boundary.

Bw1—19 to 29 inches; dark grayish brown (2.5Y 4/2) silty clay loam; many medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium angular blocky structure; firm; thin grayish brown (2.5Y 5/2) clay films or pressure faces on faces of peds; few fine roots; moderately alkaline; clear wavy boundary.

Bw2—29 to 39 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium angular blocky structure; firm; thin grayish brown (2.5Y 5/2) clay films or pressure faces on faces of peds; few fine roots; moderately alkaline; clear wavy boundary.

Bw3—39 to 52 inches; yellowish brown (10YR 5/6) silty clay loam; common medium distinct brown (10YR 5/3) mottles; moderate medium angular blocky structure; firm; thin grayish brown (10YR 5/2) clay films or pressure faces on faces of peds; few fine roots; moderately alkaline; clear wavy boundary.

BC—52 to 69 inches; yellowish brown (10YR 5/6) silty clay; many medium distinct strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; firm; very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) clay fillings in old root channels; few accumulations of black (N 2/0) iron and manganese oxide; moderately alkaline; clear wavy boundary.

2C—69 to 80 inches; yellowish red (5YR 5/6) clay; many medium distinct red (2.5YR 4/6) mottles; moderate medium angular blocky structure; firm; brown (7.5YR 5/2) clay fillings in old root channels; 5 percent chert gravel; moderately alkaline.

The solum ranges from 40 to 80 inches in thickness.

The A horizon has hue of 10YR, value of 1 to 3, and chroma of 1 to 3. It is silt loam or silty clay loam. The Bw horizon has hue of 10YR or 2.5Y, value of 3 to 6, and chroma of 1 or 2 in the upper part and 1 to 6 in the lower part. It is silty clay loam, silty clay, or clay. The 2C horizon has hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 4 to 6. It is silty clay or clay.

Pekin Series

The Pekin series consists of deep, moderately well drained soils on stream terraces. Pekin soils have a fragipan. Permeability is moderate above the fragipan and very slow within the fragipan. The soils formed in silty alluvium. The slopes range from 2 to 12 percent.

Pekin soils in Orange County have a lower content of clay in the particle-size control section than the limits defined as the range for the Pekin series. Also, the base saturation is lower. These differences, however, do not affect the use or behavior of the soils.

Pekin soils are commonly adjacent to Bartle and Elkinsville soils. Unlike Pekin soils, Bartle soils have gray mottles immediately below the Ap horizon. Bartle soils are in nearly level areas on terraces. Elkinsville soils do not have a fragipan, and they are mostly near terrace breaks and on the breaks.

Typical pedon of Pekin silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 2,000 feet west and 2,200 feet north of the southeast corner of sec. 31, T. 1 N., R. 2 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam with pockets of yellowish brown (10YR 5/6) silt loam, very pale brown (10YR 7/4) dry; moderate medium granular structure; friable; many very fine and fine roots; medium acid; abrupt smooth boundary.

Bt1—7 to 14 inches; yellowish brown (10YR 5/6) silt loam; common medium faint pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; few very fine roots; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Bt2—14 to 20 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct light brownish gray (10YR 6/2) and light yellowish brown (10YR 6/4) mottles; weak fine and medium prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; thin discontinuous yellowish brown (10YR 5/4) clay films on faces of peds; very strongly acid; clear wavy boundary.

Btx—20 to 43 inches; light brownish gray (10YR 6/2) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; moderate very coarse prismatic structure; very firm and brittle; few very fine roots; common fine discontinuous oblique and inped vesicular pores; thin discontinuous light yellowish brown (10YR 6/4) clay films on faces of prisms; common accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid; gradual wavy boundary.

C—43 to 60 inches; light brownish gray (10YR 6/2) loam with strata of silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; massive; firm; common accumulations of black (10YR 2/1) soft iron and manganese oxide; strongly acid.

The solum ranges from 40 to 60 inches in thickness. The depth to the fragipan ranges from 20 to 36 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. The Bt horizon has hue of 10YR, value of 5 or 6, and chroma of 3 to 6, except for the mottles, which are lighter. It is silt loam or silty clay loam. The Btx horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 6. It is silt loam or silty clay loam. The C horizon is stratified silt loam, silty clay loam, loam, and fine sandy loam.

Peoga Series

The Peoga series consists of deep, poorly drained, slowly permeable soils on uplands. Peoga soils formed in loess and in silty and clayey deposits. The slopes range from 0 to 2 percent.

Peoga soils are adjacent to Bedford and Bromer soils. Unlike Peoga soils, Bedford soils have a fragipan, and they are not gray in the upper part of the subsoil. Bedford soils are in higher positions on the landscape. Bromer soils are not dominantly gray and are in slightly higher positions on the landscape.

Typical pedon of Peoga silt loam, clayey substratum, in a cultivated field, 50 feet east and 400 feet north of the center of sec. 26, T. 3 N., R. 1 E.

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam, light gray (10YR 6/1) dry; few fine prominent strong brown (7.5YR 5/6) mottles; weak medium and thick platy structure parting to moderate medium granular; friable; slightly acid; abrupt smooth boundary.

BAg—7 to 13 inches; gray (10YR 5/1) silt loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; thin patchy dark gray (10YR 4/1) clay films on faces of peds; neutral; gradual smooth boundary.

Btg—13 to 25 inches; gray (10YR 5/1) silty clay loam; many prominent strong brown (7.5YR 5/8) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; thin continuous dark gray (10YR 4/1) clay films on faces of peds; slightly acid; clear smooth boundary.

2Btgb1—25 to 38 inches; gray (10YR 5/1) silty clay loam; many medium prominent yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; thin continuous dark gray (10YR 4/1) clay films on faces of peds; very strongly acid; gradual wavy boundary.

2Btgb2—38 to 59 inches; dark gray (10YR 4/1) silty clay; many medium prominent strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; thin continuous dark gray (N 4/0) clay films on faces of peds; strongly acid; clear smooth boundary.

3BCgb—59 to 74 inches; dark gray (N 4/0) cherty clay; many coarse prominent strong brown (7.5YR 5/6) and light olive brown (2.5Y 5/4) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; firm; thin continuous dark gray (N 4/0) clay films on faces of peds; 32 percent chert fragments; neutral; clear wavy boundary.

3BCb—74 to 80 inches; brownish yellow (10YR 6/8) silty clay; many coarse prominent light gray (10YR 7/1) mottles; moderate medium angular blocky structure; firm; gray (10YR 6/1) clay fillings in old root and worm channels; 12 percent chert fragments; moderately alkaline.

The solum ranges from 80 to 100 inches or more in thickness.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 1 to 3.

The Bt horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is mottled.

The 2Btg horizon and the upper part of the 3BC horizon have hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 1 or 2, or they are neutral with value of 4. The horizons are mottled. The 2Btg and 3BC horizons are silty clay loam, silty clay, clay, or the cherty analogs.

Wakeland Series

The Wakeland series consists of deep, somewhat poorly drained, moderately permeable soils on bottom lands. Wakeland soils formed in silty alluvium that derived from loess-covered uplands. The slopes range from 0 to 2 percent.

Wakeland soils are commonly adjacent to Haymond and Wilbur soils. Unlike Wakeland soils, Haymond soils do not have gray mottles. Haymond soils are in slightly higher areas or are adjacent to stream channels. Wilbur soils are not dominantly gray within a depth of 20 inches, and they are in slightly higher areas.

Typical pedon of Wakeland silt loam, frequently flooded, in a cultivated field, 2,100 feet east and 1,125 feet south of the northwest corner of sec. 25, T. 2 N., R. 2 W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam, pale brown (10YR 6/3) dry; moderate medium granular structure; friable; slightly acid; abrupt smooth boundary.

C1—9 to 16 inches; brown (10YR 5/3) silt loam; common medium distinct dark yellowish brown (10YR 4/4) and light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; slightly acid; clear wavy boundary.

C2—16 to 20 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct pale brown (10YR 6/3) mottles; few fine distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; medium acid; clear wavy boundary.

C3—20 to 31 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct pale brown (10YR 6/3) mottles; yellowish brown (10YR 5/6) mottles; massive; friable; medium acid; gradual wavy boundary.

C4—31 to 44 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct pale brown (10YR 6/3) mottles; few medium distinct yellowish brown (10YR 5/6) mottles; massive; friable; medium acid; gradual wavy boundary.

C5—44 to 67 inches; light brownish gray (10YR 6/2) silt loam; many medium distinct light yellowish brown (10YR 6/4) mottles; common medium distinct yellowish brown (10YR 5/6) mottles; massive; few accumulations of black (10YR 2/1) soft iron and manganese oxide; medium acid.

The control section of this soil ranges from medium acid to neutral.

The Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3.

The C horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 1 to 4. It is mottled. It is dominantly silt loam, but in some places, there are strata of loam and sandy loam in the lower part of the C horizon.

Wellston Series

The Wellston series consists of deep, well drained, moderately permeable soils on loess-capped uplands. Wellston soils formed in loess and in the underlying residuum of sandstone or siltstone. The slopes range from 6 to 50 percent.

Wellston soils are similar to Gilpin soils and are commonly adjacent to Ebal and Zanesville soils. Gilpin soils have a thinner solum than that of Wellston soils, and they are not so deep to bedrock. Ebal soils have more clay in the solum and are deeper to bedrock; they are intermingled with the Wellston soils. Zanesville soils have a fragipan and are on wide ridges.

Typical pedon of Wellston silt loam, in an area of Wellston-Gilpin-Ebal silt loams, 12 to 18 percent slopes, eroded, in a pasture, 1,260 feet west and 2,500 feet south of the northeast corner of sec. 16, T. 2 N., R. 1 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam with pockets of strong brown (7.5YR 5/6) silt loam, very pale brown (10YR 7/4) dry; moderate medium granular structure; friable; medium acid; abrupt smooth boundary.

Bt1—7 to 15 inches; strong brown (7.5YR 5/6) silty clay loam; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; thin continuous yellowish red (5YR 4/6) clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—15 to 24 inches; strong brown (7.5YR 5/6) silty clay loam; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; thin continuous yellowish red (5YR 4/6) clay films on faces of peds; patchy yellowish brown (10YR 5/4) silt coatings between peds; very strongly acid; clear smooth boundary.

Bt3—24 to 33 inches; strong brown (7.5YR 5/6) silt loam; many medium distinct pale brown (10YR 6/3) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; friable; thin continuous yellowish red (5YR 5/6) clay films on faces of peds; very strongly acid; clear wavy boundary.

2BC1—33 to 46 inches; strong brown (7.5YR 5/6) clay loam; many medium distinct light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; thin patchy yellowish red (5YR 5/6) clay films on faces of peds; few accumulations of black (10YR 2/1) soft iron and manganese oxide; very strongly acid; clear wavy boundary.

2BC2—46 to 59 inches; strong brown (7.5YR 5/6) channery sandy clay loam; common medium distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; thin patchy strong brown (7.5YR 5/6) clay films on faces of peds; gray (10YR 5/1) clay fillings between peds; 40 percent sandstone fragments; very strongly acid; abrupt wavy boundary.

2BC3—59 to 72 inches; strong brown (7.5YR 5/6) very channery sandy clay loam; weak medium subangular blocky structure; friable; thin patchy yellowish brown (10YR 5/4) clay films on faces of peds; grayish brown (10YR 5/2) clay fillings between peds; 60 percent sandstone fragments; very strongly acid; abrupt smooth boundary.

2R—72 to 80 inches; rippable sandstone bedrock.

The solum ranges from 32 to 72 inches in thickness. The loess capping ranges from 15 to 40 inches in thickness. The depth to bedrock ranges from 40 to 72 inches.

The Ap horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. The 2BC horizon has hue of 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is silty clay loam, clay loam, loam, sandy clay loam, or the channery or very channery analogs.

Wilbur Series

The Wilbur series consists of deep, moderately well drained, moderately permeable soils on bottom lands. Wilbur soils formed in silty alluvium that derived from loess-covered uplands. The slopes range from 0 to 2 percent.

Wilbur soils are commonly adjacent to Haymond and Wakeland soils. Unlike Wilbur soils, Haymond soils do not have gray mottles above a depth of 20 inches, and they are in slightly higher areas. Wakeland soils are dominantly gray within a depth of 20 inches and are in slight depressions.

Typical pedon of Wilbur silt loam, frequently flooded, in a cultivated field, 2,480 feet east and 2,580 feet north of the southwest corner of sec. 15, T. 1 N., R. 2 W.

Ap—0 to 8 inches; dark brown (10YR 4/3) silt loam, very pale brown (10YR 7/4) dry; moderate medium granular structure; friable; medium acid; abrupt smooth boundary.

C1—8 to 21 inches; brown (10YR 5/3) silt loam; many medium distinct yellowish brown (10YR 5/6) mottles; common medium faint grayish brown (10YR 5/2) mottles; moderate medium granular structure; friable; common accumulations of very dark gray (10YR 3/1) soft iron and manganese oxide; slightly acid; clear wavy boundary.

C2—21 to 30 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct grayish brown (10YR 5/2) mottles; many medium faint brownish yellow (10YR 6/6) mottles; massive; friable; common accumulations of very dark gray (10YR 3/1) soft iron and manganese oxide; medium acid; clear wavy boundary.

C3—30 to 38 inches; brown (10YR 5/3) silt loam; many medium distinct grayish brown (10YR 5/2) mottles; many medium faint yellowish brown (10YR 5/6) mottles; massive; friable; common accumulations of very dark gray (10YR 3/1) soft iron and manganese oxide; medium acid; clear wavy boundary.

C4—38 to 60 inches; pale brown (10YR 6/3) silt loam; many medium distinct grayish brown (10YR 5/2) mottles; many medium faint yellowish brown (10YR 5/6) mottles; massive; friable; common accumulations of very dark gray (10YR 3/1) soft iron and manganese oxide; medium acid.

The control section ranges from medium acid to neutral.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4.

The C horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 6. It is dominantly silt loam, but in some places there are strata of loam, fine sandy loam, and sandy loam in the lower part of the C horizon.

Zanesville Series

The Zanesville series consists of deep, well drained and moderately well drained soils on loess-capped uplands. The soils have a fragipan. Permeability is moderate above the fragipan and slow within the fragipan. Zanesville soils formed in loess and in the underlying residuum of sandstone, shale, or siltstone. The slopes range from 0 to 12 percent.

Zanesville soils are similar to Bedford soils and are commonly adjacent to Gilpin and Wellston soils. Bedford soils are redder than Zanesville soils and have more clay in the lower part of the solum, which formed in limestone residuum. Gilpin soils do not have a fragipan. They are less than 40 inches deep to bedrock and are on steep slopes. Wellston soils do not have a fragipan and are mainly on narrow ridges.

Typical pedon of Zanesville silt loam, 6 to 12 percent slopes, eroded, in a cultivated field, 510 feet west and 1,560 feet south of the northeast corner of sec. 7, T. 1 S., R. 2 W.

Ap—0 to 9 inches; brown (10YR 4/3) silt loam with pockets of strong brown (7.5YR 5/6) silt loam, light yellowish brown (10YR 6/4) dry; moderate medium granular structure; friable; common very fine roots; slightly acid; abrupt smooth boundary.

Bt1—9 to 14 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few very fine roots; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; slightly acid; clear wavy boundary.

Bt2—14 to 21 inches; strong brown (7.5YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few very fine roots; thin continuous strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/6) clay films on faces of peds; strongly acid; clear wavy boundary.

Bt3—21 to 25 inches; yellowish brown (10YR 5/6) silt loam; many medium distinct pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; friable; few very fine roots; thin continuous strong brown (7.5YR 5/6) and dark yellowish brown (10YR 4/6) clay films on faces of peds; strongly acid; clear wavy boundary.

2Btx1—25 to 31 inches; strong brown (7.5YR 5/6) silty clay loam; many medium distinct grayish brown (10YR 5/2) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; continuous light brownish gray (10YR 6/2) silt coatings on faces of peds; very strongly acid; clear wavy boundary.

2Btx2—31 to 43 inches; yellowish brown (10YR 5/6) channery silty clay loam; many medium distinct light brownish gray (10YR 6/2) mottles; moderate very coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; thin continuous strong brown (7.5YR 5/6) clay films on faces of peds; continuous light brownish gray (10YR 6/2) silt coatings on faces of peds; 15 percent sandstone fragments; very strongly acid; clear wavy boundary.

3BC—43 to 58 inches; red (2.5YR 4/6) silty clay; many medium distinct light brownish gray (10YR 6/2) and yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; firm; light brownish gray (10YR 6/2) silt coatings on faces of peds; 5 percent sandstone channers; very strongly acid; clear wavy boundary.

3Cr—58 to 60 inches; red (2.5YR 4/6) clay shale.

The solum ranges from 40 to 60 inches in thickness. The depth to the fragipan ranges from 24 to 36 inches. The loess ranges from 24 to 48 inches in thickness. The depth to 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. The Bt horizon has hue of 10YR and 7.5YR, value of 4 or 5, and chroma of 4 or 6. The Btx horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. It is silty clay loam, silt loam, or loam.

Formation of the Soils

This section discusses the major factors of soil formation and their importance in the formation of the soils in Orange County. It also discusses the processes of soil formation that have affected the development of soils in the county.

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 the physical and mineralogical composition of the parent material, the climate under which the soil material has accumulated and existed since accumulation, the plant and animal life on and in the soil, the relief, or lay of the land, and the length of time the forces of soil formation have acted on the soil material.

Climate and plants and animals, chiefly plants, are active factors of soil formation. They act on parent material that has accumulated through the weathering of rocks and slowly change it into a natural body that has genetically related horizons. The effects of climate and of plant and animal life are conditioned by relief. The parent material also affects the kind of soil profile that forms, and in extreme cases it determines profile formation almost entirely. Finally, time is needed for changing the parent material into a horizonal soil. The amount of time varies, but some time is always required for differentiation of soil horizons. Generally, a long time is required for the development of distinct horizons.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for all five factors. Many of the processes of soil development are not understood.

Parent Material

Parent material is the unconsolidated mineral material in which a soil forms. It determines the textural, chemical, and mineralogical composition of the soil. The soils in Orange County formed in residuum of sandstone, siltstone, shale, and limestone and in alluvium.

Most of the soils in Orange County formed in material that weathered from sedimentary bedrock. The sedimentary rock consists of alternating layers of sandstone, siltstone, shale, and limestone. The layers commonly are several feet thick. The rock formations incline toward the west-southwest at a rate of about 25 feet per mile. Thus, from the northeastern part of the county to the southwestern part of the county, the soils formed in rock formations from different periods.

In the northeastern part of the county, the soils formed in limestone of the Middle Mississippian Period. Caneyville and Crider soils are examples of soils that formed in limestone. In most of the rest of the county, the soils formed in bedded shale, sandstone, siltstone, and limestone of the Late Mississippian Period. In a small area along the western edge of the county, the soils also formed in sandstone and shale of the Pennsylvanian Period. Wellston and Gilpin soils are examples of soils that formed in sandstone and shale.

There is a thin mantle of loess over most of the county, which has been important in the development of many of the soils. Most of the loess in the steeper areas has been washed away, but in the less sloping areas, it is about 2 to 4 feet thick. Zanesville soils, for example, formed in loess and in residuum of sandstone, siltstone, or shale.

Sediment deposited by water is the parent material of the soils on bottom lands and on the terraces along many of the drainageways that dissect the county. Haymond and Wakeland soils on bottom lands and Pekin and Elkinsville soils on terraces, for example, formed in water-deposited sediment.

Climate

Climate is important in the formation of soils. It influences the kind of plant and animal life on and in the soil. It determines the amount of water available for the weathering of minerals and affects the transportation of soil materials. Through its influence on the temperature of the soil, climate determines the rate of chemical reaction in the soil.

Climatic forces act upon rocks to create parent material, but the development of many soil characteristics is dependent on the changes brought about by plants and animals. Climate acting alone on parent material would be largely destructive. Rain and melting snow, for example, would wash soluble materials out of the soil. In combination with the activities of plants and animals, however, the climatic forces become constructive. Plants draw nutrients from the lower part of the soil. When the plants die, rain leaches the nutrients back into the soil. In Orange County, leaching of nutrients progresses faster than replacement. Most of the soils are strongly weathered and leached, and for that reason, they are acid and are low in fertility.

The climate in Orange County is continental. It is nearly uniform throughout the county, and differences between soils cannot be explained on the basis of climate alone.

For more information on climate, see the section "General Nature of the County."

Plant and Animal Life

Plants have been the principal organisms influencing the soils in Orange County; however, bacteria, fungi, earthworms, and other living things have also been important. Without plants and animals, soils would consist of residual or transported material derived from weathered rock, although some definite layers might form as a result of the addition of colluvial material by differential weathering or as a result of leaching.

Plants bring moisture and nutrients from the lower part of the soil to the upper part. When they die, microorganisms, such as bacteria and fungi, decompose the raw plant waste into organic matter, which is then returned to the soil.

The native vegetation of Orange County consists largely of hardwood trees. The most common species are yellow-poplar, oak, hickory, elm, maple, and ash. A small amount of organic matter from trees was incorporated into the soils early in their development. In wooded areas of uplands that have never been cleared, thin layers of forest litter and leaf mold cover the soil, and a small amount of organic matter from decayed leaves and twigs is mixed with the topmost inch or two of the surface layer.

In areas where Montgomery soils formed, the native vegetation included swamp grasses, sedges, and water-tolerant trees. These soils were covered with water much of the year, and the organic material decayed so slowly that there was some accumulation.

The vegetation throughout the county is fairly uniform, and major differences between soils cannot be explained on the basis of differences in vegetation. Although different types of vegetation are associated with different types of soils, the variation is probably the result, and not the cause, of differences between the soils.

Relief

Relief has had an important effect on the formation of the soils in Orange County. Internal soil drainage, runoff, depth to the water table, leaching, and accumulation of organic matter are affected by relief. The relief in Orange County ranges from nearly level, on bottom lands, terraces, and upland flats, to very steep, on breaks and hillsides. Much of the area has been highly dissected by weathering and streams.

Differences in relief radically affect moisture and air conditions within the soil. Soils that develop in the same type of parent material in steep areas are less strongly developed than those in nearly level to sloping areas. Horizonal development, given the same period of time, the same parent material, and the same type of vegetation, depends mainly on the amount of water that passes through the soil material. The slow rate of soil development in steep areas is caused by accelerated erosion, reduced percolation, and insufficient water in the soil to support vigorous plant growth.

In Orange County, different kinds of soils have developed from the same kind of parent material mainly because of variations in relief. Wellston and Zanesville soils, for example, both developed in loess and in the underlying residuum of sandstone and shale. Wellston soils are moderately sloping to steep and are well drained. Their subsoil is strong brown, and they have no fragipan. Zanesville soils are nearly level to moderately sloping and are moderately well drained and well drained. The upper part of their subsoil is strong brown or yellowish brown, and they have a mottled fragipan.

Time

It generally takes a long time for distinct horizons to form in a soil. Differences in parent material, relief, and climate cause soils to mature at different rates. A mature soil has well developed A and B horizons that are the result of the natural processes of soil formation. An immature or young soil has little or no horizon development.

If the parent material has been in place a long time, the soil profile generally is well developed. In Orange County, the oldest soils are those that formed in residuum of sandstone, siltstone, shale, and limestone. Zanesville soils, for example, have well developed profiles and are considered to be mature.

Soils on bottom lands and those that form in alluvium and colluvium lack well-defined horizons because the parent material is young and new material is deposited periodically. Haymond and Wakeland soils, for example, are on bottom lands and are considered to be young.

Processes of Soil Formation

Several processes are involved in the formation of soils. These processes are the accumulation of organic matter; the solution, transfer, and removal of calcium carbonates and bases; the translocation of silicate clay minerals; and the reduction and transfer of iron. In most soils, more than one of these processes has been active in horizon differentiation.

Some organic matter has accumulated in the surface layer of all the soils in Orange County. 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 Montgomery 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 a high water table or because water moves slowly through wet soils.

Clay accumulates in pores and other voids and forms clay films on the surfaces along which water moves. Leaching of bases and translocation of silicate clays are two of the most important processes in horizon differentiation in the soils in Orange County. Wellston and Crider soils are examples of soils in which translocated silicate clays have formed clay films in the Bt horizon.

The reduction and transfer of iron, or gleying, has occurred in all very poorly drained, poorly drained, and somewhat poorly drained soils in the county. It has also occurred, to some extent, in the deeper horizons of the moderately well drained soils. In naturally wet soils, this process has been significant in horizon differentiation. The gray color of the subsoil indicates the reduction of iron oxides. The reduction is commonly accompanied by some transfer of iron either from upper horizons to lower horizons or completely out of the profile. Mottles in a horizon indicate segregation of iron.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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.

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.

Channery soil. A soil that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches along the longest axis. A single piece is called a fragment.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard compacted layers to a depth below normal plow depth.

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. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

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, 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.

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 of the soil 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. 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.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, subsurface. Removal of excess ground water through buried drains installed within the soil. The drains collect the water and convey it to a gravity or pump outlet.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

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.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

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.*

Fine textured soil. Sandy clay, silty clay, and clay.

First bottom. The normal flood plain of a stream, subject to frequent or occasional flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray 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 crop (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.

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.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, alluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is in part a layer of transition from the overlying horizon 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 Arabic numeral 2 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 capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

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.

Karst (topography). The relief of an area underlain by limestone that dissolves in differing degrees, thus forming numerous depressions or small basins.

Lacustrine deposit (geology). Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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 area. An area that has little or no natural soil and supports 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.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

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).

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.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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 downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 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, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, 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.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

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.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

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 surface runoff.

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.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

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.

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 refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of 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 millimeters 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, E, 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.

Stone line. A concentration of coarse fragments in a soil. Generally it is indicative of an old weathered surface. In a cross section, the line may be one fragment or more thick. It generally overlies material that weathered in place and is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

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 solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, EB) below the surface.

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."

Surface soil. The A, E, AB, and EB horizons and all subdivisions of these horizons.

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 water soaks into the soil or flows slowly to a prepared outlet.

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 loam, silt, sandy clay loam, clay loam, silty clay* *loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

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.

Underlying material. See substratum.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands 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.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-74 at Paoli, Indiana]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	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----	40.3	19.0	29.7	69	-14	0	3.55	2.00	4.80	7	5.3
February---	44.1	21.2	32.7	71	-10	7	3.23	1.52	4.61	7	4.0
March------	52.6	29.2	40.9	81	7	41	4.64	2.50	6.38	9	3.8
April------	66.4	41.0	53.8	86	20	160	4.38	2.65	5.93	9	.2
May--------	75.7	49.6	62.7	92	28	400	4.47	2.70	6.04	8	.0
June-------	83.6	58.7	71.2	97	40	636	4.34	2.39	5.92	8	.0
July-------	87.0	62.3	74.7	98	45	766	4.45	2.77	5.95	7	.0
August-----	86.5	59.7	73.2	98	43	719	3.25	1.72	4.49	5	.0
September--	80.6	53.0	67.0	95	33	510	2.87	1.45	4.02	5	.0
October----	69.9	40.2	55.0	88	20	194	2.55	1.06	3.74	5	.0
November---	54.7	30.7	42.8	80	8	9	3.65	2.11	4.91	7	1.5
December---	43.7	23.1	33.4	70	-6	14	3.50	1.84	4.85	7	2.6
Year-----	65.4	40.6	53.1	101	-16	3,456	44.88	38.98	49.66	84	17.4

[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 (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-74 at Paoli, 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 17	May 7	May 17
2 years in 10 later than--	April 13	April 30	May 11
5 years in 10 later than--	April 6	April 18	April 30
First freezing temperature in fall:			
1 year in 10 earlier than--	October 17	October 4	September 26
2 years in 10 earlier than--	October 21	October 8	September 30
5 years in 10 earlier than--	October 29	October 17	October 7

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-74 at Paoli, Indiana]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	190	160	139
8 years in 10	195	167	146
5 years in 10	206	181	159
2 years in 10	217	195	172
1 year in 10	222	202	179

TABLE 4.--POTENTIAL AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP

Map unit	Extent of area	Cultivated crops	Pasture and hayland	Woodland	Urban uses	Intensive recreation areas
	Pct					
1. Bedford-Bromer	6	Good	Good	Good	Poor: wetness.	Fair: wetness.
2. Crider-Caneyville-Frederick	23	Fair: slope, erosion.	Good	Good	Fair: slope.	Fair: slope.
3. Wellston-Gilpin-Zanesville	71	Poor: slope, erosion.	Fair: slope.	Good	Poor: slope.	Poor: slope.

TABLE 5.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
Ba	Bartle silt loam	396	0.2
BdA	Bedford silt loam, 0 to 2 percent slopes	3,788	1.5
BdB	Bedford silt loam, 2 to 6 percent slopes	6,567	2.5
Br	Bromer silt loam	5,440	2.1
Bu	Burnside silt loam, occasionally flooded	2,996	1.2
CaD3	Caneyville-Crider complex, 12 to 18 percent slopes, severely eroded	1,460	0.6
CaE	Caneyville-Crider silt loams, 18 to 25 percent slopes	1,004	0.4
CdF	Caneyville-Rock outcrop complex, 18 to 70 percent slopes	939	0.4
CrB	Crider silt loam, 2 to 6 percent slopes	15,154	5.8
CrC2	Crider silt loam, 6 to 12 percent slopes, eroded	15,655	6.0
CrC3	Crider silt loam, 6 to 12 percent slopes, severely eroded	664	0.3
CuD2	Crider-Caneyville silt loams, 12 to 18 percent slopes, eroded	7,724	3.0
CxC2	Crider-Frederick-Caneyville silt loams, karst, 2 to 12 percent slopes, eroded	15,103	5.8
ElA	Elkinsville silt loam, 0 to 2 percent slopes	455	0.2
ElB	Elkinsville silt loam, 2 to 6 percent slopes	1,572	0.6
ElC2	Elkinsville silt loam, 6 to 12 percent slopes, eroded	554	0.2
FrD2	Frederick silt loam, 12 to 18 percent slopes, eroded	486	0.2
FrF	Frederick silt loam, 18 to 50 percent slopes	347	0.1
GoF	Gilpin-Wellston silt loams, 18 to 50 percent slopes	59,448	22.9
Hd	Haymond silt loam, frequently flooded	12,624	4.9
Mo	Montgomery silty clay loam	276	0.1
PeB	Pekin silt loam, 2 to 6 percent slopes	887	0.3
PeC2	Pekin silt loam, 6 to 12 percent slopes, eroded	530	0.2
Po	Peoga silt loam, clayey substratum	759	0.3
Pt	Pits, quarry	160	0.1
Ud	Udorthents, loamy	45	*
Wa	Wakeland silt loam, frequently flooded	1,271	0.5
WeC2	Wellston silt loam, 6 to 12 percent slopes, eroded	24,942	9.6
WeC3	Wellston silt loam, 6 to 12 percent slopes, severely eroded	2,301	0.9
WfD3	Wellston-Ebal-Gilpin complex, 12 to 18 percent slopes, severely eroded	6,417	2.5
WgD2	Wellston-Gilpin-Ebal silt loams, 12 to 18 percent slopes, eroded	46,537	18.0
Wr	Wilbur silt loam, frequently flooded	1,141	0.4
ZaA	Zanesville silt loam, 0 to 2 percent slopes	542	0.2
ZaB	Zanesville silt loam, 2 to 6 percent slopes	9,907	3.8
ZaC2	Zanesville silt loam, 6 to 12 percent slopes, eroded	5,007	1.9
ZaC3	Zanesville silt loam, 6 to 12 percent slopes, severely eroded	308	0.1
	Water areas more than 40 acres	5,294	2.0
	Water areas less than 40 acres	500	0.2
	Total	259,200	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*
Ba------------------------ Bartle	110	38	50	3.6	7.2
BdA----------------------- Bedford	100	33	43	3.1	6.2
BdB----------------------- Bedford	95	33	43	3.1	6.2
Br------------------------ Bromer	110	38	45	3.6	7.2
Bu------------------------ Burnside	90	31	39	3.2	6.4
CaD3---------------------- Caneyville-Crider	---	---	---	2.5	4.5
CaE----------------------- Caneyville-Crider	---	---	---	2.5	4.5
CdF----------------------- Caneyville-Rock outcrop	---	---	---	---	---
CrB----------------------- Crider	120	45	50	5.5	9.5
CrC2---------------------- Crider	95	35	40	5.0	9.0
CrC3---------------------- Crider	80	25	30	4.0	7.5
CuD2---------------------- Crider-Caneyville	80	25	30	3.5	7.0
CxC2---------------------- Crider-Frederick-Caneyville	95	32	40	4.0	8.0
ElA----------------------- Elkinsville	120	42	48	4.0	8.0
ElB----------------------- Elkinsville	115	42	48	4.0	8.0
ElC2---------------------- Elkinsville	105	37	42	3.4	6.8
FrD2---------------------- Frederick	95	35	40	3.5	7.7
FrF----------------------- Frederick	---	---	---	3.0	7.0
GoF----------------------- Gilpin-Wellston	---	---	---	---	---
Hd------------------------ Haymond	110	39	42	3.7	8.0
Mo------------------------ Montgomery	120	42	48	4.0	8.0

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*
PeB------------------------ Pekin	105	37	47	3.4	6.8
PeC2----------------------- Pekin	85	30	38	2.8	5.6
Po------------------------- Peoga	120	42	48	4.0	8.0
Pt. Pits					
Ud. Udorthents					
Wa------------------------- Wakeland	115	40	46	4.4	8.8
WeC2----------------------- Wellston	100	35	40	4.0	7.5
WeC3----------------------- Wellston	90	30	30	3.5	7.0
WfD3----------------------- Wellston-Ebal-Gilpin	---	---	---	2.5	5.0
WgD2----------------------- Wellston-Gilpin-Ebal	85	---	30	3.0	6.0
Wr------------------------- Wilbur	110	40	44	3.6	7.2
ZaA------------------------ Zanesville	105	38	43	3.5	7.0
ZaB------------------------ Zanesville	100	35	40	3.5	7.0
ZaC2----------------------- Zanesville	80	25	30	3.5	7.0
ZaC3----------------------- Zanesville	60	20	25	3.0	6.0

* 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.

TABLE 7.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I	455	---	---	---	---
II	62,285	34,087	25,202	2,996	---
III	62,826	61,791	1,035	---	---
IV	58,020	58,020	---	---	---
V	---	---	---	---	---
VI	8,881	8,881	---	---	---
VII	60,734	60,734	---	---	---
VIII	---	---	---	---	---

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	
Ba----------------- Bartle	3o	Slight	Slight	Slight	Slight	White oak----------- Pin oak------------- Yellow-poplar------- Sweetgum------------	75 85 85 80	Eastern white pine, white ash, red maple, yellow-poplar, white oak, American sycamore.
BdA, BdB----------- Bedford	3o	Slight	Slight	Slight	Slight	White oak----------- Northern red oak---- Yellow-poplar------- Virginia pine------- Sugar maple---------	70 75 90 75 75	Eastern white pine, red pine, yellow-poplar, white ash, white oak.
Br----------------- Bromer	2o	Slight	Slight	Slight	Slight	White oak----------- Pin oak------------- Yellow-poplar------- Sweetgum------------	75 85 85 80	Eastern white pine, white ash, red maple, yellow-poplar, white oak, American sycamore.
Bu----------------- Burnside	1o	Slight	Slight	Slight	Slight	Eastern cottonwood-- Yellow-poplar------- American sycamore--- Sweetgum------------	106 96 --- ---	Black walnut, American sycamore, eastern cottonwood, red maple, white oak, eastern white pine.
CaD3*, CaE*:								
Caneyville--------	2c	Severe	Severe	Slight	Slight	Yellow-poplar------- Black oak-----------	90 80	Yellow-poplar, Virginia pine, red maple, black oak.
Crider------------	1r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------	88 97 78 80	Eastern white pine, yellow-poplar, black walnut, white ash, white oak.
CdF*:								
Caneyville--------	2x	Severe	Severe	Slight	Slight	Yellow-poplar------- Black oak-----------	90 80	Yellow-poplar, Virginia pine, red maple, black oak.
Rock outcrop.								
CrB, CrC2, CrC3---- Crider	1o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------	88 97 78 80	Eastern white pine, yellow-poplar, black walnut, white ash, white oak.
CuD2*:								
Crider------------	1r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine------- Shortleaf pine------	88 97 78 80	Eastern white pine, yellow-poplar, black walnut, white ash, white oak.
Caneyville--------	2c	Severe	Severe	Slight	Slight	Yellow-poplar------- Black oak-----------	90 80	Yellow-poplar, Virginia pine, red maple, black oak.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
CxC2*:								
Crider	1o	Slight	Slight	Slight	Slight	Northern red oak Yellow-poplar Virginia pine Shortleaf pine	88 97 78 80	Eastern white pine, yellow-poplar, black walnut, white ash, white oak.
Frederick	2c	Slight	Moderate	Slight	Slight	Northern red oak Yellow-poplar Black locust White oak Black walnut	76 86 --- --- ---	Austrian pine, yellow-poplar, green ash, pin oak, red maple.
Caneyville	3c	Slight	Moderate	Moderate	Slight	Northern red oak Yellow-poplar Eastern redcedar	69 80 45	Green ash, Virginia pine, black oak, Austrian pine, yellow-poplar.
ElA, ElB, ElC2 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, black locust.
FrD2 Frederick	2c	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar Black locust White oak Black walnut	76 86 --- --- ---	Austrian pine, yellow-poplar, green ash, pin oak, red maple.
FrF Frederick	2c	Severe	Severe	Slight	Slight	Northern red oak Yellow-poplar Black locust White oak Black walnut	76 86 --- --- ---	Austrian pine, yellow-poplar, green ash, pin oak, red maple.
GoF*:								
Gilpin	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar	80 95	Northern red oak, eastern white pine, red pine, black cherry, yellow-poplar, black locust.
Wellston	2r	Moderate	Moderate	Slight	Slight	Northern red oak Yellow-poplar Virginia pine	81 97 76	Eastern white pine, black walnut, yellow-poplar, northern red oak.
Hd Haymond	1o	Slight	Slight	Slight	Slight	Yellow-poplar White oak Black walnut	100 90 70	Eastern white pine, black walnut, yellow-poplar, black locust.
Mo Montgomery	2w	Slight	Severe	Severe	Severe	Pin oak White oak Sweetgum	88 75 90	Eastern white pine, eastern cottonwood, red maple, green ash, pin oak, white ash, sweetgum.
PeB, PeC2 Pekin	3o	Slight	Slight	Slight	Slight	White oak Yellow-poplar Virginia pine Sugar maple	70 85 75 75	Eastern white pine, shortleaf pine, red pine, yellow-poplar, white ash.
Po Peoga	2w	Slight	Severe	Severe	Moderate	Pin oak White oak Sweetgum	90 75 90	Swamp white oak, silver maple, red maple, pin oak, white ash, sweetgum.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns: Erosion hazard	Management concerns: Equipment limitation	Management concerns: Seedling mortality	Management concerns: Windthrow hazard	Potential productivity: Common trees	Potential productivity: Site index	Trees to plant
Wa------------------ Wakeland	2o	Slight	Slight	Slight	Slight	Pin oak------------- Sweetgum------------ Yellow-poplar------- Virginia pine-------	90 88 90 85	Eastern white pine, American sycamore, red maple, white ash, eastern cottonwood.
WeC2, WeC3---------- Wellston	2o	Slight	Slight	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine-------	71 90 70	Eastern white pine, black walnut, yellow-poplar, northern red oak.
WfD3*:								
Wellston----------	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine-------	81 97 76	Eastern white pine, black walnut, yellow-poplar, northern red oak.
Ebal--------------	2c	Slight	Slight	Moderate	Moderate	Black oak----------- Northern red oak---- Yellow-poplar-------	80 --- ---	Yellow-poplar, eastern white pine, white ash, northern red oak.
Gilpin------------	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-------	80 95	Northern red oak, eastern white pine, red pine, black cherry, yellow-poplar, black locust.
WgD2*:								
Wellston----------	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar------- Virginia pine-------	81 97 76	Eastern white pine, black walnut, yellow-poplar, northern red oak.
Gilpin------------	2r	Moderate	Moderate	Slight	Slight	Northern red oak---- Yellow-poplar-------	80 95	Northern red oak, eastern white pine, red pine, black cherry, yellow-poplar, black locust.
Ebal--------------	2c	Slight	Slight	Moderate	Moderate	Black oak----------- Northern red oak---- Yellow-poplar-------	80 --- ---	Yellow-poplar, eastern white pine, white ash, northern red oak.
Wr------------------ Wilbur	1o	Slight	Slight	Slight	Slight	Yellow-poplar-------	100	Eastern white pine, black walnut, yellow-poplar, black locust, white oak.
ZaA, ZaB, ZaC2----- Zanesville	3o	Slight	Slight	Slight	Slight	Northern red oak---- Virginia pine-------	68 70	Eastern white pine, green ash, black oak, yellow-poplar.
ZaC3--------------- Zanesville	4d	Slight	Slight	Moderate	Slight	Northern red oak---- Virginia pine-------	60 70	Virginia pine, yellow-poplar, black oak, eastern white pine.

* 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
Ba----------------- Bartle	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
BdA, BdB---------- Bedford	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Br----------------- Bromer	---	Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
Bu----------------- Burnside	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce-----	Eastern white pine, pin oak.
CaD3, CaE:					
Caneyville--------	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Crider------------	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
CdF:					
Caneyville--------	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Rock outcrop.					
CrB, CrC2, CrC3--- Crider	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.

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
CuD2:					
Crider	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Caneyville	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
CxC2:					
Crider	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
Frederick	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrain pine.	Eastern white pine, pin oak.
Caneyville	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
ElA, ElB, ElC2 Elkinsville	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
FrD2, FrF Frederick	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	White fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce, Austrian pine.	Eastern white pine, pin oak.
GoF:					
Gilpin	Siberian peashrub	Eastern redcedar, radiant crab-apple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
Wellston	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, northern white-cedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Hd Haymond	---	Amur privet, Amur honeysuckle, American cranberrybush, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.

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
Mo: Montgomery	---	Silky dogwood, Amur honeysuckle, Amur privet, American cranberrybush.	Northern white-cedar, Norway spruce, Austrian pine, blue spruce, white fir, Washington hawthorn.	Eastern white pine	Pin oak.
PeB, PeC2: Pekin	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Po: Peoga	---	Silky dogwood, American cranberrybush, Amur honeysuckle, Amur privet.	Washington hawthorn, white fir, blue spruce, northern white-cedar, Austrian pine, Norway spruce.	Eastern white pine	Pin oak.
Pt. Pits					
Ud. Udorthents					
Wa: Wakeland	---	Amur honeysuckle, silky dogwood, Amur privet, American cranberrybush, silky dogwood.	Northern white-cedar, Austrian pine, white fir, blue spruce, Washington hawthorn.	---	Eastern white pine, pin oak.
WeC2, WeC3: Wellston	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, northern white-cedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
WfD3:					
Wellston	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, northern white-cedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Ebal	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---

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
WfD3: Gilpin	Siberian peashrub	Eastern redcedar, radiant crab-apple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
WgD2: Wellston	---	Amur honeysuckle, Amur privet, American cranberrybush, silky dogwood.	White fir, northern white-cedar, blue spruce, Washington hawthorn.	Norway spruce, Austrian pine.	Pin oak, eastern white pine.
Gilpin	Siberian peashrub	Eastern redcedar, radiant crab-apple, Washington hawthorn, autumn-olive, Amur honeysuckle, lilac, Tatarian honeysuckle.	Eastern white pine, Austrian pine, red pine, jack pine.	---	---
Ebal	---	Eastern redcedar, Washington hawthorn, Amur privet, arrowwood, Amur honeysuckle, Tatarian honeysuckle, American cranberrybush.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---
Wr: Wilbur	---	Amur honeysuckle, American cranberrybush, Amur privet, silky dogwood.	Austrian pine, white fir, blue spruce, northern white-cedar, Washington hawthorn.	Norway spruce	Eastern white pine, pin oak.
ZaA, ZaB, ZaC2, ZaC3: Zanesville	---	Eastern redcedar, Washington hawthorn, Amur privet, arrow-wood, Amur honey-suckle, American cranberrybush, Tatarian honey-suckle.	Austrian pine, green ash, osageorange.	Eastern white pine, pin oak.	---

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
Ba: Bartle	Severe: wetness, percs slowly.	Severe: percs slowly.	Severe: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
BdA, BdB: Bedford	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
Br: Bromer	Severe: wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
Bu: Burnside	Severe: flooding.	Slight	Moderate: flooding.	Severe: erodes easily.	Moderate: large stones, flooding.
CaD3, CaE:					
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Crider	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
CdF:					
Caneyville	Severe: slope.	Severe: slope.	Severe: slope, large stones.	Severe: slope, erodes easily.	Severe: large stones, slope.
Rock outcrop.					
CrB: Crider	Slight	Slight	Moderate: slope.	Slight	Slight.
CrC2, CrC3: Crider	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
CuD2:					
Crider	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Caneyville	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
CxC2:					
Crider	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Frederick	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.
Caneyville	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, thin layer.
ElA: Elkinsville	Slight	Slight	Slight	Slight	Slight.
ElB: Elkinsville	Slight	Slight	Moderate: slope.	Slight	Slight.
ElC2: Elkinsville	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
FrD2: Frederick	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FrF Frederick	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
GoF:					
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Hd Haymond	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Mo Montgomery	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding.
PeB Pekin	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
PeC2 Pekin	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
Po Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
Pt. Pits					
Ud. Udorthents					
Wa Wakeland	Severe: flooding, wetness.	Moderate: flooding, wetness.	Severe: wetness, flooding.	Moderate: flooding, wetness.	Severe: flooding.
WeC2, WeC3 Wellston	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
WfD3:					
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Ebal	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
WgD2:					
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Ebal	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Severe: slope.
Wr Wilbur	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.

TABLE 10.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
ZaA: Zanesville	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Severe: erodes easily.	Slight.
ZaB: Zanesville	Moderate: percs slowly, wetness.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: erodes easily.	Slight.
ZaC2, ZaC3: Zanesville	Moderate: slope, percs slowly, wetness.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

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
Ba Bartle	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
BdA Bedford	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
BdB Bedford	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Br Bromer	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Bu Burnside	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
CaD3*, CaE*:										
Caneyville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Crider	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CdF*:										
Caneyville	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
CrB Crider	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CrC2, CrC3 Crider	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CuD2*:										
Crider	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Caneyville	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CxC2*:										
Crider	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Frederick	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Caneyville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ElA, ElB Elkinsville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ElC2 Elkinsville	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FrD2 Frederick	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
FrF Frederick	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	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 herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
GoF*:										
Gilpin	Very poor.	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Wellston	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Hd Haymond	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
Mo Montgomery	Fair	Poor	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
PeB Pekin	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
PeC2 Pekin	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Po Peoga	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Pt. Pits										
Ud. Udorthents										
Wa Wakeland	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
WeC2, WeC3 Wellston	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WfD3*:										
Wellston	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ebal	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
WgD2*:										
Wellston	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Gilpin	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Ebal	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Wr Wilbur	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
ZaA Zanesville	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
ZaB Zanesville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
ZaC2, ZaC3 Zanesville	Fair	Good	Good	Good	Good	Very 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
Ba: Bartle	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: frost action, low strength.	Moderate: wetness.
BdA: Bedford	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength, frost action.	Slight.
BdB: Bedford	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength, frost action.	Slight.
Br: Bromer	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, frost action.	Moderate: wetness.
Bu: Burnside	Moderate: depth to rock, large stones, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: large stones, flooding.
CaD3, CaE:						
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
CdF:						
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: large stones, slope.
Rock outcrop.						
CrB: Crider	Moderate: too clayey.	Slight	Slight	Moderate: slope.	Severe: low strength.	Slight.
CrC2, CrC3: Crider	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
CuD2:						
Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Caneyville	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
CxC2:						
Crider	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: low strength.	Moderate: slope.
Frederick	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Severe: shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Caneyville	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, thin layer.

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
ElA: Elkinsville	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength, frost action.	Slight.
ElB: Elkinsville	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength, frost action.	Slight.
ElC2: Elkinsville	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
FrD2, FrF: Frederick	Severe: slope.	Severe: slope.	Severe: slope, shrink-swell.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
GoF:						
Gilpin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Hd: Haymond	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
Mo: Montgomery	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
PeB: Pekin	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength, frost action.	Slight.
PeC2: Pekin	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: low strength, frost action.	Moderate: slope.
Po: Peoga	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness, frost action.	Severe: wetness.
Pt. Pits						
Ud. Udorthents						
Wa: Wakeland	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, frost action.	Severe: flooding.
WeC2, WeC3: Wellston	Moderate: depth to rock, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Severe: frost action.	Moderate: slope.
WfD3:						
Wellston	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Ebal	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: 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
WfD3:						
Gilpin-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WgD2:						
Wellston---------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.	Severe: slope.
Gilpin-----------	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ebal-------------	Severe: slope.	Severe: shrink-swell, slope.	Severe: slope, shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, slope, shrink-swell.	Severe: slope.
Wr---------------- Wilbur	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding, frost action.	Severe: flooding.
ZaA--------------- Zanesville	Moderate: depth to rock, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Slight.
ZaB--------------- Zanesville	Moderate: depth to rock, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: slope, wetness.	Severe: low strength.	Slight.
ZaC2, ZaC3-------- Zanesville	Moderate: slope, wetness, depth to rock.	Moderate: slope, wetness.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.

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
Ba: Bartle	Severe: wetness, percs slowly.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
BdA: Bedford	Severe: wetness, percs slowly.	Slight	Moderate: too clayey, wetness.	Moderate: wetness.	Poor: too clayey, hard to pack.
BdB: Bedford	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: too clayey, wetness.	Moderate: wetness.	Poor: too clayey, hard to pack.
Br: Bromer	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
Bu: Burnside	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, depth to rock, wetness.	Severe: flooding, wetness.	Poor: small stones.
CaD3*, CaE*:					
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CdF*:					
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
Rock outcrop.					
CrB: Crider	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
CrC2, CrC3: Crider	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
CuD2*:					
Crider	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Caneyville	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, too clayey, hard to pack.
CxC2*:					
Crider	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
Frederick	Moderate: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

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
CxC2*:					
Caneyville	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
ElA Elkinsville	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
ElB Elkinsville	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
ElC2 Elkinsville	Moderate: slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, slope.
FrD2, FrF Frederick	Severe: slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
GoF*:					
Gilpin	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Wellston	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Hd Haymond	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Good.
Mo Montgomery	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
PeB Pekin	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, wetness.
PeC2 Pekin	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey, slope, wetness.
Po Peoga	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness, thin layer.
Pt*. Pits					
Ud. Udorthents					
Wa Wakeland	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
WeC2, WeC3 Wellston	Moderate: depth to rock, percs slowly, slope.	Severe: slope.	Severe: depth to rock.	Moderate: depth to rock, slope.	Fair: area reclaim, small stones, slope.

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
WfD3*:					
Wellston-----------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Ebal---------------	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Gilpin-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
WgD2*:					
Wellston-----------	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: slope.
Gilpin-------------	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Poor: slope, area reclaim, thin layer.
Ebal---------------	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
Wr----------------- Wilbur	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
ZaA, ZaB----------- Zanesville	Severe: percs slowly, wetness.	Severe: wetness.	Severe: depth to rock.	Moderate: depth to rock, wetness.	Fair: too clayey, area reclaim.
ZaC2, ZaC3--------- Zanesville	Severe: percs slowly, wetness.	Severe: slope, wetness.	Severe: depth to rock.	Moderate: depth to rock, slope, wetness.	Fair: slope, too clayey, area reclaim.

* 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," and "improbable." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ba: Bartle	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
BdA, BdB: Bedford	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim.
Br: Bromer	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
Bu: Burnside	Fair: area reclaim, thin layer, large stones.	Improbable: excess fines, large stones.	Improbable: excess fines, large stones.	Poor: small stones, area reclaim.
CaD3*, CaE*:				
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CdF*:				
Caneyville	Poor: area reclaim, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, large stones, slope.
Rock outcrop.				
CrB: Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
CrC2, CrC3: Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
CuD2*:				
Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
CxC2*:				
Crider	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
Frederick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, thin layer.
Caneyville	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ElA, ElB: Elkinsville	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
ElC2: Elkinsville	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FrD2------------------ Frederick	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, thin layer.
FrF------------------- Frederick	Poor: slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, too clayey, thin layer.
GoF*:				
Gilpin---------------	Poor: thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Wellston-------------	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Hd-------------------- Haymond	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Mo-------------------- Montgomery	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
PeB------------------- Pekin	Fair: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
PeC2------------------ Pekin	Fair: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
Po-------------------- Peoga	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, wetness.
Pt*. Pits				
Ud. Udorthents				
Wa-------------------- Wakeland	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Good.
WeC2, WeC3------------ Wellston	Fair: area reclaim, thin layer, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
WfD3*:				
Wellston-------------	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Ebal-----------------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Gilpin---------------	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.

See footnote at end of table.

TABLE 14.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
WgD2*:				
Wellston	Fair: area reclaim, thin layer, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Gilpin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope, small stones.
Ebal	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Wr: Wilbur	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
ZaA, ZaB, ZaC2, ZaC3: Zanesville	Fair: area reclaim, thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim.

* 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-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
Ba: Bartle	Moderate: seepage.	Moderate: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness, rooting depth.	Wetness, erodes easily, rooting depth.
BdA: Bedford	Moderate: seepage.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Erodes easily, rooting depth.
BdB: Bedford	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
Br: Bromer	Moderate: seepage.	Severe: piping.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
Bu: Burnside	Moderate: seepage, depth to rock.	Severe: large stones.	Moderate: deep to water, slow refill, large stones.	Deep to water	Large stones, erodes easily.	Large stones, erodes easily.
CaD3*:						
Caneyville	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
Crider	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope.
CaE*:						
Caneyville	Severe: slope.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
Crider	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope.
CdF*:						
Caneyville	Severe: slope.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Rock outcrop.						
CrB: Crider	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable	Favorable.
CrC2, CrC3: Crider	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope.
CuD2*:						
Crider	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope.
Caneyville	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
CxC2*:						
Crider	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Slope	Slope.
Frederick	Severe: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope	Slope.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
CxC2*:						
Caneyville	Moderate: depth to rock.	Severe: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.
ElA Elkinsville	Moderate: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
ElB Elkinsville	Moderate: seepage, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
ElC2 Elkinsville	Severe: slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
FrD2, FrF Frederick	Severe: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope	Slope.
GoF*:						
Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Wellston	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Hd Haymond	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Erodes easily	Erodes easily.
Mo Montgomery	Slight	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly.	Erodes easily, ponding, percs slowly.	Wetness, erodes easily, percs slowly.
PeB Pekin	Moderate: seepage, slope.	Severe: piping.	Severe: slow refill.	Percs slowly, frost action, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
PeC2 Pekin	Severe: slope.	Severe: piping.	Severe: slow refill.	Percs slowly, frost action, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Po Peoga	Moderate: seepage.	Severe: piping, wetness.	Severe: no water.	Percs slowly, frost action.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
Pt*. Pits						
Ud. Udorthents						
Wa Wakeland	Moderate: seepage.	Severe: piping, wetness.	Moderate: slow refill.	Flooding, frost action.	Erodes easily, wetness.	Wetness, erodes easily.
WeC2, WeC3 Wellston	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
WfD3*:						
Wellston	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Ebal	Severe: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily.

See footnote at end of table.

TABLE 15.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Terraces and diversions	Grassed waterways
WfD3*:						
Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
WgD2*:						
Wellston	Severe: slope.	Severe: piping.	Severe: no water.	Deep to water	Slope, erodes easily.	Slope, erodes easily.
Gilpin	Severe: slope.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, depth to rock, large stones.	Slope, depth to rock, large stones.
Ebal	Severe: slope.	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, erodes easily, percs slowly.	Slope, erodes easily.
Wr Wilbur	Moderate: seepage.	Severe: piping.	Moderate: deep to water, slow refill.	Deep to water	Erodes easily	Erodes easily.
ZaA Zanesville	Moderate: depth to rock, seepage.	Severe: piping.	Severe: no water.	Percs slowly	Erodes easily, wetness.	Erodes easily, rooting depth.
ZaB Zanesville	Moderate: seepage, depth to rock, slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Erodes easily, wetness.	Erodes easily, rooting depth.
ZaC2, ZaC3 Zanesville	Severe: slope.	Severe: piping.	Severe: no water.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, wetness.

* 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	
Ba------------------ Bartle	0-9	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-90	20-35	5-15
	9-25	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-35	5-15
	25-44	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
	44-60	Silty clay loam, silt loam.	CL	A-6, A-7	0	100	100	90-100	70-95	30-45	10-25
BdA, BdB---------- Bedford	0-10	Silt loam--------	CL, ML	A-6, A-4	0	100	100	95-100	85-95	30-40	5-15
	10-29	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	95-100	85-95	25-45	15-25
	29-65	Silt loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	95-100	85-95	25-45	15-25
	65-80	Silty clay, clay, silty clay loam.	CL, CH	A-7	0-5	90-100	75-95	70-95	65-90	45-55	20-30
Br------------------ Bromer	0-9	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	95-100	90-100	85-100	20-35	3-13
	9-43	Silt loam, silty clay loam.	CL-ML, CL	A-6, A-4	0	100	95-100	90-100	85-100	25-40	6-20
	43-56	Silty clay loam, silt loam.	CL	A-4, A-6, A-7	0	95-100	90-100	85-100	75-95	30-45	9-24
	56-80	Silty clay, clay, cherty clay, very cherty clay.	CH, GC, CL, SC	A-6, A-7, A-2	0-5	40-70	30-70	25-70	25-65	35-60	15-35
Bu------------------ Burnside	0-12	Silt loam--------	ML, CL, CL-ML	A-4	0-10	100	100	80-95	75-95	20-35	2-10
	12-64	Channery loam, very channery sandy loam, flaggy silt loam.	SC, GC, SM, GM	A-2, A-4	10-60	35-80	30-60	30-50	26-45	<20	NP-10
CaD3: Caneyville-------	0-2	Silty clay loam	CL	A-6	0-3	90-100	85-100	75-100	65-100	30-40	11-20
	2-24	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Crider-------------	0-4	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	4-27	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	27-62	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
CaE: Caneyville-------	0-10	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	10-20	Silt loam, silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	20-29	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	29	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Crider-------------	0-13	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	13-30	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	30-63	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40

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	
CdF:											
Caneyville------	0-5	Stony silt loam	ML, CL, CL-ML	A-4, A-6	5-30	90-100	85-100	75-100	60-95	20-35	2-12
	5-14	Silty clay, clay, silty clay loam.	CH, CL	A-7	5-30	90-100	85-100	75-100	65-100	42-70	20-45
	14-26	Clay, silty clay	CH	A-7	5-30	90-100	85-100	75-100	65-100	50-75	30-45
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
CrB, CrC2-------- Crider	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	9-45	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	45-80	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
CrC3------------- Crider	0-3	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	3-45	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	45-66	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
CuD2:											
Crider----------	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	6-25	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	25-70	Silty clay, clay, silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
Caneyville------	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	6-18	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	18-36	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CxC2:											
Crider----------	0-9	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	85-100	25-35	4-12
	9-25	Silt loam, silty clay loam.	CL, ML, CL-ML	A-7, A-6, A-4	0	100	95-100	90-100	85-100	25-42	4-20
	25-80	Silty clay, clay, cherty silty clay loam.	CL, CH	A-7, A-6	0-5	85-100	75-100	70-100	60-100	35-65	15-40
Frederick-------	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-5	80-100	75-100	75-95	75-90	<35	NP-15
	6-19	Silt loam, silty clay loam, cherty silty clay loam.	CL, CL-ML	A-6, A-7	0-5	80-100	60-100	55-100	50-95	20-45	5-25
	19-80	Clay, clay loam, silty clay.	CH, ML-CH	A-7	0-5	90-100	85-100	70-100	60-95	60-85	30-55
Caneyville------	0-4	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	75-100	60-95	20-35	2-12
	4-12	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-3	90-100	85-100	75-100	65-100	42-70	20-45
	12-32	Clay, silty clay	CH	A-7	0-3	90-100	85-100	75-100	65-100	50-75	30-45
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 16.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
ElA, ElB, ElC2--- Elkinsville	0-10	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-90	25-40	5-15
	10-36	Silty clay loam, silt loam.	CL	A-6, A-4	0	100	100	85-100	65-90	30-40	8-18
	36-59	Silty clay loam, loam, sandy clay loam.	CL	A-4, A-6	0	100	100	80-100	50-90	30-40	8-18
	59-80	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
FrD2, FrF-------- Frederick	0-6	Silt loam--------	ML, CL, CL-ML	A-4, A-6	0-5	80-100	75-100	75-95	75-90	<35	NP-15
	6-19	Silt loam, silty clay loam, cherty silty clay loam.	CL, CL-ML	A-6, A-7	0-5	80-100	60-100	55-100	50-95	20-45	5-25
	19-80	Clay, clay loam, silty clay.	CH, ML-CH	A-7	0-5	90-100	85-100	70-100	60-95	60-85	30-55
GoF: Gilpin-----------	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	7-32	Channery loam, channery silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Wellston---------	0-5	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	5-27	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	27-72	Silt loam, clay loam, channery loam.	CL-ML, CL, CH, SC, SM-SC	A-4, A-6, A-7	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	72-81	Weathered bedrock	---	---	---	---	---	---	---	---	---
Hd--------------- Haymond	0-9	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	9-40	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	40-60	Fine sandy loam, silt loam, loam.	ML, SM	A-4	0	95-100	90-100	80-100	35-90	27-36	4-10
Mo--------------- Montgomery	0-19	Silty clay loam	CL	A-7	0	100	100	100	85-100	40-50	20-30
	19-69	Silty clay loam, silty clay.	CH	A-7	0	100	100	95-100	90-100	50-65	30-42
	69-80	Stratified clay to silty clay loam.	CL, CH	A-7	0	100	100	90-100	85-100	40-55	20-32
PeB, PeC2-------- Pekin	0-7	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	85-100	65-100	20-30	5-15
	7-20	Silt loam, silty clay loam.	CL	A-6	0	100	100	90-100	70-100	25-40	10-20
	20-43	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	88-98	65-90	25-35	5-15
	43-60	Stratified fine sandy loam to silty clay loam.	CL, CL-ML	A-4, A-6	0	100	100	80-95	50-85	20-40	5-15
Po--------------- Peoga	0-13	Silt loam--------	ML, CL-ML, CL	A-4, A-6	0	100	95-100	90-100	70-95	20-35	3-11
	13-38	Silt loam, silty clay loam.	CL-ML, CL	A-6, A-4	0	100	95-100	90-100	70-95	25-40	6-20
	38-80	Silty clay, cherty clay, very cherty clay.	GC, CL, CH	A-7, A-2-7	0-5	45-75	35-75	30-75	30-70	40-65	15-40

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	
Pt. Pits											
Ud. Udorthents											
Wa---------------- Wakeland	0-9	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
	9-60	Silt loam--------	ML	A-4	0	100	100	90-100	80-90	27-36	4-10
WeC2, WeC3------- Wellston	0-8	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	8-46	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	46-50	Silt loam, clay loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WfD3:											
Wellston---------	0-1	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	1-25	Silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	25-44	Silt loam, silty clay loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Ebal------------	0-1	Silty clay loam	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	80-98	25-40	5-15
	1-9	Channery silt loam, silt loam, silty clay loam.	CL, GC	A-6, A-7	0-3	60-70	50-70	45-70	40-65	30-45	12-20
	9-19	Channery silty clay, silty clay loam, clay.	CL, CH, GC	A-7	3-15	60-70	50-70	45-70	35-65	40-55	20-30
	19-58	Clay-------------	CH	A-7	0-3	95-100	90-100	80-100	70-95	60-75	35-45
	58-68	Weathered bedrock	---	---	---	---	---	---	---	---	---
Gilpin----------	0-1	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	1-22	Channery loam, channery silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WgD2:											
Wellston---------	0-7	Silt loam--------	ML	A-4	0	95-100	90-100	85-100	70-95	25-35	3-10
	7-46	Clay loam, silt loam, silty clay loam.	CL, CL-ML	A-6, A-4	0-5	75-100	70-100	60-95	60-90	25-40	5-20
	46-72	Silt loam, channery sandy clay loam, channery loam.	CL-ML, CL, SC, SM-SC	A-4, A-6	0-10	65-90	65-90	60-90	40-65	20-35	5-15
	72	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gilpin----------	0-6	Silt loam--------	CL, CL-ML	A-4, A-6	0-5	80-95	75-90	70-85	65-80	20-40	4-15
	6-28	Channery loam, channery silt loam, silty clay loam.	GC, SC, CL, CL-ML	A-2, A-4, A-6	0-30	50-95	45-90	35-85	30-80	20-40	4-15
	28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

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	
WgD2:											
Ebal-------------	0-6	Silt loam--------	CL-ML, CL	A-4, A-6	0	95-100	95-100	90-100	80-98	25-40	5-15
	6-16	Channery silt loam, silt loam, silty clay loam.	CL, GC	A-6, A-7	0-3	60-70	50-70	45-70	40-65	30-45	12-20
	16-75	Channery silty clay, silty clay loam, clay.	CL, CH, GC	A-7	3-15	60-70	50-70	45-70	35-65	40-55	20-30
	75	Weathered bedrock	---	---	---	---	---	---	---	---	---
Wr---------------- Wilbur	0-8	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	70-90	<25	3-7
	8-60	Silt loam--------	ML, CL-ML	A-4	0	100	100	90-100	70-90	<25	3-7
ZaA, ZaB--------- Zanesville	0-8	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	8-25	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	25-43	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	43-56	Channery clay, sandy clay loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	56	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
ZaC2, ZaC3-------- Zanesville	0-9	Silt loam--------	CL-ML, CL, ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	4-15
	9-25	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	90-100	80-100	25-40	5-20
	25-43	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6	0-3	90-100	85-100	80-100	60-100	20-40	2-20
	43-58	Silty clay, loam, clay loam, channery sandy clay loam.	SC, CL, SM, GM	A-6, A-4, A-2, A-1-b	0-10	65-100	50-95	40-95	20-85	20-40	2-20
	58	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less 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	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
Ba: Bartle	0-9	15-26	1.30-1.45	0.6-2.0	0.20-0.24	5.1-7.3	Low	0.43	4	5	1-3
	9-25	22-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low	0.43			
	25-44	22-35	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low	0.43			
	44-60	22-35	1.40-1.60	0.2-0.6	0.15-0.18	4.5-7.3	Low	0.43			
BdA, BdB: Bedford	0-10	10-16	1.30-1.45	0.6-2.0	0.22-0.24	3.6-7.3	Low	0.43	4-3	5	1-2
	10-29	24-32	1.30-1.45	0.6-2.0	0.18-0.20	3.6-5.5	Moderate	0.43			
	29-65	25-35	1.50-1.70	<0.06	0.06-0.08	3.6-5.5	Moderate	0.43			
	65-80	35-60	1.30-1.50	0.2-0.6	0.06-0.08	3.6-5.5	Moderate	0.32			
Br: Bromer	0-9	10-18	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low	0.43	4	5	2-4
	9-43	20-32	1.40-1.60	0.6-2.0	0.18-0.22	4.5-5.5	Moderate	0.43			
	43-56	22-34	1.40-1.60	0.06-0.2	0.18-0.22	4.5-6.0	Moderate	0.43			
	56-80	45-80	1.40-1.65	0.06-0.2	0.03-0.07	5.6-7.3	High	0.32			
Bu: Burnside	0-12	15-27	1.20-1.40	0.6-2.0	0.22-0.24	4.5-6.0	Low	0.37	4	5	1-2
	12-64	14-25	1.40-1.60	0.6-2.0	0.05-0.12	4.5-6.0	Low	0.37			
CaD3: Caneyville	0-2	27-40	1.20-1.40	0.6-2.0	0.17-0.22	4.5-7.3	Low	0.43	3	---	1-4
	2-24	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate	0.28			
	24	---	---	---	---	---	---	----			
Crider	0-4	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low	0.32	4	---	1-4
	4-27	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low	0.28			
	27-62	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.0	Moderate	0.28			
CaE: Caneyville	0-10	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low	0.43	3	---	2-4
	10-20	25-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate	0.28			
	20-29	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate	0.28			
	29	---	---	---	---	---	---	----			
Crider	0-13	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low	0.32	4	---	2-4
	13-30	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low	0.28			
	30-63	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.0	Moderate	0.28			
CdF: Caneyville	0-5	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-6.0	Low	0.43	3	---	2-4
	5-14	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-6.0	Moderate	0.28			
	14-26	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate	0.28			
	26	---	---	---	---	---	---	----			
Rock outcrop.											
CrB, CrC2: Crider	0-9	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low	0.32	4	---	2-4
	9-45	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low	0.28			
	45-80	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.0	Moderate	0.28			
CrC3: Crider	0-3	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low	0.32	4	---	1-2
	3-45	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low	0.28			
	45-66	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.0	Moderate	0.28			
CuD2: Crider	0-6	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low	0.32	4	---	2-4
	6-25	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low	0.28			
	25-70	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.0	Moderate	0.28			
Caneyville	0-6	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low	0.43	3	---	2-4
	6-18	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate	0.28			
	18-36	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate	0.28			
	36	---	---	---	---	---	---	----			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm3	In/hr	In/in	pH					Pct
CxC2:											
Crider----------	0-9	15-27	1.20-1.40	0.6-2.0	0.19-0.23	5.1-7.3	Low-----------	0.32	4	---	2-4
	9-25	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.1-7.3	Low-----------	0.28			
	25-80	30-60	1.20-1.55	0.6-2.0	0.12-0.18	4.5-6.0	Moderate-----	0.28			
Frederick-------	0-6	13-23	1.25-1.50	2.0-6.0	0.15-0.24	4.5-6.0	Low-----------	0.32	4	---	1-3
	6-19	20-40	1.40-1.65	0.6-2.0	0.12-0.18	4.5-6.0	Moderate-----	0.24			
	19-80	50-85	1.40-1.65	0.6-2.0	0.09-0.18	4.5-5.5	High----------	0.24			
Caneyville------	0-4	10-25	1.20-1.40	0.6-2.0	0.15-0.22	4.5-7.3	Low-----------	0.43	3	---	2-4
	4-12	36-60	1.35-1.60	0.2-0.6	0.12-0.18	4.5-7.3	Moderate-----	0.28			
	12-32	40-60	1.35-1.60	0.2-0.6	0.12-0.18	5.6-7.8	Moderate-----	0.28			
	32	---	---	---	---	---	-------------	----			
ElA, ElB, ElC2--- Elkinsville	0-10	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	5-2
	10-36	22-30	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.0	Moderate-----	0.37			
	36-59	16-30	1.45-1.65	0.6-2.0	0.15-0.20	4.5-5.5	Moderate-----	0.37			
	59-80	20-34	1.40-1.60	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
FrD2, FrF-------- Frederick	0-6	13-23	1.25-1.50	2.0-6.0	0.15-0.24	4.5-6.0	Low-----------	0.32	4	---	1-3
	6-19	20-40	1.40-1.65	0.6-2.0	0.12-0.18	4.5-6.0	Moderate-----	0.24			
	19-80	50-85	1.40-1.65	0.6-2.0	0.09-0.18	4.5-5.5	High----------	0.24			
GoF:											
Gilpin----------	0-7	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low-----------	0.32	3	---	1-4
	7-32	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low-----------	0.24			
	32	---	---	---	---	---	-------------	----			
Wellston--------	0-5	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6	1-3
	5-27	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
	27-72	15-40	1.30-1.60	0.6-2.0	0.10-0.17	4.5-6.0	Low-----------	0.37			
	72-81	---	---	---	---	---	-------------	----			
Hd--------------- Haymond	0-9	10-18	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	9-40	10-18	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
	40-60	10-18	1.30-1.45	0.6-2.0	0.20-0.22	6.1-7.3	Low-----------	0.37			
Mo--------------- Montgomery	0-19	35-40	1.35-1.55	0.2-0.6	0.20-0.23	6.1-7.8	High----------	0.37	5	7	3-6
	19-69	40-55	1.45-1.65	<0.2	0.11-0.18	6.1-8.4	High----------	0.37			
	69-80	35-60	1.50-1.70	<0.2	0.18-0.20	7.4-8.4	Moderate-----	0.37			
PeB, PeC2-------- Pekin	0-7	15-26	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.43	4	5	1-3
	7-20	25-35	1.40-1.60	0.6-2.0	0.20-0.22	4.5-5.5	Low-----------	0.43			
	20-43	22-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Low-----------	0.43			
	43-60	20-34	1.40-1.60	0.6-2.0	0.06-0.08	4.5-7.3	Low-----------	0.43			
Po--------------- Peoga	0-13	12-22	1.25-1.40	0.6-2.0	0.22-0.24	5.1-7.3	Low-----------	0.43	5	5	2-5
	13-38	22-34	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.5	Low-----------	0.43			
	38-80	45-80	1.40-1.65	0.06-0.2	0.05-0.10	4.5-7.3	High----------	0.32			
Pt. Pits											
Ud. Udorthents											
Wa--------------- Wakeland	0-9	10-17	1.30-1.50	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	9-60	10-17	1.30-1.50	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
WeC2, WeC3------- Wellston	0-8	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6	1-3
	8-46	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
	46-50	15-40	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37			
	50	---	---	---	---	---	-------------	----			

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	G/cm^3	In/hr	In/in	pH					Pct
WfD3:											
Wellston---------	0-1	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6	1-3
	1-25	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
	25-44	15-35	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37			
	44	---	---	---	---	---	-------------	----			
Ebal------------	0-1	27-35	1.35-1.50	0.6-2.0	0.22-0.24	4.5-6.0	Low-----------	0.37	3	5	.5-2
	1-9	20-30	1.40-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Moderate------	0.28			
	9-19	38-50	1.45-1.65	0.2-0.6	0.06-0.09	4.5-6.0	Moderate------	0.28			
	19-58	55-70	1.55-1.75	<0.06	0.07-0.10	4.5-6.0	High----------	0.28			
	58-68	---	---	---	---	---	-------------	----			
Gilpin----------	0-1	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low-----------	0.32	3	---	1-4
	1-22	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low-----------	0.24			
	22	---	---	---	---	---	-------------	----			
WgD2:											
Wellston---------	0-7	13-27	1.30-1.50	0.6-2.0	0.18-0.22	5.1-6.5	Low-----------	0.37	4	6	1-3
	7-46	18-35	1.30-1.65	0.6-2.0	0.17-0.21	4.5-6.0	Low-----------	0.37			
	46-72	15-30	1.30-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low-----------	0.37			
	72	---	---	---	---	---	-------------	----			
Gilpin----------	0-6	15-27	1.20-1.40	0.6-2.0	0.12-0.18	3.6-5.5	Low-----------	0.32	3	---	1-4
	6-28	18-35	1.20-1.50	0.6-2.0	0.10-0.16	3.6-5.5	Low-----------	0.24			
	28	---	---	---	---	---	-------------	----			
Ebal------------	0-6	20-28	1.35-1.50	0.6-2.0	0.22-0.24	4.5-6.0	Low-----------	0.37	3	5	.5-2
	6-16	20-35	1.40-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Moderate------	0.28			
	16-75	38-60	1.45-1.65	0.2-0.6	0.06-0.09	4.5-6.0	Moderate------	0.28			
	75	---	---	---	---	---	-------------	----			
Wr---------------- Wilbur	0-8	10-17	1.30-1.45	0.6-2.0	0.22-0.24	5.6-7.3	Low-----------	0.37	5	5	1-3
	8-60	10-17	1.30-1.45	0.6-2.0	0.20-0.22	5.6-7.3	Low-----------	0.37			
ZaA, ZaB---------- Zanesville	0-8	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-5.5	Low-----------	0.37	3	---	1-3
	8-25	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-5.5	Low-----------	0.37			
	25-43	18-33	1.50-1.75	0.06-0.6	0.08-0.12	4.5-5.5	Low-----------	0.37			
	43-56	20-50	1.50-1.70	0.2-2.0	0.08-0.12	4.5-5.5	Low-----------	0.28			
	56	---	---	---	---	---	-------------	----			
ZaC2, ZaC3-------- Zanesville	0-9	12-27	1.35-1.40	0.6-2.0	0.19-0.23	4.5-5.5	Low-----------	0.37	3	---	1-3
	9-25	18-35	1.35-1.45	0.6-2.0	0.17-0.22	4.5-5.5	Low-----------	0.37			
	25-43	18-33	1.50-1.75	0.06-0.6	0.08-0.12	4.5-5.5	Low-----------	0.37			
	43-58	20-50	1.50-1.70	0.2-2.0	0.08-0.12	4.5-5.5	Low-----------	0.28			
	58	---	---	---	---	---	-------------	----			

TABLE 18.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "brief," "apparent," and "perched" are explained in the text. The symbol > 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	Hydro-logic 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				
Ba----------------- Bartle	D	None---------	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High-----	High-----	High.
BdA, BdB----------- Bedford	C	None---------	---	---	2.0-4.0	Perched	Mar-Apr	>60	---	High-----	High-----	High.
Br----------------- Bromer	C	None---------	---	---	1.0-3.0	Perched	Jan-Apr	>60	---	High-----	High-----	High.
Bu----------------- Burnside	B	Occasional	Brief-----	Mar-Jun	3.0-5.0	Apparent	Feb-Jun	40-65	Hard	Moderate	Low------	High.
CaD3, CaE:												
Caneyville--------	C	None---------	---	---	>6.0	---	---	20-40	Hard	---	High-----	Moderate.
Crider------------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
CdF:												
Caneyville--------	C	None---------	---	---	6.0	---	---	20-40	Hard	---	High-----	Moderate.
Rock outcrop.												
CrB, CrC2, CrC3--- Crider	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
CuD2:												
Crider------------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
Caneyville--------	C	None---------	---	---	>6.0	---	---	20-40	Hard	---	High-----	Moderate.
CxC2:												
Crider------------	B	None---------	---	---	>6.0	---	---	>60	---	---	Moderate	Moderate.
Frederick---------	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
Caneyville--------	C	None---------	---	---	>6.0	---	---	20-40	Hard	---	High-----	Moderate.
ElA, ElB, ElC2----- Elkinsville	B	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate	High.
FrD2, FrF---------- Frederick	B	None---------	---	---	>6.0	---	---	>60	---	Moderate	Moderate	High.
GoF:												
Gilpin------------	C	None---------	---	---	>6.0	---	---	20-40	Soft	Moderate	Low------	High.
Wellston----------	B	None---------	---	---	>6.0	---	---	>40	Hard	High-----	Moderate	High.
Hd----------------- Haymond	B	Frequent----	Brief-----	Jan-May	>6.0	---	---	>60	---	High-----	Low------	Low.

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				
Mo*: Montgomery	D	None	---	---	+1-1.0	Apparent	Dec-May	>60	---	Moderate	High	Low.
PeB, PeC2: Pekin	C	None	---	---	2.0-6.0	Apparent	Mar-Apr	>60	---	High	Moderate	High.
Po: Peoga	C	None	---	---	0-1.0	Perched	Jan-May	>60	---	High	High	High.
Pt. Pits												
Ud. Udorthents												
Wa: Wakeland	B/D	Frequent	Brief	Jan-May	1.0-3.0	Apparent	Jan-Apr	>60	---	High	High	Low.
WeC2, WeC3: Wellston	B	None	---	---	>6.0	---	---	>40	Hard	High	Moderate	High.
WfD3:												
Wellston	B	None	---	---	>6.0	---	---	>40	Hard	High	Moderate	High.
Ebal	B	None	---	---	>6.0	---	---	50-80	Soft	Moderate	High	High.
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	High.
WgD2:												
Wellston	B	None	---	---	>6.0	---	---	>40	Hard	High	Moderate	High.
Gilpin	C	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low	High.
Ebal	B	None	---	---	>6.0	---	---	50-80	Soft	Moderate	High	High.
Wr: Wilbur	C	Frequent	Brief	Oct-Jun	3.0-6.0	Apparent	Mar-Apr	>60	---	High	Moderate	Moderate.
ZaA, ZaB, ZaC2, ZaC3: Zanesville	C	None	---	---	2.0-3.0	Perched	Dec-Apr	>40	Hard	---	Moderate	High.

* In the "High water table--Depth" column, 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.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
*Bartle	Fine-silty, mixed, mesic Aeric Fragiaqualfs
Bedford	Fine-silty, mixed, mesic Typic Fragiudults
Bromer	Fine-silty, mixed, mesic Aeric Ochraqualfs
Burnside	Loamy-skeletal, mixed, acid, mesic Typic Udifluvents
Caneyville	Fine, mixed, mesic Typic Hapludalfs
Crider	Fine-silty, mixed, mesic Typic Paleudalfs
Ebal	Fine, mixed, mesic Ultic Hapludalfs
Elkinsville	Fine-silty, mixed, mesic Ultic Hapludalfs
Frederick	Clayey, mixed, mesic Typic Paleudults
Gilpin	Fine-loamy, mixed, mesic Typic Hapludults
Haymond	Coarse-silty, mixed, nonacid, mesic Typic Udifluvents
*Montgomery	Fine, mixed, mesic Typic Haplaquolls
*Pekin	Fine-silty, mixed, mesic Aquic Fragiudalfs
Peoga	Fine-silty, mixed, mesic Typic Ochraqualfs
Udorthents	Loamy, mixed, mesic Typic Udorthents
Wakeland	Coarse-silty, mixed, nonacid, mesic Aeric Fluvaquents
Wellston	Fine-silty, mixed, mesic Ultic Hapludalfs
Wilbur	Coarse-silty, mixed, nonacid, mesic Aquic Udifluvents
Zanesville	Fine-silty, mixed, mesic Typic Fragiudalfs

* 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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