



United States
Department of
Agriculture



Natural
Resources
Conservation
Service

In cooperation with
the Kentucky Natural
Resources and
Environmental Protection
Cabinet and the Kentucky
Agricultural Experiment
Station

Soil Survey of Bracken and Robertson Counties, Kentucky



How To Use This Soil Survey

General Soil Maps

The general soil maps, which are in color, show the survey area divided into groups of associated soils called general soil map units. These maps are useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the applicable map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

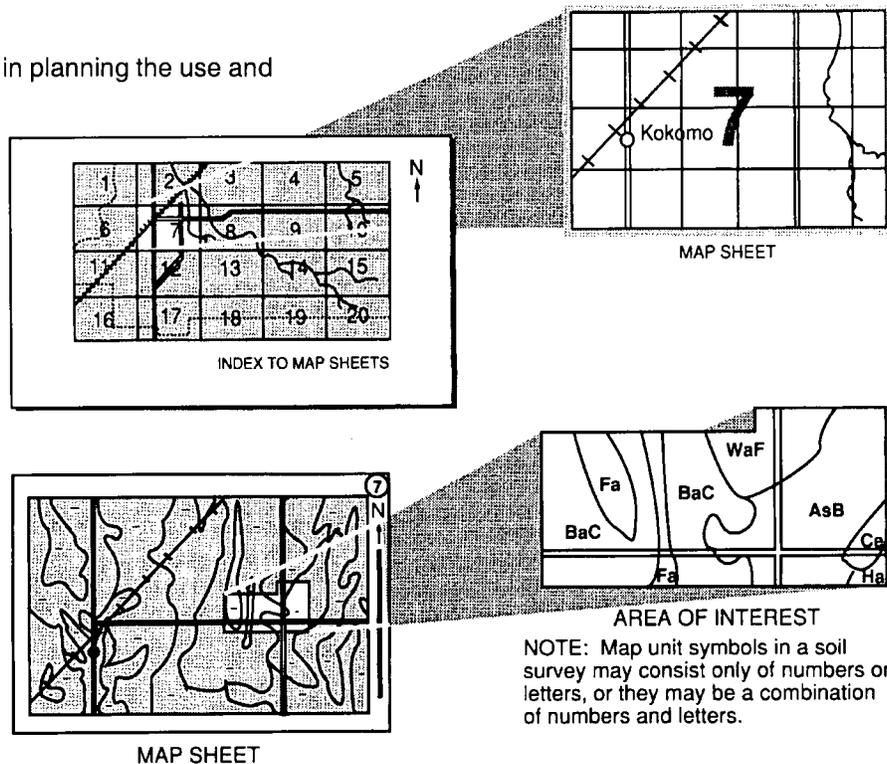
Detailed Soil Maps

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets**. Note the number of the map sheet and turn to that sheet.

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Contents**, which lists the map units by symbol and name and shows the page where each map unit is described.

The **Contents** shows which table has data on a specific land use for each detailed soil map unit. Also see the **Contents** for sections of this publication that may address your specific needs.



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 Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed during the period 1988-92. Soil names and descriptions were approved in 1993. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1994. This survey was made cooperatively by the Natural Resources Conservation Service, the Kentucky Natural Resources and Environmental Protection Cabinet, and the Kentucky Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Bracken County Conservation District and to the Robertson County Conservation District.

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

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Cover: An area of Lowell silt loam, shale substratum, 6 to 12 percent slopes, eroded, and Lowell silt loam, shale substratum, 12 to 20 percent slopes, eroded, used for crops and hay. Eden flaggy silty clay loam, 20 to 35 percent slopes, eroded, is in the wooded areas.

Additional information about the Nation's natural resources is available on the Natural Resources Conservation Service home page on the World Wide Web. The address is <http://www.nrcs.usda.gov>.

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Foreword

This soil survey contains information that affects land use planning in this survey area. It contains predictions of soil behavior for selected land uses. The survey also highlights soil limitations, 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 ensure 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.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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 maps. 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 Natural Resources Conservation Service or the Cooperative Extension Service.

David Sawyer
State Conservationist
Natural Resources Conservation Service

Soil Survey of Bracken and Robertson Counties, Kentucky

By Steve E. Jacobs, Robert A. Eigel, and Richard D. Jones, Natural Resources Conservation Service

Fieldwork by Steve E. Jacobs, Richard D. Jones, Douglas H. Hines, and Robert A. Eigel, Natural Resources Conservation Service

United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Kentucky Natural Resources and Environmental Protection Cabinet and the Kentucky Agricultural Experiment Station

BRACKEN AND ROBERTSON COUNTIES are in the north-central part of Kentucky (fig. 1). The combined land area of the counties is 192,688 acres, or about 301 square miles. Bracken County has a land area of 128,854 acres, and Robertson County has one of 63,834 acres. In addition, Bracken County has 4,970 acres of water and Robertson County has 397 acres (U.S. Department of Commerce 1983).

Bracken County is bounded on the south by Robertson County, on the east by Mason County, on the southwest by Harrison County, on the west by Pendleton County, and on the north by the Ohio River. In 1990, Bracken County had a population of 7,766 and Brooksville, the county seat, had a population of 670 (Kentucky Cabinet for Economic Development 1993).

Robertson County is bounded on the north by Bracken County, on the northeast by Mason County, on the southeast by Fleming County, on the south by Nicholas County, and on the west by Harrison County. In 1990, Robertson County had a population of 2,124 and Mount Olivet, the county seat, had a population of 384 (Kentucky Cabinet for Economic Development 1993).

Farming, mainly growing tobacco and raising livestock, is the main enterprise in both counties.

General Nature of the Survey Area

This section gives general information about Bracken and Robertson Counties. It describes farming, early history, climate, natural resources, and topography and drainage in the survey area.

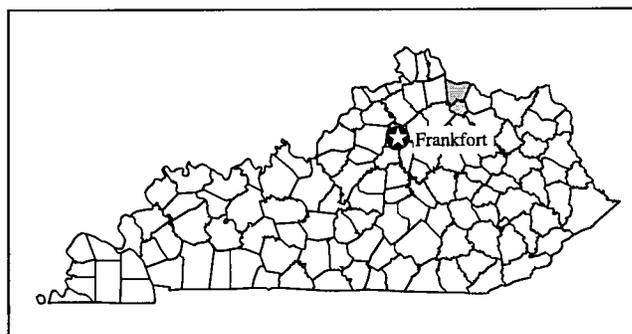


Figure 1.—Location of Bracken and Robertson Counties in Kentucky.

Farming

Agriculture is of primary economic importance in Bracken and Robertson Counties. It accounts for about 16 percent of the total income in Bracken County and for about 38 percent of the total income in Robertson County (Kentucky Cabinet for Economic Development 1993).

Most of the nearly level to sloping ridgetops and stream terraces in the survey area are used for cultivated crops, hay, or pasture. In 1992, a total of 29,920 acres in the survey area was used for harvested crops (Kentucky Agricultural Statistics Service 1993). The average farm size in 1992 was 148 acres in Bracken County and 161 acres in Robertson County.

In 1992, about 21,310 acres in Bracken County was used for harvested crops. Of this acreage, about

70 percent was used for hay. Alfalfa, fescue, orchardgrass, red clover, and timothy are the primary hay crops. Most of the hayland is planted to Kentucky 31 fescue and orchardgrass. About 22 percent of the hay grown in Bracken County is alfalfa (Kentucky Agricultural Statistics Service 1993).

Corn is the principal grain crop grown in Bracken County. It accounted for about 25 percent of the 4,010 acres of row crops grown in 1992 (Kentucky Agricultural Statistics Service 1993). Corn and tobacco are grown along the major streams and on the broader ridgetops throughout the county. The largest acreage is on terraces along the Ohio River. Winter wheat, barley, and rye are grown mostly as cover crops.

About 3,010 acres, or about 15 percent of the harvested cropland, in Bracken County was used for burley tobacco in 1992 (Kentucky Agricultural Statistics Service 1993). The county ranked 24th in the State in total production of burley tobacco that year, producing more than 7 million pounds. Burley tobacco accounted for about 61 percent of the total farm receipts in the county.

In 1992, about 8,610 acres in Robertson County was used for harvested crops. Of this acreage, about 78 percent was used for hay. Alfalfa, fescue, timothy, and orchardgrass are the important hay crops. About 12 percent of the hay grown in Robertson County is alfalfa (Kentucky Agricultural Statistics Service 1993).

In 1992, corn was grown on about 400 acres, or about 23 percent of the total acreage used for row crops, in Robertson County. It was grown mainly for grain (Kentucky Agricultural Statistics Service 1993). Corn and tobacco are grown mostly on stream terraces throughout the county. The largest acreage is along the North Fork of the Licking River and the Licking River. Winter wheat is the most commonly grown cover crop.

In 1992, burley tobacco was grown on about 1,310 acres in Robertson County. Although it is grown on only about 15 percent of the harvested cropland in the county, it accounts for nearly 70 percent of the total county income derived from farming (Kentucky Agricultural Statistics Service 1993).

Livestock enterprises are also of economic agricultural importance in Bracken and Robertson Counties. In 1992, the sale of livestock and livestock products accounted for 36 percent of the total farm income in Bracken County and 29 percent in Robertson County.

Pasture is the dominant land use in the survey area (fig. 2). In 1992, there were about 16,500 head of cattle and calves in Bracken County and about 5,500 head in Robertson County (Kentucky Agricultural Statistics Service 1993). Horses, hogs,

and sheep are also raised in the survey area, though in much smaller numbers.

Vegetables, nursery crops, greenhouse products, and orchard crops are produced in both counties, but they account only for a small amount of total crop cash receipts.

Early History

Bracken County was established in 1796 as the 23rd county in Kentucky. It was formed from parts of Mason and Campbell Counties. The county derived its name from the Big Bracken and Little Bracken Creeks. These two creeks, which are in the northeastern part of Bracken County, flow to the Ohio River at Augusta. They were named after William Bracken, an early pioneer and settler (Collins 1986).

Brooksville, the county seat of Bracken County, was established in 1839. It is almost in the center of the county. It is about 9 miles southwest of Augusta and approximately 18 miles west of Maysville, which is in neighboring Mason County.

For more than a century, Augusta, a principal town and former county seat, was an important steamboat landing on the Ohio River. The first college ever established under the patronage of the Methodist Episcopal Church was the old Augusta College, which was founded in 1822. The land surveys in Bracken County were among the very first in the State. It is probable they were only preceded by the surveys made by Gen. George Washington in 1770, in what are now Lawrence and Greenup Counties.

Robertson County was established in 1867 out of part of Nicholas, Harrison, Bracken, and Mason Counties (fig. 3). It was the 111th county to be formed in Kentucky. The county was named after George Robertson, a former Chief Justice of the Kentucky Court of Appeals. George Robertson's father, William Robertson, was a celebrated historian and the uncle of John Henry, the father of Patrick Henry.

Mount Olivet, the county seat of Robertson County, was incorporated in 1851. Kentontown, the oldest settlement in the county, was established in 1795. It was named for Simon Kenton, the noted frontiersman (Collins 1986).

On August 19, 1782, the Battle of Blue Licks was fought several miles south of Mount Olivet, along the Licking River (Lee 1981). It is known as the last battle of the American Revolution. Daniel Boone's son Israel was killed in the battle. Today, the area is one of Kentucky's State parks.

Two of the seventeen remaining covered bridges in Kentucky are in the survey area. One of the bridges is in Bracken County. It spans Locust Creek at Woolcott,



Figure 2.—A farm pond and cattle in a pastured area of Lowell silt loam, 2 to 6 percent slopes.

about 4.5 miles north of Brooksville, off Kentucky Highway 546. The other bridge is in Robertson County. It spans Johnson Creek, about 4 miles southeast of Mount Olivet, on Kentucky Highway 1029.

Climate

Prepared by the National Climatic Data Center, Ashville, North Carolina.

In Bracken and Robertson Counties, summers are hot in the valleys and slightly cooler in the hills and winters are moderately cold. Rainfall is fairly heavy and well distributed throughout the year. Snow falls nearly every winter, but the snow cover usually lasts only a few days.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Falmouth, Kentucky, in the period 1951-90. 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 on January 28, 1963, is -25 degrees. In summer, the average temperature is 73 degrees and the average daily maximum temperature is 85 degrees. The highest recorded temperature, which occurred on August 21, 1983, is 103 degrees.

Growing degree days are shown in table 1. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (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 about 43 inches. Of this, about 24 inches, or 55 percent, usually falls in April through September. The growing season for most crops falls within this period. The heaviest 1-day rainfall during the period of record was 5.35 inches on



Figure 3.—An early farmstead in Robertson County. It is in an area of Boonesboro silt loam, frequently flooded. Cynthiana-Faywood complex, rocky, 20 to 35 percent slopes, eroded, is on the side slope in the background.

September 9, 1965. Thunderstorms occur on about 45 days each year, and most occur in summer.

The average seasonal snowfall is about 11 inches. The greatest snow depth at any one time during the period of record was 16 inches. On the average, 10 days of the year have at least 1 inch of snow 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 64 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in spring.

Natural Resources

The most important natural resources in Bracken and Robertson Counties are soils, water, woodland, and limestone. Sand and gravel are resources of minor extent.

Domestic water demands are generally met by ground water and surface water supplies in the survey area. Most of the incorporated towns and many rural areas are served by community water systems. Wells and cisterns provide water to many farmsteads. Farm ponds, small lakes, and streams throughout the survey area provide water for livestock, some irrigation, and fishing. Rivers in the survey area are a source of most of the domestic water used in the area

and much of the water for ground water recharge. A series of locks, dams, and reservoirs along the rivers helps to control flooding. The Ohio River in Bracken County and the Licking River in Robertson County, in addition to areas along these rivers, provide opportunities for camping, fishing, and boating.

Woodland makes up about 50,000 acres in Bracken County, or nearly 37 percent of the total acreage, and about 26,000 acres in Robertson County, or about 40 percent of the total acreage (Kinsley and Powell 1978). Most of the woodland has been logged and supports second growth timber at various stages of maturity. Timber production contributes to the economy of both counties. The primary trees harvested are black walnut, white oak, northern red oak, and white ash. Eastern redcedar is harvested and used for fenceposts and some kinds of lumber.

Limestone has been quarried in both counties, as is indicated by several small, abandoned quarries. There are numerous, scattered limestone blocks in the southern part of Robertson County, along the Licking River, west of Kentontown. These blocks were hand-cut from the limestones of the Lexington Limestone Formation and intended for use in construction projects, such as the abandoned highway bridge that crosses the Licking River nearby. Other limestone was quarried and used as a source or agricultural lime, road material, and aggregate. Currently, there are no active quarries within the survey area.

Sand and gravel has been dredged from the bed of the Ohio River and some of the larger streams for use as road material and aggregate. Other sources of this material are the Illinoian and Wisconsin glacial deposits along the Ohio River, in the northern part of Bracken County (USGS 1971a-b, 1973a-d, 1975a-b, 1976, 1977, 1978a-b).

Topography and Drainage

The topography of Bracken and Robertson Counties is diversified. The counties are in parts of two major physiographic regions. These regions are the Hills of the Bluegrass Physiographic Region and the Outer Bluegrass Physiographic Region (Bailey and Winsor 1964).

The northern and southern parts of Bracken County and nearly all of Robertson County are in the Hills of the Bluegrass Physiographic Region. This strongly dissected region is characterized by long, narrow ridgetops and short, moderately steep to very steep side slopes that are separated by long, narrow flood plains. The gently sloping and sloping soils on the ridgetops are used mainly for hay or pasture, but some

small tracts are used for tobacco or corn. The moderately steep to very steep soils on side slopes are used for pasture or woodland. The part of this region in northern Bracken County is drained by tributaries of the Ohio River. The major streams are Locust Creek, Little Bracken Creek, Bracken Creek, and Snag Creek. The part of this region in southern Bracken County and that in Robertson County are drained mainly by tributaries of the North Fork of the Licking River and the Licking River. The major streams flowing to the North Fork of the Licking River include Willow Creek, Stone Creek, and Camp Branch in Bracken County and Salt Lick, Elms Run, and Panther Creek in Robertson County. The major streams flowing to the Licking River include Greasy Creek, Cedar Creek, West Creek, and Johnson Creek in Robertson County.

A small area in the northeastern and central parts of Bracken County and a small area in east-central Robertson County are in the Outer Bluegrass Physiographic Region. This region is made up mainly of broad, rolling ridgetops and side slopes. The nearly level to sloping soils on ridgetops are used mainly for tobacco, corn, or small grain. Most of the steeper side slopes are used for hay or pasture. Because the soils in this region are in landscape positions directly above those of the soils in the Hills of the Bluegrass Physiographic Region, the river drainage system is similar. The region is drained by the tributaries of the Ohio River, the North Fork of the Licking River, and the Licking River. Major streams in Bracken County include Bracken Creek and Locust Creek, which flow to the Ohio River, and Camp Creek and Willow Branch, which flow to the North Fork of the Licking River. In Robertson County, major streams include Panther Creek, which flows to the North Fork of the Licking River, and Johnson Creek, which flows to the Licking River.

Elevation in the survey area ranges from about 460 feet above sea level in an area along the Ohio River near Foster, in Bracken County, to about 1,009 feet at Riggs school near Mount Olivet, in Robertson County (USGS 1973c, 1977).

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the survey area. The information includes a description of the soils and miscellaneous areas and their location and a discussion of their suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of

crops and native plants; 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 biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept or model of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area 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-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries (Soil Survey Division Staff 1993).

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, 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.

Soil taxonomy, 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 (Soil Survey Staff 1975).

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 interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are 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 are 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 predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict 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.

General Soil Map Units

The general soil maps show broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil maps is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one map unit can occur in another but in a different pattern.

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

Because of their small scale, the maps are 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 soil boundary lines on the general soil maps for the survey area completely join with those for adjoining counties. The composition of the map units is different, however, because the map units have been designed differently and concepts have been changed.

Soil Descriptions for Bracken County

1. Wheeling-Nolin-Otwell

Very deep, nearly level to very steep, well drained and moderately well drained soils that have a loamy subsoil; on stream terraces and flood plains

Setting

Landform: The Ohio River valley and smaller stream valleys that empty into the Ohio River, in the northern part of the county

Slope: 0 to 55 percent

Composition

Extent of the map unit in Bracken County: 2 percent

Extent of the soils in the map unit:

Wheeling soils—48 percent

Nolin soils—21 percent

Otwell soils—11 percent

Minor soils—20 percent

Soil Properties and Qualities

Wheeling

Depth: Very deep

Drainage class: Well drained

Landscape position: Terraces and side slopes of sloughs

Parent material: Dominantly mixed loamy alluvium with some glacial drift of the Quaternary System

Surface texture: Loam

Slope: Gently sloping to very steep

Nolin

Depth: Very deep

Drainage class: Well drained

Landscape position: Flood plains

Parent material: Mixed loamy alluvium of the Quaternary System

Surface texture: Silt loam

Slope: Nearly level and gently sloping

Otwell

Depth: Very deep

Drainage class: Moderately well drained

Landscape position: Terraces

Parent material: Mixed silty alluvium of the Quaternary System

Surface texture: Silt loam

Slope: Gently sloping and sloping

Minor Soils

- Allegheny and Monongahela soils in small areas of glacial drift
- Elk and Lawrence soils on terraces
- Newark soils on flood plains and in areas that are subject to ponding

Use and Management

Major uses: Cropland (fig. 4), hayland, and residential development



Figure 4.—An area of cropland in the Wheeling-Nolin-Otwell general soil map unit in Bracken County.

Management concerns: Farmland—flooding, seasonal high water table, slope, erosion; urban areas—flooding, low strength, seasonal high water table, slow permeability, slope

Management measures: Farmland—flood control, drainage systems, outlet ditches, cover crops with a deep or moderately deep root system, streambank vegetation; urban areas—site selection, addition of fill material, grading, proper design

2. Elk-Otwell-Nolin

Very deep, nearly level to sloping, well drained and moderately well drained soils that have a loamy subsoil; on stream terraces and flood plains

Setting

Landform: The Licking River valley and the North Fork of the Licking River valley, in the southern part of the county

Slope: 0 to 12 percent

Composition

Extent of the map unit in Bracken County: 1 percent

Extent of the soils in the map unit:

Elk soils—42 percent

Otwell soils—21 percent

Nolin soils—14 percent

Minor soils—23 percent

Soil Properties and Qualities

Elk

Depth: Very deep

Drainage class: Well drained

Landscape position: Stream terraces

Parent material: Mixed loamy alluvium of the Quaternary System

Surface texture: Silt loam

Slope: Nearly level to sloping

Otwell

Depth: Very deep

Drainage class: Moderately well drained

Landscape position: Stream terraces
Parent material: Mixed loamy alluvium of the Quaternary System
Surface texture: Silt loam
Slope: Gently sloping and sloping

Nolin

Depth: Very deep
Drainage class: Well drained
Landscape position: Flood plains below the Elk and Otwell soils
Parent material: Mixed loamy alluvium of the Quaternary System
Surface texture: Silt loam
Slope: Nearly level and gently sloping

Minor Soils

- Boonesboro and Newark soils on flood plains
- Lawrence and Wheeling soils on stream terraces
- Cynthiana, Eden, Faywood, and Lowell soils on the lower side slopes and on footslopes
- Woolper soils on footslopes

Use and Management

Major uses: Cropland, hayland, and pasture
Management concerns: Flooding, seasonal high water table, erosion
Management measures: Flood control, drainage systems, outlet ditches, cover crops with a deep or moderately deep root system, streambank vegetation

3. Lowell-Nicholson

Deep and very deep, gently sloping to moderately steep, well drained and moderately well drained soils that have a clayey or loamy subsoil; on ridgetops and the upper side slopes

Setting

Landform: Uplands
Slope: 2 to 20 percent

Composition

Extent of the map unit in Bracken County: 10 percent
Extent of the soils in the map unit:
 Lowell soils—67 percent
 Nicholson soils—30 percent
 Minor soils—3 percent

Soil Properties and Qualities

Lowell

Depth: Deep and very deep
Drainage class: Well drained

Landscape position: Ridgetops and the upper side slopes
Parent material: Clayey residuum derived from limestone and shale of the Ordovician System
Surface texture: Silt loam
Slope: Gently sloping to moderately steep

Nicholson

Depth: Very deep
Drainage class: Moderately well drained
Landscape position: Ridgetops
Parent material: Silty material over clayey residuum derived from limestone of the Ordovician System
Surface texture: Silt loam
Slope: Gently sloping and sloping

Minor Soils

- Eden and Faywood soils on side slopes
- Sandview soils on broad ridgetops

Use and Management

Major uses: Cropland, hay, pasture, and residential development
Management concerns: Farmland—seasonal high water table, slope, erosion; urban areas—slope, low strength, seasonal high water table, depth to bedrock, slow permeability
Management measures: Farmland—conservation tillage, forage management, cover crops with a deep or moderately deep root system; urban areas—site selection, addition of fill material, grading, proper design

4. Eden

Moderately deep, sloping to very steep, well drained soils that have a clayey subsoil; on ridgetops and side slopes

Setting

Landform: Uplands, throughout the county
Slope: 6 to 35 percent

Composition

Extent of the map unit in Bracken County: 83 percent
Extent of the soils in the map unit:
 Eden soils—91 percent
 Minor soils—9 percent

Soil Properties and Qualities

Depth: Moderately deep
Drainage class: Well drained
Landscape position: Ridgetops and side slopes

Parent material: Clayey residuum derived from shale and limestone of the Ordovician System
Surface texture: Flaggy silty clay loam
Slope: Sloping to very steep

Minor Soils

- Boonesboro and Nolin soils on flood plains
- Cynthiana, Faywood, Lowell, and Nicholson soils on ridgetops and side slopes

Use and Management

Major uses: Pasture, woodland, and residential development
Management concerns: Farmland—slope, high content of flagstones, moderate depth to bedrock, erosion; urban areas—slope, low strength, depth to bedrock, slow permeability
Management measures: Farmland—rotation grazing system, proper plant selection, site selection for cultivated crops; urban areas—site selection, addition of fill material, grading, proper design

5. Allegheny-Lowell-Monongahela

Very deep and deep, gently sloping to moderately steep, well drained and moderately well drained soils that have a loamy or clayey subsoil; formed in alluvial deposits on uplands; on ridgetops and side slopes

Setting

Landform: A small area of uplands that are part of an ancient Pliocene river channel, south of the North Fork of the Licking River
Slope: 2 to 20 percent

Composition

Extent of the map unit in Bracken County: Less than 1 percent
Extent of the soils in the map unit:
 Allegheny soils—35 percent
 Lowell soils—35 percent
 Monongahela soils—9 percent
 Minor soils—21 percent

Soil Properties and Qualities

Allegheny

Depth: Very deep
Drainage class: Well drained
Landscape position: Ridgetops
Parent material: Mixed loamy alluvium of the Tertiary System
Surface texture: Loam
Slope: Gently sloping to moderately steep

Lowell

Depth: Deep and very deep
Drainage class: Well drained
Landscape position: Ridgetops and side slopes
Parent material: Clayey residuum derived from limestone and shale of the Ordovician System
Surface texture: Silt loam
Slope: Gently sloping to moderately steep

Monongahela

Depth: Very deep
Drainage class: Moderately well drained
Landscape position: Ridgetops
Parent material: Mixed loamy alluvium of the Tertiary System
Surface texture: Loam
Slope: Gently sloping and sloping

Minor Soils

- Boonesboro and Nolin soils on flood plains
- Elk and Otwell soils in areas of finer textured deposits on ridgetops

Use and Management

Major uses: Cropland, hayland, and pasture
Management concerns: Seasonal high water table, slope, erosion
Management measures: Conservation tillage, grassed waterways, cover crops with a moderately deep root system

Broad Land Use Considerations in Bracken County

The soils in Bracken County vary in their suitability for major land uses. About 15 percent of the acreage is used for cultivated crops or hay. Burley tobacco and corn are the dominant cultivated crops. Most of the acreage in general soil map units 1, 2, and 5 is cultivated, and most of the acreage in map unit 3 is cultivated or used for hay. Flooding and a seasonal high water table are the main limitations affecting cultivated crops and hay in map units 1 and 2, and erosion and a seasonal high water table are the main ones in map units 3 and 5.

Pasture and grazed woodland are the dominant land uses in the county, with about 79 percent of the total acreage used for these purposes. All of the map units in the county are suited to grasses and legumes. Map unit 4 is almost exclusively used for livestock grazing (fig. 5), with small, scattered areas on the broader ridgetops and flood plains used for cultivated crops. The very steep slopes and a common



Figure 5.—An area of the Eden general soil map unit in Bracken County. The cattle are grazing in an area of Eden flaggy silty clay loam, 20 to 35 percent slopes, eroded. On the ridgetops are areas of Nicholson silt loam, 2 to 6 percent slopes, and Lowell silt loam, shale substratum, 12 to 20 percent slopes, eroded.

occurrence of flagstones on the soil surface are the main limitations affecting pasture maintenance and renovation in map unit 4. Brief periods of flooding may limit the use of map units 1 and 2 for pasture, and the seasonal high water table may limit the use of map units 1, 2, 3, and 5 for deep-rooted plants.

Only a small acreage in the county is wooded. The largest areas of ungrazed woodland are on the very steep bluffs above the Ohio River. The suitability for trees is good or excellent in all of the map units. A shallow or moderately deep root system and the low available water capacity of some of the soils may result in a high seedling mortality rate. The wetness and the slope are moderate or severe limitations affecting the use of equipment in some areas. Planting during the wetter periods helps to reduce the seedling mortality rate. Harvesting during the drier season and using specialized equipment help to overcome the equipment limitation.

A few areas of the county have been developed for urban uses. In general, deep or very deep, gently

sloping or sloping, well drained or moderately well drained soils are the best suited soils in the county for building site development. The Allegheny, Elk, Lowell, Monongahela, Nicholson, Otwell, and Wheeling soils in map units 1, 2, 3, and 5 are examples. Management concerns for the soils in map unit 4 and some of the soils in map units 1, 2, 3, and 5 include the seasonal high water table, a shrink-swell potential, low strength, the slope, slow permeability, and the depth to bedrock. The soils on flood plains and low terraces that are subject to flooding, such as those in map units 1 and 2, are generally unsuitable as sites for buildings.

In most areas of the county, individual septic tank absorption fields are used. The nonflooded phases of Allegheny, Elk, and Wheeling soils are suitable as sites for septic tank absorption fields. The restricted or slow permeability and the seasonal high water table are the main limitations in map units 1, 2, 3, and 5. The depth to bedrock, the slope, and the slow permeability are the main limitations in map unit 4. Soils on flood

plains or low terraces in all of the map units that are subject to flooding are generally unsuited to septic tank absorption fields. Proper design or alternative waste disposal systems can help to overcome or reduce most of these limitations.

The limitations affecting the suitability of the map units for recreational uses range from severe to slight, depending upon the intensity of the expected use. Some soils in map units 1 and 2 are unsuited to many of these uses because of the flooding. All of the map units are suited to some recreational uses, such as paths and trails for hiking or horseback riding. Small areas that are suited to intensive recreational uses generally are available in the map units that otherwise have severe limitations.

The suitability for wildlife habitat generally is good to excellent throughout the county. All of the map units have major soils that are generally well suited to habitat for openland or woodland wildlife. A few small areas in map unit 2 are suited to wetland wildlife habitat.

Soil Descriptions for Robertson County

1. Nolin-Allegheny-Elk

Very deep, nearly level to moderately steep, well drained soils that have a loamy subsoil; on flood plains and stream terraces

Setting

Landform: The North Fork of the Licking River valley, in the northern part of the county, and the Licking River valley and Johnson Creek valley, in the southern part of the county

Slope: 0 to 20 percent

Composition

Extent of the map unit in Robertson County: 3 percent

Extent of the soils in the map unit:

Nolin soils—35 percent

Allegheny soils—31 percent

Elk soils—26 percent

Minor soils—8 percent

Soil Properties and Qualities

Nolin

Depth: Very deep

Drainage class: Well drained

Landscape position: Flood plains below the Allegheny and Elk soils

Parent material: Mixed loamy alluvium of the Quaternary System

Surface texture: Silt loam

Slope: Nearly level and gently sloping

Allegheny

Depth: Very deep

Drainage class: Well drained

Landscape position: Stream terraces

Parent material: Mixed loamy alluvium of the Quaternary System

Surface texture: Loam

Slope: Gently sloping to moderately steep

Elk

Depth: Very deep

Drainage class: Well drained

Landscape position: Stream terraces

Parent material: Mixed loamy alluvium of the Quaternary System

Surface texture: Silt loam

Slope: Nearly level to sloping

Minor Soils

- Monongahela and Otwell soils on stream terraces
- Woolper soils on footslopes

Use and Management

Major uses: Cropland, hayland, and pasture

Management concerns: Flooding, erosion

Management measures: Flood control, drainage systems, outlet ditches, cover crops having a deep root system, streambank vegetation

2. Monongahela-Allegheny-Lowell

Very deep and deep, gently sloping to moderately steep, moderately well drained and well drained soils that have a loamy or clayey subsoil; formed in alluvial deposits on uplands; on ridgetops and side slopes

Setting

Landform: Uplands that follow an ancient Pliocene river channel, in the southern part of the county

Slope: 2 to 20 percent

Composition

Extent of the map unit in Robertson County: 3 percent

Extent of the soils in the map unit:

Monongahela soils—34 percent

Allegheny soils—24 percent

Lowell soils—18 percent

Minor soils—24 percent

Soil Properties and Qualities

Monongahela

Depth: Very deep

Drainage class: Moderately well drained

Landscape position: Ridgetops

Parent material: Mixed loamy alluvium of the Tertiary System

Surface texture: Loam

Slope: Gently sloping and sloping

Allegheny

Depth: Very deep

Drainage class: Well drained

Landscape position: Ridgetops

Parent material: Mixed loamy alluvium of the Tertiary System

Surface texture: Loam

Slope: Gently sloping to moderately steep

Lowell

Depth: Deep and very deep

Drainage class: Well drained

Landscape position: Ridgetops and side slopes

Parent material: Clayey residuum derived from limestone and shale of the Ordovician System

Surface texture: Silt loam

Slope: Gently sloping to moderately steep

Minor Soils

- Cynthiana, Eden, and Faywood soils on ridgetops and side slopes
- Elk, Lawrence, and Otwell soils in areas of finer textured deposits on ridgetops and stream terraces
- Newark and Nolin soils on flood plains

Use and Management

Major uses: Cropland, hayland, pasture, and some residential development

Management concerns: Farmland—seasonal high water table, slope, erosion; urban areas—seasonal high water table, restricted or slow permeability, shrink-swell potential, low strength

Management measures: Farmland—drainage systems, conservation tillage, grassed waterways, cover crops having a moderately deep or deep root system; urban areas—site selection, addition of fill material, proper design, land grading

3. Lowell-Nicholson

Deep and very deep, gently sloping to moderately steep, well drained and moderately well drained soils that have a clayey or loamy subsoil; on ridgetops and the upper side slopes

Setting

Landform: Uplands

Slope: 2 to 20 percent

Composition

Extent of the map unit in Robertson County: 1 percent

Extent of the soils in the map unit:

Lowell soils—79 percent

Nicholson soils—11 percent

Minor soils—10 percent

Soil Properties and Qualities

Lowell

Depth: Deep and very deep

Drainage class: Well drained

Landscape position: Ridgetops and the upper side slopes

Parent material: Clayey residuum derived from limestone and shale of the Ordovician System

Surface texture: Silt loam

Slope: Gently sloping to moderately steep

Nicholson

Depth: Very deep

Drainage class: Moderately well drained

Landscape position: Ridgetops

Parent material: Silty material over clayey residuum derived from limestone of the Ordovician System

Surface texture: Silt loam

Slope: Gently sloping and sloping

Minor Soils

- Allegheny soils that formed in sandy alluvial deposits on ridgetops
- Eden soils on side slopes
- Sandview soils on ridgetops

Use and Management

Major uses: Cropland, hayland, pasture, and residential development

Management concerns: Farmland—seasonal high water table, slope, erosion; urban areas—slope, low strength, seasonal high water table, depth to bedrock, slow permeability

Management measures: Farmland—conservation tillage, forage management, cover crops having a deep or moderately deep root system; urban areas—site selection, addition of fill material, grading, proper design

4. Eden

Moderately deep, sloping to very steep, well drained soils that have a clayey subsoil; on ridgetops and side slopes

Setting

Landform: Uplands, throughout the county
Slope: 6 to 35 percent

Composition

Extent of the map unit in Robertson County:
92 percent

Extent of the soils in the map unit:
Eden soils—89 percent
Minor soils—11 percent

Soil Properties and Qualities

Depth: Moderately deep
Drainage class: Well drained
Landscape position: Ridgetops and side slopes
Parent material: Clayey residuum derived from shale and limestone of the Ordovician System
Surface texture: Flaggy silty clay loam
Slope: Sloping to very steep

Minor Soils

- Allegheny and Elk soils on stream terraces
- Cynthiana, Fairmount, Faywood, and Lowell soils on ridgetops and side slopes
- Nolin soils on flood plains

Use and Management

Major uses: Pasture, hayland, woodland, and residential development
Management concerns: Farmland—slope, high content of flagstones, moderate depth to bedrock, erosion; urban areas—slope, low strength, depth to bedrock, slow permeability
Management measures: Farmland—rotation grazing system, proper plant selection, site selection for cultivated crops; urban areas—site selection, addition of fill material, grading, proper design

Broad Land Use Considerations in Robertson County

The soils in Robertson County vary in their suitability for major land uses. About 12 percent of the acreage is used for cultivated crops or hay. Burley tobacco and corn are the dominant cultivated crops. Most of the acreage in general soil map units 1 and 2 is cultivated, and most of the acreage in map unit 3 is cultivated or used for hay. Flooding and erosion are the main limitations affecting cultivated crops in map unit 1, and erosion and a seasonal high water table are the main limitations affecting cultivated crops and hay in map units 2 and 3.

Pasture and grazed woodland are the dominant land uses in the county, with about 85 percent of the total acreage used for these purposes. All of the map units in the county are suited to grasses or legumes. Map unit 4 is almost exclusively used for livestock grazing (fig. 6), with small, scattered areas on the broader ridgetops and flood plains used for cultivated crops. The very steep slopes and a common occurrence of flagstones on the soil surface are the main limitations affecting pasture maintenance and renovation in map unit 4. Brief periods of flooding may limit the use of map unit 1 for pasture, and the seasonal high water table may limit the use of map units 2 and 3 for deep-rooted plants.

Only a small acreage in the county is wooded. Areas of ungrazed woodland are generally small and widely scattered throughout the county. The suitability for trees is good or excellent in all of the map units. A shallow or moderately deep rooting depth and the low available water capacity of some of the soils may result in a high seedling mortality rate. The wetness and the slope are moderate or severe limitations affecting the use of equipment in some areas. Planting during the wetter periods helps to reduce the seedling mortality rate. Harvesting during the drier season and using specialized equipment help to overcome the equipment limitation.

A few areas of the county have been developed for urban uses. In general, deep or very deep, gently sloping or sloping, well drained or moderately well drained soils are the best suited soils in the county for building site development. The Allegheny, Elk, Lowell, Monongahela, and Nicholson soils in map units 1, 2, and 3 are examples. Management concerns for the soils in map unit 4 and some of the soils in map units 1, 2, and 3 include the seasonal high water table, a shrink-swell potential, low strength, slow



Figure 6.—A typical area of the Eden general soil map unit in Robertson County. The soil on the ridgetops is Eden flaggy silty clay loam, 6 to 20 percent slopes, eroded, and that on the side slopes is Eden flaggy silty clay loam, 20 to 35 percent slopes, eroded.

permeability, the slope, and the depth to bedrock. The soils on flood plains and low terraces that are subject to flooding, such as those in map unit 1, are generally unsuitable as sites for buildings.

In most areas of the county, individual septic tank absorption fields are used. The nonflooded phases of Allegheny and Elk soils are suitable as sites for septic tank absorption fields. The restricted or slow permeability and the seasonal high water table are the main limitations in map units 2 and 3. The depth to bedrock, the slope, and the slow permeability are the main limitations in map unit 4. Soils on flood plains or low terraces in all of the map units that are subject to flooding are generally unsuited to septic tank absorption fields. Proper design or alternative waste

disposal systems can help to overcome or reduce most of these limitations.

The limitations affecting the suitability of the map units for recreational uses range from severe to slight, depending on the intensity of the expected use. Some soils in map unit 1 are unsuited to many of these uses because of the flooding. All of the map units are suited to some recreational uses, such as paths and trails for hiking or horseback riding. Small areas that are suited to intensive recreational uses generally are available in the map units that otherwise have severe limitations.

The suitability for wildlife habitat generally is good to excellent throughout the county. All of the map units have major soils that are generally well suited to openland or woodland wildlife habitat.

Detailed Soil Map Units

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

A map unit delineation on a map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. 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 other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties 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, or similar, inclusions. They may or may not be mentioned in the map unit description. Other included soils and miscellaneous areas, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, inclusions. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in

the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

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

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

In the descriptions the suitability of the soils for various uses is described. *Well suited* indicates that the soils have favorable properties for the specified use and that limitations are easy to overcome. Good performance and low maintenance can be expected. *Suited* indicates that the soils have moderately favorable properties for the specified use. One or more properties make these soils less desirable than well suited soils. *Poorly suited* indicates that the soils have one or more properties unfavorable for the selected use. Overcoming the limitations requires special design, extra maintenance, or costly alteration. *Unsuited* indicates that the soils do not meet the requirements for the selected use or that extreme measures are needed to overcome the limitations.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, 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, slope, stoniness, salinity, 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, Lowell silt loam, shale substratum, 2 to 6 percent slopes, is a phase of the Lowell series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Cynthiana-Faywood complex, rocky, 20 to 35 percent slopes, eroded, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other 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 or miscellaneous areas.

AIB—Allegheny loam, 2 to 6 percent slopes

Setting

Landform: River valleys and uplands

Landscape position: Stream terraces and on ridgetops above the Licking River

Size of areas: 5 to 30 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Allegheny soil and similar components: 90 to 95 percent

Contrasting components: 5 to 10 percent

Minor Components

Similar components:

- Soils that are more sandy throughout than the Allegheny soil
- Soils in low areas that are subject to rare flooding
- Soils that are more clayey in the subsoil than the Allegheny soil

Contrasting components:

- The Elk soils that have a fine-silty particle-size control section
- The moderately well drained Otwell soils that have a fragipan and a fine-silty particle-size control section
- The moderately well drained Monongahela soils that have a fragipan

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown and brown, very friable loam

Subsoil:

9 to 22 inches; strong brown, friable sandy clay loam
22 to 45 inches; strong brown, friable sandy clay loam

45 to 65 inches; strong brown, friable clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Available water capacity: High

Permeability: Moderate

Parent material: On uplands—mixed alluvium derived from sandstone, siltstone, and shale of the Tertiary System; on stream terraces—mixed alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Low

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.

- Pasture renovation should be frequent enough to maintain the desired plants.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Common trees: Northern red oak, yellow poplar, black cherry, Osage orange, white ash, white oak

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- Because the surface layer of the soil is loose, it should be disturbed as little as possible.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand slightly droughty conditions and heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, and cover should be those that can withstand slightly droughty conditions and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Well suited

Management considerations:

- Constructing roads on well compacted fill material helps to prevent the damage caused by heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the moderate permeability of the subsoil.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

AIC—Allegheny loam, 6 to 12 percent slopes

Setting

Landform: River valleys and uplands

Landscape position: Stream terraces, ridgetops above the Licking River, and a ridgetop above the Ohio River

Size of areas: 3 to 85 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Allegheny soil and similar components: 90 to 95 percent

Contrasting components: 5 to 10 percent

Minor Components

Similar components:

- Soils that are more sandy throughout than the Allegheny soil
- Soils in low areas that are subject to rare flooding
- Soils that are 40 to 60 inches deep over bedrock
- Soils that are more clayey in the subsoil than the Allegheny soil

Contrasting components:

- The Elk soils that have a fine-silty particle-size control section
- The moderately well drained Otwell soils that have a fragipan and a fine-silty particle-size control section
- The moderately well drained Monongahela soils that have a fragipan

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown and brown, very friable loam

Subsoil:

9 to 22 inches; strong brown, friable sandy clay loam
 22 to 45 inches; strong brown, friable sandy clay loam
 45 to 65 inches; strong brown, friable clay loam

Soil Properties and Qualities*Depth:* Very deep*Organic matter content:* Moderate*Natural fertility:* Medium*Drainage class:* Well drained*Available water capacity:* High*Permeability:* Moderate

Parent material: On uplands—mixed alluvium derived from sandstone, siltstone, and shale of the Tertiary System; on stream terraces—mixed alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Runoff: Medium or rapid*Tilth:* Good*Shrink-swell potential:* Low*Erosion hazard:* Severe**Use and Management****Cropland***Suitability:* Suited*Management considerations:*

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture*Suitability:* Well suited*Management considerations:*

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located salting facilities and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.

- A well planned mowing and harvesting schedule should be established.

- See table 5 for yield estimates of grasses and legumes.

Woodland*Suitability:* Well suited

Some common trees: American elm, black cherry, black oak, eastern redcedar, Osage orange, white ash, white oak

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- Because the surface layer of the soil is loose, it should be disturbed as little as possible.
- See table 7 for additional information on woodland.

Recreation*Suitability:* Suited*Management considerations:*

- The species selected for planting should be those that can withstand slightly droughty conditions and heavy foot or vehicular traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat*Suitability:* Well suited*Management considerations:*

- The plants selected for food plots, forage, and cover should be those that can withstand slightly droughty conditions and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Suited*Management considerations:*

- Constructing roads on well compacted fill material helps to prevent the damage caused by heavy vehicular traffic.
- Land shaping can help to overcome the slope.

- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the moderate permeability of the subsoil.
- Land shaping can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIIe

AID—Allegheny loam, 12 to 20 percent slopes

Setting

Landform: River valleys and uplands

Landscape position: Stream terraces and on ridgetops above the Licking River

Size of areas: 5 to 80 acres

Major uses: Hayland, pasture, and a few small areas of woodland

Composition

Allegheny soil and similar components: 85 to 90 percent

Contrasting components: 10 to 15 percent

Minor Components

Similar components:

- Soils that are more sandy throughout than the Allegheny soil
- Soils that are in the lower landscape positions and subject to rare flooding
- Soils that are 40 to 60 inches deep over bedrock
- Soils that are more clayey in the subsoil than the Allegheny soil
- Soils that have a gravelly surface layer
- Soils that are moderately eroded

Contrasting components:

- The Elk soils that have a fine-silty particle-size control section
- The moderately well drained Otwell soils that have a fragipan and a fine-silty particle-size control section
- The moderately well drained Monongahela soils that have a fragipan

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown and brown, very friable loam

Subsoil:

9 to 22 inches; strong brown, friable sandy clay loam
22 to 45 inches; strong brown, friable sandy clay loam

45 to 65 inches; strong brown, friable clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Available water capacity: High

Permeability: Moderate

Parent material: On uplands—mixed alluvium derived from sandstone, siltstone, and shale of the Tertiary System; on stream terraces—mixed alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Runoff: Rapid

Tilth: Good

Shrink-swell potential: Low

Erosion hazard: Very severe

Use and Management

Cropland

Suitability: Poorly suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.

- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American elm, black cherry, black oak, eastern redcedar, Osage orange, yellow poplar

Some trees preferred for planting: Black walnut, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cutting or applying appropriate herbicides in a timely manner.
- Because the surface layer of the soil is loose, it should be disturbed as little as possible.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand slightly droughty conditions and heavy foot traffic.
- Picnic areas and campgrounds should be restricted to sites where slope is less than 15 percent.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, and cover should be those that can withstand slightly droughty conditions and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- Constructing roads on well compacted fill material helps to prevent the damage caused by heavy vehicular traffic.
- Land shaping can help to overcome the slope.
- Erosion-control measures should be applied during construction.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the moderate permeability of the subsoil.
- Land shaping can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IVE

AnB—Allegheny loam, 2 to 6 percent slopes, rarely flooded

Setting

Landform: River valleys

Landscape position: Low stream terraces along the Licking River

Size of areas: 3 to 70 acres

Major uses: Cultivated crops, small grain, hayland, and pasture

Composition

Allegheny soil and similar components: 85 to 90 percent

Contrasting components: 10 to 15 percent

Minor Components

Similar components:

- Soils that are more sandy throughout than the Allegheny soil
- Soils that are in the lower landscape positions and subject to occasional flooding
- Soils that are 40 to 60 inches deep over bedrock
- Soils that have a gravelly surface layer

Contrasting components:

- The Elk soils that have a fine-silty particle-size control section
- The moderately well drained Otwell soils that have a fragipan and a fine-silty particle-size control section
- The moderately well drained Monongahela soils that have a fragipan

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown and brown, very friable loam

Subsoil:

9 to 22 inches; strong brown, friable sandy clay loam
22 to 45 inches; strong brown, friable sandy clay loam
45 to 65 inches; strong brown, friable clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Available water capacity: High

Permeability: Moderate

Parent material: Mixed alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Low

Flooding: Frequency—rare; duration—brief

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Suited; well suited where protected from flooding

Management considerations:

- Installing berms or levees can help to control the flooding.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include restricted grazing during periods of flooding, proper stocking rates, and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.

- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American elm, black cherry, white ash, white oak

Some trees preferred for planting: Black walnut, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- Because the surface layer of the soil is loose, it should be disturbed as little as possible.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- Recreational development should be restricted to picnic areas, playgrounds, ballfields, and other noncamping uses because of the hazard of flooding.
- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, and cover should be those that can withstand slightly droughty conditions and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- Constructing roads and buildings on elevated, well compacted fill material helps to prevent the damage caused by flooding.

- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

Bo—Boonesboro silt loam, frequently flooded

Setting

Landform: Stream valleys

Landscape position: Low flood plains in narrow valleys

Slope: 0 to 3 percent

Size of areas: 3 to 190 acres

Major uses: Pasture, woodland, and small areas of cultivated crops

Composition

Boonesboro soil and similar components: 90 to 95 percent

Contrasting components: 5 to 10 percent

Minor Components

Similar components:

- Soils that have more coarse fragments than the Boonesboro soil and do not have a dark surface layer

Contrasting components:

- The somewhat poorly drained Newark soils that have a fine-silty control section, are very deep to bedrock, and do not have a mollic epipedon
- The very deep Nolin soils that have a fine-silty control section and do not have a mollic epipedon
- The very deep Woolper soils that have a fine textured control section

Typical Profile

Surface layer:

0 to 8 inches; dark brown, very friable silt loam

Transitional layer:

8 to 16 inches; dark brown, friable silt loam

Subsoil:

16 to 26 inches; dark yellowish brown, friable flaggy silty clay loam

Bedrock:

26 inches; hard limestone bedrock of the Point Pleasant Formation

Soil Properties and Qualities

Depth: Moderately deep

Organic matter content: High

Natural fertility: High

Drainage class: Well drained

Available water capacity: Moderate

Permeability: Moderate in the surface layer and rapid in the subsoil

Parent material: Loamy alluvium derived from calcareous shale and limestone deposited over limestone bedrock of the Point Pleasant Formation in Bracken County and over the Lexington Limestone Formation in Robertson County; Ordovician System

Runoff: Very slow

Tilth: Good

Shrink-swell potential: Low

Hazard of flooding: Frequency—frequent; duration—brief

Erosion hazard: None or slight

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Installing berms or levees can help to control the flooding.
- Applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth and maintain the organic matter content.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- Diversions help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover and can tolerate the flooding.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located salting facilities and livestock water to aid in the distribution of grazing.
- Where practical, building fences along streams to restrict livestock access helps to control streambank erosion.

- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American elm, hackberry, sandbar willow, sweetgum, white ash, yellow poplar

Some trees preferred for planting: Eastern cottonwood, sweetgum, white ash, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- Recreational development should be restricted to picnic areas, paths and trails, playgrounds, and other noncamping uses because of the hazard of flooding.
- The species selected for planting should be those that can withstand slightly droughty conditions and heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions during the growing season; tolerate frequent, brief periods of flooding; and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Unsited

Management considerations:

- Constructing roads and buildings on elevated, well compacted fill material helps to overcome the damage caused by flooding.

- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Unsited

Management considerations:

- Constructing absorption fields in raised areas or on elevated fill material helps to prevent inundation by floodwater and to overcome the moderate depth to bedrock.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: Ilw

CnE2—Cynthiana-Faywood complex, rocky, 20 to 35 percent slopes, eroded

Setting

Landform: Uplands

Landscape position: Side slopes

Size of areas: 5 to 200 acres

Major uses: Pasture, unimproved woodland, and a few small areas of hayland

Composition

Cynthiana soil and similar components: 50 to 60 percent

Faywood soil and similar components: 35 to 45 percent

Rock outcrop, occurring as limestone ledges: 0.1 to 2.0 percent

Other contrasting components: 5 to 10 percent

Minor Components

Similar components:

- Soils that are less than 10 inches deep over bedrock
- Soils that have redder colors in the upper part of the subsoil than the Faywood soil

Contrasting components:

- The deep or very deep Lowell soils
- The very deep Woolper soils that have a mollic epipedon
- The Fairmount soils that have a mollic epipedon

Typical Profile

Cynthiana

Surface layer:

0 to 4 inches; dark yellowish brown, firm flaggy silty clay loam

Subsoil:

4 to 10 inches; light olive brown, firm flaggy clay
10 to 17 inches; yellowish brown, firm flaggy clay

Bedrock:
17 inches; hard limestone bedrock of the Point Pleasant Formation

Faywood

Surface layer:
0 to 4 inches; dark brown, very friable silt loam

Subsoil:
4 to 7 inches; dark yellowish brown and yellowish brown, firm silty clay loam
7 to 20 inches; yellowish brown, firm and very firm clay

Substratum:
20 to 32 inches; brownish yellow and light yellowish brown, very firm very channery silty clay

Bedrock:
32 inches; hard limestone bedrock of the Point Pleasant Formation

Soil Properties and Qualities

Cynthiana

Depth: Shallow
Organic matter content: Moderate
Natural fertility: Medium
Drainage class: Well drained
Rock fragments at the surface: Extent of surface covered—20 percent; kind—limestone flagstones
Available water capacity: Low
Permeability: Moderately slow
Parent material: Bracken County—clayey residuum derived from limestone of the Point Pleasant Formation; Robertson County—clayey residuum derived from limestone of the Lexington Limestone and Clays Ferry Formations; Ordovician System
Runoff: Very rapid
Shrink-swell potential: Moderate
Erosion hazard: Very severe

Faywood

Depth: Moderately deep
Organic matter content: Moderate
Natural fertility: Medium
Drainage class: Well drained
Rock fragments at the surface: Extent of surface covered—0 to 15 percent; kind—limestone channers and flagstones
Available water capacity: Moderate
Permeability: Moderately slow and slow
Parent material: Bracken County—clayey residuum derived from limestone of the Point Pleasant Formation; Robertson County—clayey residuum

derived from limestone of the Lexington Limestone and Clays Ferry Formations; Ordovician System

Runoff: Very rapid
Shrink-swell potential: Moderate
Erosion hazard: Very severe

Use and Management

Cropland

Suitability: Unsited
• The slope, the depth to bedrock, the rock outcrop, and the very severe hazard of erosion are management concerns.
• Overcoming the limitations is difficult and costly.

Hay and Pasture

Suitability: Poorly suited to hay but suited to permanent pasture (fig. 7)
Management considerations:
• The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderate or shallow root system, and can withstand droughtiness.
• Pasture renovation should be frequent enough to maintain the desired species.
• A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
• A well planned mowing and harvesting schedule should be established.
• See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Suited
Some common trees: Black locust, eastern redcedar, Osage orange, white ash, white oak
Some trees preferred for planting: White ash, white oak
Management considerations:
• Weeds and undesirable grasses that compete with trees for moisture can be controlled by cutting or applying appropriate herbicides in a timely manner.
• Laying out permanent roads and access trails on the contour and at a grade of 10 percent or less, installing water bars and culverts, applying gravel to the road surface or trail, and planting a vegetative cover help to control erosion.
• Using tracked or specialized machinery helps to overcome the equipment limitation caused by the slope.
• See table 7 for additional information on woodland.



Figure 7.—Cattle grazing in an area of Cynthiana-Faywood complex, rocky, 20 to 35 percent slopes, eroded.

Recreation

Suitability: Poorly suited

Management considerations:

- The species selected for planting should be those that can withstand slightly droughty conditions and moderate foot traffic.
- Recreational development should be restricted to paths and trails and to areas used for viewing natural scenery or wildlife.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions during the growing season and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding fill material to the basin and berm during construction of ponds for water or fish management helps to increase the holding capacity of the pond and the depth to bedrock.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- Land grading and shaping can help to overcome the slope.
- Buildings should be limited to those with properly designed foundations and no basements.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Cynthiaiana—unsuited; Faywood—poorly suited

Management considerations in areas of the Faywood soil:

- Increasing the size of the absorption field and adding fill material help to overcome the slow permeability of the subsoil and the limited depth to bedrock.
- Installing septic tank absorption fields on the contour or land grading can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: Cynthiaiana—VIIs;
Faywood—VIe

DAM—Dam, large**Setting**

This map unit consists of areas of water impoundment structures, or earthen dams. These dams are in scattered areas throughout Bracken County.

Composition

The dams are constructed of earthen materials, consisting of soil and rock with varying amounts of sand, silt, clay, and rock fragments. The impounded areas consist of ponds and lakes used primarily for recreation or flood control or as a source of water, but other uses include refuse water containment. In addition to the dam structure, emergency spillways, parking areas, and roads located on or near the dam are included in this map unit. Mapped areas are commonly triangular in shape and are about 1 or 2 acres in size.

Use and Management

Reclaimed areas of this map unit support grasses, forbs, and small trees. The spreading and smoothing

of native soil material is common in these areas. The main limitations affecting the establishment of vegetation are acidity and low fertility. In places a high content of rock fragments in the surface layer or the steep slope can be a limitation. Applying lime and fertilizer, mulching, and selecting species that are suited to this disturbed soil material can help to establish a better plant cover.

Interpretive Groups

This map unit has not been assigned a land capability classification.

EfD2—Eden flaggy silty clay loam, 6 to 20 percent slopes, eroded**Setting**

Landform: Uplands

Landscape position: Ridgetops and side slopes

Size of areas: 5 to more than 300 acres

Major uses: Hayland, pasture, unimproved woodland, and a few small areas of cultivated crops on ridgetops

Composition

Eden soil and similar components: 80 to 90 percent
Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that have a loamy surface layer and are in landscape positions above the Licking River
- Soils that are less than 20 inches deep over the paralithic contact

Contrasting components:

- The very deep Allegheny soils that have a fine-loamy particle-size control section and are in landscape positions above the Licking River
- The Faywood soils that are moderately deep to hard bedrock
- The deep and very deep Lowell soils
- The very deep, moderately well drained Nicholson soils that have a fragipan and a fine-silty particle-size control section

Typical Profile

Surface layer:

0 to 3 inches; dark yellowish brown, firm flaggy silty clay loam

Subsoil:

3 to 11 inches; light olive brown, mottled, firm silty clay

11 to 20 inches; light olive brown, firm channery silty clay

20 to 27 inches; light olive brown, mottled, firm silty clay

Substratum:

27 to 36 inches; olive, mottled, very firm extremely channery silty clay

Paralithic contact:

36 inches; interbedded soft, calcareous shale, siltstone, and limestone of the Kope Formation

Soil Properties and Qualities

Depth: Moderately deep

Depth to the paralithic contact: 20 to 40 inches

Organic matter content: Low

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—15 to 35 percent; kind—limestone flagstones and channers

Available water capacity: Low

Permeability: Slow

Parent material: Clayey residuum derived from interbedded calcareous shale, siltstone, and limestone of the Kope and Clays Ferry Formations; Ordovician System

Runoff: Medium or rapid

Tilth: Poor

Shrink-swell potential: Moderate

Erosion hazard: Severe

Use and Management

Cropland

Suitability: Poorly suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, can withstand droughtiness, and need minimum renovation.
- Controlling undesirable woody vegetation by cutting

or by applying herbicides helps to maintain the quality of pastures.

- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Suited

Some common trees: Black locust, black oak, black walnut, eastern redcedar, hickory, Osage orange, white ash, white oak

Some trees preferred for planting: Norway spruce, white ash, white oak, eastern white pine

Management considerations:

- Eastern white pine should only be grown and used for pulpwood or posts because the high pH of the soil's parent material restricts the penetration of roots.
- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cutting or by applying appropriate herbicides in a timely manner.
- Because the soil is highly erodible, it should be disturbed as little as possible.
- Because the soil is only moderately deep and has a low available water capacity, tree planting should be timed to take maximum advantage of rainfall and to avoid dry periods.
- Laying out permanent roads and access trails on the contour, installing water bars and culverts, applying gravel to the road surface or trail, and planting a vegetative cover help to control erosion.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand slightly droughty conditions, have a moderately deep root system, and are able to withstand heavy foot or vehicular traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- Picnic areas and campgrounds should be restricted to sites with slope of less than 15 percent.
- Paths and trails can be established in areas with slope of more than 15 percent.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions during the growing season and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Poorly suited*Management considerations:*

- Properly designing building foundations helps to overcome the limited depth to bedrock and the moderate shrink-swell potential.
- Land grading and shaping can help to overcome the slope.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields*Suitability:* Poorly suited*Management considerations:*

- Increasing the size of the absorption field and adding fill material help to overcome the slow permeability of the subsoil and the moderate depth to bedrock.
- In areas where slope is more than 15 percent, installing septic tank absorption fields on the contour or land grading can help to overcome the slope and improve the effectiveness of absorption fields.
- The common flagstones at the soil surface and in the soil profile hamper the installation of septic tank absorption fields; however, use of proper equipment and the addition of fill material help to overcome this limitation.
- See table 11 for additional information.

Interpretive Groups*Land capability classification:* IVE**EfE2—Eden flaggy silty clay loam, 20 to 35 percent slopes, eroded****Setting***Landform:* Uplands*Landscape position:* Side slopes*Size of areas:* 5 to more than 300 acres*Major uses:* Pasture and unimproved woodland**Composition**

Eden soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components*Similar components:*

- The Eden soils that are severely eroded
- Soils that have slopes of more than 35 percent

Contrasting components:

- The shallow Fairmount soils that have a mollic epipedon
- The Faywood soils that are moderately deep to hard bedrock
- The deep and very deep Lowell soils
- The very deep Woolper soils that have a mollic epipedon

Typical Profile*Surface layer:*

0 to 3 inches; dark yellowish brown, firm flaggy silty clay loam

Subsoil:

3 to 11 inches; light olive brown, mottled, firm silty clay

11 to 20 inches; light olive brown, firm channery silty clay

20 to 27 inches; light olive brown, mottled, firm silty clay

Substratum:

27 to 36 inches; olive, mottled, very firm extremely channery silty clay

Paralithic contact:

36 inches; interbedded soft, calcareous shale, siltstone, and limestone of the Kope Formation

Soil Properties and Qualities*Depth:* Moderately deep*Depth to the paralithic contact:* 20 to 40 inches*Organic matter content:* Low*Natural fertility:* Medium*Drainage class:* Well drained*Rock fragments at the surface:* Extent of surface covered—15 to 35 percent; kind—limestone flagstones and channers*Available water capacity:* Low*Permeability:* Slow*Parent material:* Clayey residuum derived from interbedded calcareous shale, siltstone, and limestone of the Kope and Clays Ferry Formations; Ordovician System*Runoff:* Very rapid

Shrink-swell potential: Moderate

Erosion hazard: Very severe

Use and Management

Cropland

Suitability: Unsited

Hay and Pasture

Suitability: Unsited to hay; suited to pasture

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, can withstand droughtiness, and need minimum renovation.
- Controlling undesirable woody vegetation by cutting or by applying herbicides helps to maintain the quality of pastures.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- This soil should not be used for hay or pasture but should be restricted to use as woodland in areas where the slope is more than 30 percent.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Suited

Some common trees: Black locust, black oak, black walnut, eastern redcedar, hickory, Osage orange, white ash, white oak

Some trees preferred for planting: Norway spruce, white ash, white oak, eastern white pine

Management considerations:

- Eastern white pine should only be grown and used for pulpwood or posts because the high pH of the soil's parent material restricts the penetration of roots.
- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cutting or applying appropriate herbicides in a timely manner.
- Because the soil is highly erodible, it should be disturbed as little as possible.
- Because the soil is only moderately deep and has a low available water capacity, tree planting should be timed to take maximum advantage of rainfall and to avoid dry periods.
- Laying out permanent roads and access trails on the contour, installing water bars and culverts, applying gravel to the road surface or trail, and planting a vegetative cover help to control erosion.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- The species selected for planting should be those that can withstand slightly droughty conditions, have a moderately deep root system, and are able to withstand heavy foot or vehicular traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- Properly designing building foundations helps to overcome the limited depth to bedrock, the moderate shrink-swell potential, and slippage.
- Land grading and shaping can help to overcome the slope.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic and to minimize slippage.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Unsited

Interpretive Groups

Land capability classification: V1e

EkB—Elk silt loam, 2 to 6 percent slopes

Setting

Landform: River and stream valleys and some uplands

Landscape position: Terraces and ridgetops

Size of areas: 3 to 70 acres

Major uses: Cropland, hayland, pasture, and a few small areas of woodland

Composition

Elk soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that have a darker surface layer than that of the Elk soil or more clay in the subsoil
- Small areas of Elk soils that are moderately well drained
- A few soils that are in the lower landscape positions and are subject to rare flooding

Contrasting components:

- The somewhat poorly drained Lawrence soils that have a fragipan
- The moderately well drained Otwell soils that have a fragipan
- The Wheeling soils that have a fine-loamy particle-size control section
- Small areas of Newark and Nolin soils that are subject to frequent flooding and are on flood plains

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown, very friable silt loam

Subsoil:

9 to 14 inches; dark yellowish brown, friable silt loam
 14 to 27 inches; dark yellowish brown, friable silty clay loam
 27 to 65 inches; yellowish brown, mottled, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—rounded pebbles

Available water capacity: High

Permeability: Moderate

Parent material: On stream terraces—mixed alluvium derived from limestone, siltstone, shale, and sandstone of the Quaternary System; upland deposits in the southern part of Robertson County—mixed alluvium that is from the eastern part of Kentucky and follows an ancient Pliocene river channel of the Tertiary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Low

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American sycamore, black walnut, hackberry, pin oak, red maple, yellow poplar

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Well suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuited to

campgrounds and playgrounds and should be restricted to other uses.

- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Well suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for dwellings and roads.
- Constructing roads and buildings on elevated, well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Increasing the size of the septic tank absorption field helps to overcome the moderate permeability of the subsoil.
- If absorption fields are built in areas of included soils that are in the lower landscape positions and subject to flooding, they should be constructed on elevated fill material to help prevent inundation by floodwater.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

EkC—Elk silt loam, 6 to 12 percent slopes

Setting

Landform: River and stream valleys and some uplands

Landscape position: Terraces and ridgetops

Size of areas: 5 to 105 acres

Major uses: Cropland, hayland, pasture, and a few small areas of woodland

Composition

Elk soil and similar components: 80 to 95 percent

Contrasting components: 5 to 20 percent

Minor Components

Similar components:

- Soils that have a darker surface layer than that of the Elk soil or have more clay in the subsoil
- Small areas of Elk soils that are moderately well drained
- A few areas of Elk soils that are in the lower landscape positions and are subject to rare flooding

Contrasting components:

- Allegheny soils that have a fine-loamy particle-size control section and are more acid than the Elk soil
- The moderately well drained Otwell soils that have a fragipan
- The Wheeling soils that have a fine-loamy particle-size control section
- Small areas of Newark and Nolin soils that are subject to frequent flooding and are on flood plains

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown, very friable silt loam

Subsoil:

9 to 14 inches; dark yellowish brown, friable silt loam

14 to 27 inches; dark yellowish brown, friable silty clay loam

27 to 65 inches; yellowish brown, mottled, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—rounded pebbles

Available water capacity: High

Permeability: Moderate

Parent material: On stream terraces—mixed alluvium derived from limestone, siltstone, shale, and sandstone of the Quaternary System; upland deposits in the southern part of Robertson County—mixed alluvium that is from the eastern part of Kentucky and follows an ancient Pliocene river channel of the Tertiary System

Runoff: Medium
Tilth: Good
Shrink-swell potential: Low
Erosion hazard: Severe

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American sycamore, black walnut, hackberry, pin oak, red maple, yellow poplar

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with

conventional equipment or applying appropriate herbicides in a timely manner.

- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuited to campgrounds and should be restricted to other uses.
- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- This soil is poorly suited to playgrounds unless the site is leveled or graded during construction.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for dwellings and roads.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- Land shaping can help to overcome the slope.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the moderate permeability of the subsoil.
- If absorption fields are built in areas of included soils that are in the lower landscape positions and subject to flooding, they should be constructed on elevated fill material to help prevent inundation by floodwater.

- Land shaping can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIIe

ErA—Elk silt loam, 0 to 2 percent slopes, occasionally flooded

Setting

Landform: River and stream valleys

Landscape position: Low stream terraces

Size of areas: 3 to 70 acres

Major uses: Cropland, hayland, pasture, and minor areas of woodland

Composition

Elk soil and similar components: 85 to 95 percent

Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that have a darker surface layer or more clay in the subsoil than the Elk soil
- Small areas of Elk soils that are moderately well drained

Contrasting components:

- The moderately well drained Otwell soils that have a fragipan
- The Wheeling soils that have a fine-loamy particle-size control section
- Small areas of Newark and Nolin soils that are subject to frequent flooding and are on flood plains

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown, very friable silt loam

Subsoil:

9 to 14 inches; dark yellowish brown, friable silt loam

14 to 27 inches; dark yellowish brown, friable silty clay loam

27 to 65 inches; yellowish brown, mottled, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—rounded pebbles

Available water capacity: High

Permeability: Moderate

Parent material: Mixed alluvium derived from limestone, siltstone, shale, and sandstone of the Quaternary System

Runoff: Very slow

Tilth: Good

Shrink-swell potential: Low

Flooding: Frequency—occasional; duration—brief

Erosion hazard: None or slight

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth and maintain the organic matter content.
- Installing berms or levees can help to control the flooding.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- Diversions help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover and can tolerate the flooding.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American sycamore, black walnut, hackberry, pin oak, red maple, yellow poplar

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- Recreational development should be restricted to picnic areas, playgrounds, paths and trails, and other noncamping uses because of the hazard of flooding.
- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- Constructing roads and buildings on well compacted, elevated fill material helps to prevent the damage caused by low strength of the subsoil and flooding.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the moderate permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to prevent inundation by floodwater.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: 1lw

ErB—Elk silt loam, 2 to 6 percent slopes, rarely flooded

Setting

Landform: River and stream valleys

Landscape position: Low stream terraces

Size of areas: 3 to 100 acres

Major uses: Cropland, hayland, pasture, and small areas of woodland

Composition

Elk soil and similar components: 85 to 95 percent

Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that have a darker surface layer or more clay in the subsoil than the Elk soil
- Small areas of Elk soils that are moderately well drained

Contrasting components:

- The moderately well drained Otwell soils that have a fragipan
- The Wheeling soils that have a fine-loamy particle-size control section
- Small areas of Newark and Nolin soils that are subject to frequent flooding and are on flood plains

Typical Profile

Surface layer:

0 to 9 inches; dark yellowish brown, very friable silt loam

Subsoil:

9 to 14 inches; dark yellowish brown, friable silt loam

14 to 27 inches; dark yellowish brown, friable silty clay loam

27 to 65 inches; yellowish brown, mottled, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—rounded pebbles

Available water capacity: High

Permeability: Moderate

Parent material: Mixed alluvium derived from limestone, siltstone, shale, and sandstone of the Quaternary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Low

Hazard of flooding: Frequency—rare; duration—brief

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Installing berms or levees can help to control the flooding.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- Diversions help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover and can tolerate the flooding.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American sycamore, black walnut, hackberry, pin oak, red maple, yellow poplar

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- Recreational development should be restricted to picnic areas, playgrounds, paths and trails, and other noncamping uses because of the hazard of flooding.
- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- Constructing roads and buildings on elevated, well compacted fill material helps to prevent the damage caused by low strength of the subsoil and flooding.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the moderate permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to prevent inundation by floodwater.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

FrF—Fairmount flaggy silty clay loam, very rocky, 20 to 60 percent slopes

Setting

Landform: Uplands

Landscape position: Side slopes

Size of areas: 5 to more than 200 acres

Major uses: Pasture and unimproved woodland

Composition

Fairmount soil and similar components: 75 to 85 percent

Rock outcrop occurring as limestone ledges: 2 to 10 percent

Other contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that are less than 10 inches deep over bedrock
- Soils that are 20 to 25 inches deep over bedrock
- Soils that do not have the dark colors of the Fairmount soil

Contrasting components:

- The deep or very deep Lowell soils that do not have a mollic epipedon
- The very deep Woolper soils
- The Eden soils that are moderately deep to a paralithic contact and do not have a mollic epipedon
- The moderately deep Faywood soils that do not have a mollic epipedon

Typical Profile

Surface layer:

0 to 11 inches; dark brown, friable to firm flaggy silty clay loam

Subsoil:

11 to 17 inches; dark yellowish brown, firm or very firm flaggy clay

Bedrock:

17 inches; hard limestone bedrock of the Tanglewood Member of the Lexington Limestone Formation

Soil Properties and Qualities

Depth: Shallow

Organic matter content: High

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—30 percent; kind—limestone flagstones

Available water capacity: Low

Permeability: Slow or moderately slow

Parent material: Bracken County—clayey residuum derived from limestone and shale of the Fairview Formation; Robertson County—clayey residuum derived from the limestone members of the Lexington Limestone Formation and the limestone and shale of the Fairview Formation; Ordovician System

Runoff: Very rapid

Shrink-swell potential: Moderate

Erosion hazard: Very severe

Use and Management

Cropland

Suitability: Unsited

- The slope, the depth to bedrock, the rock outcrop, and the very severe hazard of erosion are management concerns.
- Overcoming the limitations is difficult and costly.

Hay and Pasture

Suitability: Unsited to hay; poorly suited to permanent pasture

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, can withstand droughtiness, and need minimum renovation.
- Controlling undesirable woody vegetation by cutting or by applying herbicides helps to maintain the quality of pastures.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- This soil should not be used for hay or pasture but should be restricted to use as woodland in areas where the slope is more than 30 percent.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Suited

Some common trees: Black locust, black oak, eastern redcedar, Osage orange, white oak, hickory

Some trees preferred for planting: White ash, white oak

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cutting

or applying appropriate herbicides in a timely manner.

- Laying out permanent roads and access trails on the contour and at a grade of 10 percent or less, installing water bars and culverts, applying gravel to the road surface or trail, and planting a vegetative cover help to control erosion.
- Using tracked or specialized machinery helps to overcome the equipment limitation caused by the slope.
- Because the soil is shallow to bedrock and has a low available water capacity, tree planting should be timed to take maximum advantage of rainfall and to avoid dry periods.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- The species selected for planting should be those that can withstand slightly droughty conditions and moderate foot traffic.
- Recreational development should be restricted to paths and trails and to areas used for viewing natural scenery or wildlife.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Unsited

Management considerations:

- The slope, low strength, the depth to bedrock, the flagstones, and the rock ledges are management concerns.
- Overcoming the limitations is difficult and costly.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Unsited

- See table 11 for additional information.

Interpretive Groups

Land capability classification: VIle

FwB—Faywood silt loam, 2 to 6 percent slopes

Setting

Landform: Uplands

Landscape position: Ridgetops

Size of areas: 3 to more than 10 acres

Major uses: Cultivated crops, pasture, hayland, and a few small areas of woodland

Composition

Faywood soil and similar components: 85 to 90 percent

Contrasting components: 10 to 15 percent

Minor Components

Similar components:

- Soils that have redder colors in the upper part of the subsoil than those of the Faywood soil
- Soils that have a loamy surface layer and are near the Licking River

Contrasting components:

- The shallow Cynthiana soils
- The deep or very deep Lowell soils
- The moderately well drained Nicholson soils that have a fine-silty particle-size control section and a fragipan
- The very deep Sandview soils that have a fine-silty particle-size control section

Typical Profile

Surface layer:

0 to 4 inches; dark brown, very friable silt loam

Subsoil:

4 to 7 inches; dark yellowish brown and yellowish brown, firm silty clay loam

7 to 20 inches; yellowish brown, firm and very firm clay

Substratum:

20 to 32 inches; brownish yellow and light yellowish brown, very firm very channery silty clay

Bedrock:

32 inches; hard limestone bedrock of the Point Pleasant Formation

Soil Properties and Qualities

Depth: Moderately deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 15 percent; kind—limestone channers and flagstones

Available water capacity: Moderate
Permeability: Moderately slow or slow
Parent material: Bracken County—clayey residuum derived from limestone and shale of the Grant Lake, Point Pleasant, and Clays Ferry Formations; Robertson County—clayey residuum derived from limestone and shale of the Lexington Limestone and Clays Ferry Formations; Ordovician System
Runoff: Slow or medium
Shrink-swell potential: Moderate
Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderately deep root system, and can withstand slight droughtiness.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black locust, eastern redcedar, hickory, Osage orange, white ash, white oak

Some trees preferred for planting: Eastern white pine, northern red oak, white ash, white oak

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting,

or applying appropriate herbicides in a timely manner.

- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand slightly droughty conditions and heavy foot traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Limiting buildings to those without basements and those with properly designed foundations helps to overcome the limited depth to bedrock and the moderate shrink-swell potential.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to overcome the slow permeability of the subsoil and the moderate depth to bedrock.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

FyD2—Faywood-Cynthiana complex, 6 to 20 percent slopes, eroded

Setting

Landform: Uplands

Landscape position: Side slopes

Size of areas: 5 to 160 acres

Major uses: Pasture, hayland, woodland, and a few small areas of cultivated crops

Composition

Faywood soil and similar components: 50 to 60 percent

Cynthiana soil and similar components: 30 to 35 percent

Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that have redder colors in the upper part of the subsoil than those of the Faywood soil
- Soils that are less than 10 inches deep over bedrock

Contrasting components:

- The Fairmount soils that have a mollic epipedon
- The deep or very deep Lowell soils
- The very deep Woolper soils that have a mollic epipedon

Typical Profile

Faywood

Surface layer:

0 to 4 inches; dark brown, very friable silt loam

Subsoil:

4 to 7 inches; dark yellowish brown and yellowish brown, firm silty clay loam

7 to 20 inches; yellowish brown, firm and very firm clay

Substratum:

20 to 32 inches; brownish yellow and light yellowish brown, very firm very channery silty clay

Bedrock:

32 inches; hard limestone bedrock of the Point Pleasant Formation

Cynthiana

Surface layer:

0 to 4 inches; dark yellowish brown, firm flaggy silty clay loam

Subsoil:

4 to 10 inches; light olive brown, firm flaggy clay

10 to 17 inches; yellowish brown, firm flaggy clay

Bedrock:

17 inches; hard limestone bedrock of the Point Pleasant Formation

Soil Properties and Qualities

Faywood

Depth: Moderately deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 15 percent; kind—limestone channers and flagstones

Available water capacity: Moderate

Permeability: Moderately slow or slow

Parent material: Bracken County—clayey residuum derived from limestone and shale of the Point Pleasant and Clays Ferry Formations; Robertson County—clayey residuum derived from limestone and shale of the Lexington Limestone and Clays Ferry Formations; Ordovician System

Runoff: Medium or rapid

Shrink-swell potential: Moderate

Erosion hazard: Severe

Cynthiana

Depth: Shallow

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—20 percent; kind—limestone flagstones

Available water capacity: Low

Permeability: Moderately slow

Parent material: Bracken County—clayey residuum derived from limestone and shale of the Point Pleasant and Clays Ferry Formations; Robertson County—clayey residuum derived from limestone and shale of the Lexington Limestone and Clays Ferry Formations; Ordovician System

Runoff: Medium or rapid

Shrink-swell potential: Moderate

Erosion hazard: Severe

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.

- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover and can withstand droughtiness.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Suited

Some common trees: Black locust, eastern redcedar, hickory, Osage orange, white ash, white oak

Some trees preferred for planting: White ash, white oak

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cutting or applying appropriate herbicides in a timely manner.
- Laying out permanent roads and access trails on the contour and at a grade of 10 percent or less, installing water bars and culverts, applying gravel to the road surface or trail, and planting a vegetative cover help to control erosion.
- See table 7 for additional information on woodland.

Recreation

Suitability: Faywood—suited; Cynthiana—poorly suited

Management considerations:

- The species selected for planting in areas of the Faywood soil should be those that can withstand slightly droughty conditions and heavy foot traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- The species selected for planting in areas of the Cynthiana soil should be those that have a shallow root system and can withstand droughty conditions.
- Recreational development in areas of the Cynthiana soil should be restricted to picnic areas or scenic trails.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions, have a shallow or moderately deep root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding fill material to the basin and berm during construction of ponds for water or fish management helps to increase the holding capacity of the pond and the depth to bedrock.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Faywood—suited; Cynthiana—poorly suited

Management considerations:

- Land grading and shaping can help to overcome the slope.
- Limiting buildings to those without basements and those with properly designed foundations helps to overcome the limited depth to bedrock and the moderate shrink-swell potential.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Faywood—poorly suited; Cynthiana—unsuited

Management considerations in areas of the Faywood soil:

- Increasing the size of the absorption field and adding fill material help to overcome the slow permeability of the subsoil and the moderate depth to bedrock.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: Faywood—IVe; Cynthiana—VIs

La—Lawrence silt loam, rarely flooded

Setting

Landform: River and stream valleys

Landscape position: Terraces

Slope: 0 to 4 percent

Size of areas: 5 to 70 acres

Major uses: Cropland, hayland, pasture, and a few small areas of woodland

Composition

Lawrence soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that have slopes of as much as 6 percent

Contrasting components:

- The well drained Elk soils that do not have a fragipan
- The moderately well drained Otwell soils
- Small areas of Newark soils that do not have a fragipan, are in the lower positions on flood plains, and are subject to frequent flooding

Typical Profile

Surface layer:

0 to 8 inches; yellowish brown, friable silt loam

Subsoil:

8 to 18 inches; dark yellowish brown and strong brown, mottled, friable silt loam

18 to 32 inches; a fragipan of yellowish brown and strong brown, mottled, firm and brittle silty clay loam

32 to 52 inches; yellowish brown and strong brown, mottled, firm silty clay loam

52 to 80 inches; yellowish brown, mottled, firm silty clay

Soil Properties and Qualities

Depth: Very deep

Depth to the fragipan: 18 to 32 inches

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Somewhat poorly drained

Seasonal high water table: Depth—1 to 2 feet; kind—perched

Available water capacity: Moderate

Permeability: Moderate above the fragipan and slow in the fragipan

Parent material: Mixed alluvium derived from limestone, siltstone, and shale of the Quaternary System

Runoff: Very slow

Tilth: Good

Shrink-swell potential: Moderate

Flooding: Frequency—rare; duration—brief

Erosion hazard: None or slight

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth and maintain the organic matter content.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- Selection of crops tolerant of the wetness and delayed planting may be needed because of the seasonal high water table and the flooding.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage, have a moderately deep root system, and can tolerate wetness and short periods of flooding.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black oak, hackberry, pin oak, red maple, sweetgum, yellow poplar

Some trees preferred for planting: American sycamore, eastern white pine, pin oak, sweetgum, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- Seedling mortality is high due to the seasonal high water table.
- Planting seedlings during dry periods increases the seedling survival rate.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand wetness and periods of brief flooding as well as heavy foot or vehicular traffic.
- Recreational development should be restricted to picnic areas, playgrounds, and paths and trails because of the wetness and the flooding.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat*Suitability:* Suited*Management considerations:*

- The plants selected for food plots, forage, or cover should be those that can tolerate the wetness, have a moderate root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding berms to fish ponds during construction minimizes the loss of desirable species and the addition of undesirable species during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Poorly suited*Management considerations:*

- Constructing roads and buildings on elevated, well compacted fill material helps to overcome the wetness and to prevent the damage caused by low strength in the subsoil and flooding.
- See table 10 for additional information.

Septic Tank Absorption Fields*Suitability:* Poorly suited*Management considerations:*

- Constructing absorption fields in raised areas or on elevated fill material helps to prevent inundation by floodwater and overcome the wetness.
- Increasing the size of the absorption field helps to overcome the slow permeability in the fragipan.
- See table 11 for additional information.

Interpretive Groups*Land capability classification:* IIIw**LoB—Lowell silt loam, 2 to 6 percent slopes****Setting***Landform:* Uplands*Landscape position:* Ridgetops*Size of areas:* 5 to 20 acres*Major uses:* Cultivated crops, pasture, hayland, and a few small areas of woodland**Composition**

Lowell soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components*Similar components:*

- Soils that are moderately eroded

Contrasting components:

- The shallow Cynthiana soils
- The moderately well drained Nicholson soils that have a fine-silty particle-size control section and a fragipan
- The very deep Sandview soils that have a fine-silty particle-size control section

Typical Profile*Surface layer:*

0 to 8 inches; dark brown, very friable silt loam

Subsoil:

8 to 20 inches; dark brown and strong brown, friable silty clay loam

20 to 35 inches; strong brown and dark yellowish brown, firm silty clay

35 to 44 inches; grayish brown and brown, mottled, very firm silty clay

Bedrock:

44 inches; hard limestone bedrock of the Grant Lake Formation

Soil Properties and Qualities*Depth:* Deep*Organic matter content:* Moderate*Natural fertility:* Medium*Drainage class:* Well drained*Rock fragments at the surface:* Extent of surface covered—0 to 5 percent; kind—limestone channers*Available water capacity:* High*Permeability:* Moderately slow*Parent material:* Clayey residuum derived from limestone and shale of the Grant Lake, Point Pleasant, and Clays Ferry Formations; Ordovician System*Runoff:* Slow or medium*Tilth:* Good*Shrink-swell potential:* Moderate*Erosion hazard:* Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black oak, black locust, hickory, northern red oak, Osage orange, sugar maple, white ash

Some trees preferred for planting: Eastern white pine, northern red oak, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Properly designing building foundations helps to overcome the moderate shrink-swell potential of the subsoil.
- If buildings with basements are constructed, care should be taken to select sites with adequate depth to bedrock.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to overcome the moderately slow permeability of the subsoil.
- Depth to bedrock is a moderate limitation affecting septic tank absorption fields.
- Selecting sites where bedrock is at the greatest depth helps to overcome the limited depth to bedrock.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

LoC—Lowell silt loam, 6 to 12 percent slopes

Setting

Landform: Uplands

Landscape position: Ridgetops

Size of areas: 5 to 65 acres

Major uses: Cultivated crops, pasture, hayland, and a few small areas of woodland

Composition

Lowell soil and similar components: 80 to 90 percent
Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that are moderately eroded
- Soils that have slopes of less than 6 percent or more than 12 percent

Contrasting components:

- The moderately deep Faywood soils
- The moderately well drained Nicholson soils that have a fine-silty particle-size control section and a fragipan
- The very deep Sandview soils that have a fine-silty particle-size control section

Typical Profile

Surface layer:

0 to 8 inches; dark brown, very friable silt loam

Subsoil:

8 to 20 inches; dark brown and strong brown, friable silty clay loam

20 to 35 inches; strong brown and dark yellowish brown, firm silty clay

35 to 44 inches; grayish brown and brown, mottled, very firm silty clay

Bedrock:

44 inches; hard limestone bedrock of the Grant Lake Formation

Soil Properties and Qualities

Depth: Deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—limestone channers

Available water capacity: High

Permeability: Moderately slow

Parent material: Clayey residuum derived from limestone and shale of the Grant Lake, Point Pleasant, and Clays Ferry Formations; Ordovician System

Runoff: Medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Severe

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops,

including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.

- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited (fig. 8)

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black oak, black locust, hickory, northern red oak, Osage orange, sugar maple, white ash

Some trees preferred for planting: Eastern white pine, northern red oak, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- Playgrounds should be restricted to the included areas with slopes of less than 6 percent, or the playground site should be leveled during construction.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited



Figure 8.—An area of Lowell silt loam, 6 to 12 percent slopes, used as hayland.

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Properly designing building foundations helps to overcome the moderate shrink-swell potential of the subsoil.
- If buildings with basements are constructed, care should be taken to select sites with adequate depth to bedrock.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to overcome the moderately slow permeability of the subsoil.
- Depth to bedrock is a moderate limitation affecting septic tank absorption fields.
- Selecting sites where bedrock is at the greatest depth helps to overcome the limited depth to bedrock.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIIe

**LwB—Lowell silt loam, shale substratum,
2 to 6 percent slopes**

Setting

Landform: Uplands

Landscape position: Ridgetops

Size of areas: 5 to 100 acres

Major uses: Cultivated crops, pasture, hayland, and a few small areas of woodland

Composition

Lowell soil and similar components: 85 to 95 percent
Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that are moderately eroded

Contrasting components:

- The moderately well drained Nicholson soils that have a fine-silty particle-size control section and a fragipan
- The very deep Sandview soils that have a fine-silty particle-size control section

Typical Profile

Surface layer:

0 to 7 inches; dark yellowish brown, very friable silt loam

Subsoil:

7 to 17 inches; yellowish brown, firm silty clay

17 to 30 inches; yellowish brown, mottled, firm silty clay

30 to 48 inches; yellowish brown, mottled, very firm clay

Substratum:

48 to 64 inches; yellowish brown, firm silty clay

Bedrock:

64 inches; soft, weathered siltstone, shale, and limestone of the Fairview Formation

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—limestone channers

Available water capacity: High

Permeability: Moderately slow

Parent material: Clayey residuum derived from limestone and shale of the Fairview Formation; Ordovician System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black oak, black locust, hickory, northern red oak, Osage orange, sugar maple, white ash

Some trees preferred for planting: Eastern white pine, northern red oak, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Properly designing building foundations helps to overcome the moderate shrink-swell potential of the subsoil.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to overcome the moderately slow permeability of the subsoil.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

LwC2—Lowell silt loam, shale substratum, 6 to 12 percent slopes, eroded**Setting**

Landform: Uplands

Landscape position: Ridgetops

Size of areas: 5 to 180 acres

Major uses: Cultivated crops, pasture, hayland, and a few areas of woodland

Composition

Lowell soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that are not eroded or are slightly eroded or severely eroded
- Soils that have slopes of less than 6 percent or more than 12 percent

- Soils that are moderately well drained or well drained

Contrasting components:

- The moderately deep Eden soils
- The moderately well drained Nicholson soils that have a fine-silty particle-size control section and a fragipan
- The very deep Sandview soils that have a fine-silty particle-size control section

Typical Profile

Surface layer:

0 to 5 inches; dark yellowish brown, very friable silt loam

Subsoil:

5 to 15 inches; yellowish brown, firm silty clay

15 to 28 inches; yellowish brown, mottled, firm silty clay

28 to 46 inches; yellowish brown, mottled, very firm clay

Substratum:

46 to 62 inches; yellowish brown, firm silty clay

Bedrock:

62 to 66 inches; soft, weathered siltstone, shale, and limestone of the Fairview Formation

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—limestone channers

Available water capacity: High

Permeability: Moderately slow

Parent material: Clayey residuum derived from limestone and shale of the Fairview Formation; Ordovician System

Runoff: Medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Severe

Use and Management**Cropland**

Suitability: Suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help

to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.

- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black oak, black locust, hickory, northern red oak, Osage orange, sugar maple, white ash

Some trees preferred for planting: Eastern white pine, northern red oak, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- Playgrounds should be restricted to the included areas with slopes of less than 6 percent, or the playground site should be leveled during construction.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.

- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Properly designing building foundations helps to overcome the moderate shrink-swell potential of the subsoil.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to overcome the moderately slow permeability of the subsoil.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIIe

LwD2—Lowell silt loam, shale substratum, 12 to 20 percent slopes, eroded

Setting

Landform: Uplands

Landscape position: Ridgetops

Size of areas: 5 to 300 acres

Major uses: Pasture, hayland, woodland, and some small areas of cultivated crops

Composition

Lowell soil and similar components: 80 to 90 percent
Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that are not eroded or are slightly eroded or severely erosion
- Soils that have slopes of more than 20 percent

Contrasting components:

- The moderately deep Eden soils
- The moderately well drained Nicholson soils that have a fine-silty particle-size control section and a fragipan and are in areas of less sloping included soils

- The very deep Sandview soils that have a fine-silty particle-size control section

Typical Profile

Surface layer:

0 to 5 inches; dark yellowish brown, very friable silt loam

Subsoil:

5 to 15 inches; yellowish brown, firm silty clay

15 to 28 inches; yellowish brown, mottled, firm silty clay

28 to 46 inches; yellowish brown, mottled, very firm clay

Substratum:

46 to 62 inches; yellowish brown, firm silty clay

Bedrock:

62 to 66 inches; soft, weathered siltstone, shale, and limestone of the Fairview Formation

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—limestone channers

Available water capacity: High

Permeability: Moderately slow

Parent material: Clayey residuum derived from limestone and shale of the Fairview Formation; Ordovician System

Runoff: Rapid

Tilth: Fair

Shrink-swell potential: Moderate

Erosion hazard: Very severe

Use and Management

Cropland

Suitability: Poorly suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black oak, black locust, hickory, northern red oak, Osage orange, sugar maple, white ash

Some trees preferred for planting: Eastern white pine, northern red oak, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- Laying out permanent roads and access trails on the contour, installing water bars and culverts, applying gravel to the road surface or trail, and planting a vegetative cover help to control erosion.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- Picnic areas and campgrounds should be restricted to sites where slope is less than 15 percent.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.

- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Properly designing building foundations helps to overcome the moderate shrink-swell potential of the subsoil.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- Land leveling and shaping during construction can help to overcome the slope.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to overcome the moderately slow permeability of the subsoil.
- Installing septic tank absorption fields on the contour or land grading can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IVe

MgB—Monongahela loam, 2 to 6 percent slopes

Setting

Landform: River valleys and uplands

Landscape position: Stream terraces and on ridgetops above the Licking River

Size of areas: 5 to 180 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Monongahela soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that are in the lower landscape positions and are subject to rare flooding
- Soils that are somewhat poorly drained
- Soils that have a surface layer of silt loam

Contrasting components:

- The well drained Allegheny soils that do not have a fragipan
- The Otwell soils that have a fine-silty particle-size control section
- The Newark and Nolin soils that are in the lower positions on flood plains and are subject to frequent flooding

Typical Profile

Surface layer:

0 to 7 inches; dark brown, very friable loam

Subsoil:

7 to 17 inches; dark yellowish brown, friable clay loam

17 to 27 inches; yellowish brown, friable loam

27 to 41 inches; a fragipan of yellowish brown, mottled, very firm and brittle loam

41 to 50 inches; yellowish brown, mottled, friable loam

Substratum:

50 to 74 inches; yellowish brown, friable sandy clay loam

Soil Properties and Qualities

Depth: Very deep

Depth to the fragipan: 18 to 34 inches

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Moderately well drained

Rock fragments at the surface: Extent of surface covered—0 to 14 percent; kind—rounded quartz pebbles

Seasonal high water table: Depth—1.5 to 3.0 feet; kind—perched

Available water capacity: Moderate

Permeability: Moderately slow or slow

Parent material: On ridgetops—mixed alluvium derived from sandstone, siltstone, and shale of the Tertiary System; on stream terraces—mixed alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Low

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Because of the perched water table and the fragipan, the crops selected for planting should be those that can withstand the wetness and have a moderate root system.

- Planting and harvesting may need to be delayed because of the seasonal high water table.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderate root system, and can tolerate both wetness and droughtiness.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black walnut, northern red oak, Osage orange, white ash, yellow poplar

Some trees preferred for planting: Eastern white pine, northern red oak, shortleaf pine, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- Because the surface layer of the soil is loose, it should be disturbed as little as possible.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that have a moderately deep root system, are tolerant of both wet and dry conditions, and are able to withstand heavy foot or vehicular traffic.
- Installation of a drainage system helps to overcome the wetness and the slow permeability in the subsoil affecting camp areas and playgrounds.
- See table 8 for additional information.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand both wet and dry conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for dwellings and roads.
- Installing a drainage system around building foundations minimizes the damage caused by wetness.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the slow permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to overcome the wetness and the moderate depth to the fragipan.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

MgC—Monongahela loam, 6 to 12 percent slopes

Setting

Landform: River valleys and uplands

Landscape position: Stream terraces and on ridgetops above the Licking River

Size of areas: 5 to 200 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Monongahela soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that have more clay in the subsoil than the Monongahela soil
- Soils that have a surface layer of silt loam

Contrasting components:

- The well drained Allegheny soils that do not have a fragipan
- The Otwell soils that have a fine-silty particle-size control section

Typical Profile

Surface layer:

0 to 7 inches; dark brown, very friable loam

Subsoil:

7 to 17 inches; dark yellowish brown, friable clay loam

17 to 27 inches; yellowish brown, friable loam

27 to 41 inches; a fragipan of yellowish brown, mottled, very firm and brittle loam

41 to 50 inches; yellowish brown, mottled, friable loam

Substratum:

50 to 74 inches; yellowish brown, friable sandy clay loam

Soil Properties and Qualities

Depth: Very deep

Depth to the fragipan: 18 to 34 inches

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Moderately well drained

Rock fragments at the surface: Extent of surface covered—0 to 14 percent; kind—rounded quartz pebbles

Seasonal high water table: Depth—1.5 to 3.0 feet; kind—perched

Available water capacity: Moderate

Permeability: Moderately slow or slow

Parent material: On ridgetops—mixed alluvium derived from sandstone, siltstone, and shale of the Tertiary System; on stream terraces—mixed alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Runoff: Medium

Tilth: Good

Shrink-swell potential: Low

Erosion hazard: Severe

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Because of the perched water table and the fragipan, the crops selected for planting should be those that can withstand the wetness and have a moderate root system.
- Planting and harvesting may need to be delayed because of the seasonal high water table.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderately deep root system, and can tolerate both wetness and droughtiness.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black walnut, northern red oak, Osage orange, white ash, yellow poplar

Some trees preferred for planting: Eastern white pine, northern red oak, shortleaf pine, white oak, yellow poplar.

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- Because the surface layer of the soil is loose, it should be disturbed as little as possible.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that have a moderately deep root system, can tolerate both wet and dry conditions, and are able to withstand heavy foot or vehicular traffic.
- Installing a drainage system in camp areas helps to overcome the wetness and the slow permeability in the subsoil.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand both wet and dry conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Installing a drainage system around building foundations minimizes the damage caused by wetness.

- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- Land shaping can help to overcome the slope.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the slow permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to overcome the wetness and the moderate depth to the fragipan.
- Land shaping can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIIe

Ne—Newark silt loam, frequently flooded**Setting**

Landform: River and stream valleys

Landscape position: Flood plains

Slope: 0 to 2 percent

Size of areas: 5 to 20 acres

Major uses: Cropland, hayland, pasture, and a few small areas of woodland

Composition

Newark soil and similar components: 85 to 95 percent

Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that are moderately well drained
- Soils that are poorly drained

Contrasting components:

- The well drained Nolin soils

Typical Profile

Surface layer:

0 to 10 inches; dark brown, friable silt loam

Subsoil:

10 to 20 inches; brown and yellowish brown, mottled, friable silt loam

20 to 32 inches; light brownish gray, mottled, firm silty clay loam

Substratum:

32 to 62 inches; light brownish gray, mottled, very firm silty clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Somewhat poorly drained

Seasonal high water table: At a depth of 0.5 foot to 1.5 feet

Available water capacity: High

Permeability: Moderate

Parent material: Mixed alluvium derived from limestone, siltstone, sandstone, and shale of the Quaternary System

Runoff: Ponded or very slow

Tilth: Good

Shrink-swell potential: Moderate

Hazard of flooding: Frequency—frequent; duration—brief

Erosion hazard: None or slight

Use and Management

Cropland

Suitability: Suited

Management considerations:

- A drainage system helps to remove excess water.
- Installing berms or levees can help to control the flooding.
- The crops selected for planting should be those that can tolerate the wetness.
- Planting may need to be delayed because of the seasonal high water table and the flooding.
- Applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth and maintain the organic matter content.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and can tolerate both wetness and flooding.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along

with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.

- A well planned mowing and harvesting schedule should be established.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Eastern cottonwood, green ash, pin oak, sweetgum, river birch

Some trees preferred for planting: American sycamore, eastern cottonwood, green ash, pin oak, sweetgum

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- The seedling mortality rate is high because of the seasonal high water table and the flooding.
- Planting seedlings during dry periods increases the seedling survival rate.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- The species selected for planting should be those that can tolerate wetness and periods of brief flooding as well as heavy foot or vehicular traffic.
- Recreational development should be restricted to picnic areas and paths and trails because of the wetness and the flooding.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Poorly suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand wetness and brief periods of flooding and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding berms to fish ponds during construction minimizes the loss of desirable species and the addition of undesirable species during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Unsited*Management considerations:*

- Constructing roads and buildings on elevated, well compacted fill material helps to overcome the wetness and prevent the damage caused by low strength of the subsoil and flooding.
- See table 10 for additional information.

Septic Tank Absorption Fields*Suitability:* Unsited*Management considerations:*

- Constructing absorption fields in raised areas or on elevated fill material helps to overcome the wetness and prevent inundation by floodwater.
- See table 11 for additional information.

Interpretive Groups*Land capability classification:* IIw**Ng—Newark silt loam, ponded****Setting***Landform:* River and stream valleys*Landscape position:* Flood plains*Slope:* 0 or 1 percent*Size of areas:* 5 to 20 acres*Major uses:* Woodland**Composition**

Newark soil and similar components: 85 to 95 percent

Contrasting components: 5 to 15 percent

Minor Components*Similar components:*

- Soils that have more gravel in the subsoil than the Newark soil
- Soils that are moderately well drained
- Soils that are poorly drained

Contrasting components:

- The well drained Nolin soils

Typical Profile*Surface layer:*

0 to 10 inches; dark brown, friable silt loam

Subsoil:

10 to 20 inches; brown and yellowish brown, mottled, friable silt loam

20 to 32 inches; light brownish gray, mottled, firm silty clay loam

Substratum:

32 to 62 inches; light brownish gray, mottled, very firm silty clay loam

Soil Properties and Qualities*Depth:* Very deep*Organic matter content:* Moderate*Natural fertility:* Medium*Drainage class:* Somewhat poorly drained*Seasonal high water table:* At the surface to 1.0 foot above the surface*Available water capacity:* High*Permeability:* Moderate*Parent material:* Mixed alluvium derived from limestone, siltstone, sandstone, and shale of the Quaternary System*Runoff:* Ponded*Tilth:* Good*Shrink-swell potential:* Moderate*Hazard of ponding:* Duration—very long; some areas inundated year round*Erosion hazard:* None or slight**Use and Management****Cropland***Suitability:* Unsited**Hay and Pasture***Suitability:* Unsited**Woodland***Suitability:* Well suited*Some common trees:* Black willow, eastern cottonwood, green ash, pin oak, silver maple, sweetgum, river birch*Some trees preferred for planting:* American sycamore, eastern cottonwood, green ash, pin oak, sweetgum*Management considerations:*

- Weeds and undesirable shrubs can be controlled by cutting.
- See table 7 for additional information on woodland.

Recreation*Suitability:* Unsited**Wildlife Habitat***Suitability:* Well suited to wetland wildlife habitat (fig. 9)*Management considerations:*

- The plants selected for food plots, forage, or cover should be hydrophytic and should meet the needs of the wildlife species for which they are managed.
- Prohibiting the installation of drainage systems helps to maintain the quality of wetlands.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Unsited

- See table 10 for additional information.



Figure 9.—Standing water in an area of Newark silt loam, ponded.

Septic Tank Absorption Fields

Suitability: Unsited

- See table 11 for additional information.

Interpretive Groups

Land capability classification: Vw

NhB—Nicholson silt loam, 2 to 6 percent slopes

Setting

Landform: Uplands

Landscape position: Ridgetops

Size of areas: 5 to 170 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Nicholson soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that are somewhat poorly drained
- Soils that have a darker surface layer than that of the Nicholson soil

Contrasting components:

- The well drained Lowell soils that have a fine textured particle-size control section and do not have a fragipan
- The well drained Sandview soils that do not have a fragipan

Typical Profile

Surface layer:

0 to 7 inches; dark yellowish brown, very friable silt loam

Subsoil:

7 to 21 inches; dark yellowish brown, friable silty clay loam

21 to 38 inches; a fragipan of yellowish brown, mottled, firm and brittle silty clay loam
 38 to 72 inches; yellowish brown, mottled, firm silty clay

Soil Properties and Qualities

Depth: Very deep
Depth to the fragipan: 16 to 30 inches
Organic matter content: Moderate
Natural fertility: Medium
Drainage class: Moderately well drained
Seasonal high water table: Depth—1.5 to 2.5 feet; kind—perched
Available water capacity: Moderate
Permeability: Moderate above the fragipan and slow in the fragipan
Parent material: Silty material over clayey residuum derived from limestone of the Grant Lake Formation and from the calcareous shale, limestone, and siltstone of the Fairview Formation; Ordovician System
Runoff: Slow or medium
Tilth: Good
Shrink-swell potential: Moderate
Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Suited
Management considerations:

- Because of the perched water table and the fragipan, the crops selected for planting should be those that can withstand the wetness and have only a moderate root system.
- Planting and harvesting may need to be delayed because of the seasonal high water table.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited
Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory

ground cover, have a moderately deep root system, and can tolerate both wet and dry conditions.

- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited
Some common trees: Black oak, hickory, northern red oak, sweetgum, white oak, yellow poplar
Some trees preferred for planting: Eastern white pine, northern red oak, sweetgum, white ash, white oak, yellow poplar
Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited
Management considerations:

- The species selected for planting should be those that have a moderately deep root system, can tolerate both wet and dry conditions, and are able to withstand heavy foot or vehicular traffic.
- Installation of a drainage system helps to overcome the wetness and the slow permeability in the subsoil affecting camp areas and playgrounds.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited
Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand both wet and dry conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Installing a drainage system around building foundations minimizes the damage caused by wetness.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields*Suitability:* Poorly suited*Management considerations:*

- Increasing the size of the absorption field helps to overcome the slow permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to overcome the wetness and the moderate depth to the fragipan.
- See table 11 for additional information.

Interpretive Groups*Land capability classification:* IIe**NhC—Nicholson silt loam, 6 to 12 percent slopes****Setting***Landform:* Uplands*Landscape position:* Ridgetops and the upper side slopes*Size of areas:* 5 to 130 acres*Major uses:* Cultivated crops, hayland, pasture, and a few small areas of woodland**Composition**

Nicholson soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components*Similar components:*

- Soils that have a darker surface layer than that of the Nicholson soil
- Soils that have a layer that is too thin or not brittle enough to be a fragipan

Contrasting components:

- The well drained Lowell soils that have a fine textured particle-size control section and do not have a fragipan
- The moderately deep, well drained Faywood soils that have a fine textured particle-size control section and do not have a fragipan

Typical Profile*Surface layer:*

0 to 7 inches; dark yellowish brown, very friable silt loam

Subsoil:

7 to 21 inches; dark yellowish brown, friable silty clay loam

21 to 38 inches; a fragipan of yellowish brown, mottled, firm and brittle silty clay loam

38 to 72 inches; yellowish brown, mottled, firm silty clay

Soil Properties and Qualities*Depth:* Very deep*Depth to the fragipan:* 16 to 30 inches*Organic matter content:* Moderate*Natural fertility:* Medium*Drainage class:* Moderately well drained*Seasonal high water table:* Depth—1.5 to 2.5 feet; kind—perched*Available water capacity:* Moderate*Permeability:* Moderate above the fragipan and slow in the fragipan*Parent material:* Silty material over clayey residuum derived from limestone of the Grant Lake Formation and from the calcareous shale, limestone, and siltstone of the Fairview Formation; Ordovician System*Runoff:* Medium*Tilth:* Good*Shrink-swell potential:* Moderate*Erosion hazard:* Severe**Use and Management****Cropland***Suitability:* Suited*Management considerations:*

- Because of the perched water table and the fragipan, the crops selected for planting should be those that can withstand the wetness and have a moderately deep root system.
- Planting and harvesting may need to be delayed because of the seasonal high water table.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.

- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderately deep root system, and can tolerate both wet and dry conditions.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black oak, hickory, northern red oak, sweetgum, white oak, yellow poplar

Some trees preferred for planting: Eastern white pine, northern red oak, sweetgum, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that have a moderately deep root system, can tolerate both wet and dry conditions, and are able to withstand heavy foot or vehicular traffic.
- Installing a drainage system in camp areas helps to overcome the wetness and the slow permeability in the subsoil.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand both wet and dry

conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.

- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Installing a drainage system around building foundations minimizes the damage caused by wetness.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- Land shaping can help to overcome the slope.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Increasing the size of the absorption field helps to overcome the slow permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to overcome the wetness and the moderate depth to the fragipan.
- Land shaping can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIIe

No—Nolin silt loam, frequently flooded

Setting

Landform: River and stream valleys

Landscape position: Flood plains

Slope: 0 to 3 percent

Size of areas: 5 to 120 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Nolin soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that have a darker surface layer than that of the Nolin soil

- Soils that have slopes of more than 3 percent and are along major streams
- Soils that are moderately well drained

Contrasting components:

- The Elk soils that have an argillic horizon and are on low terraces
- The moderately deep Boonesboro soils
- The somewhat poorly drained Newark soils
- The Wheeling soils that have an argillic horizon and a fine-loamy particle-size control section and are on low terraces along the Ohio River

Typical Profile

Surface layer:

0 to 9 inches; dark brown, very friable silt loam

Subsoil:

9 to 30 inches; dark yellowish brown, friable silt loam
30 to 62 inches; dark yellowish brown, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Medium

Natural fertility: High

Drainage class: Well drained

Available water capacity: High

Permeability: Moderate

Parent material: Loamy alluvium derived from limestone, siltstone, and shale of the Quaternary System

Runoff: Very slow

Tilth: Good

Shrink-swell potential: Low

Flooding: Frequency—frequent; duration—brief

Erosion hazard: None or slight

Use and Management

Cropland

Suitability: Well suited (fig. 10)

Management considerations:

- Installing berms or levees can help to control the flooding.
- Applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth and maintain the organic matter content.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- Diversions help to control runoff and overwash from adjacent, higher terraces and upland side slopes.

- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover and can tolerate the flooding.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located salting facilities and livestock water to aid in the distribution of grazing.
- Where practical, building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American elm, black walnut, eastern cottonwood, hickory, black willow, sweetgum, yellow poplar

Some trees preferred for planting: Black walnut, eastern cottonwood, sweetgum, white ash, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- Recreational development should be restricted to picnic areas, paths and trails, and other noncamping uses because of the hazard of flooding.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand slightly droughty conditions during the growing season; tolerate frequent, brief periods of flooding; and meet the needs of the wildlife species for which they are managed.



Figure 10.—Tobacco in an area of Nolin silt loam, frequently flooded.

- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Unsited

Management considerations:

- Constructing roads and buildings on elevated, well compacted fill material helps to prevent the damage caused by low strength of the subsoil and flooding.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Unsited

Management considerations:

- Constructing absorption fields in raised areas or on elevated fill material helps to prevent inundation by floodwater.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: 1lw

OtB—Otwell silt loam, 2 to 6 percent slopes**Setting**

Landform: River and stream valleys

Landscape position: Terraces

Size of areas: 5 to 50 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Otwell soil and similar components: 85 to 95 percent
Contrasting components: 5 to 15 percent

Minor Components*Similar components:*

- Soils that have more clay or more sand throughout than the Otwell soil
- Soils that do not have a fragipan or have a weakly expressed fragipan
- The Otwell soils that are subject to rare flooding and in the lower landscape positions

Contrasting components:

- The well drained Elk soils that do not have a fragipan
- The somewhat poorly drained Lawrence soils

Typical Profile*Surface layer:*

0 to 9 inches; dark brown, very friable silt loam

Subsoil:

9 to 24 inches; yellowish brown, friable silty clay loam
24 to 51 inches; a fragipan of yellowish brown and pale brown, mottled, firm and brittle silty clay loam

Substratum:

51 to 62 inches; yellowish brown and pale brown, mottled, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Depth to the fragipan: 20 to 31 inches

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Moderately well drained

Rock fragments at the surface: Extent of surface covered—0 to 3 percent; kind—rounded quartz pebbles

Seasonal high water table: Depth—2.0 to 3.5 feet; kind—perched

Available water capacity: Moderate

Permeability: Moderately slow above the fragipan and very slow in the fragipan

Parent material: Mixed alluvium derived from loess, limestone, siltstone, calcareous shale, and, in a few areas along the Ohio River, glacial drift; Quaternary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Moderate

Use and Management**Cropland**

Suitability: Suited

Management considerations:

- Because of the perched water table and the fragipan, the crops selected for planting should be those that can withstand the wetness and have only a moderate root system.
- Planting and harvesting may need to be delayed because of the seasonal high water table.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderately deep root system, and can tolerate both wet and dry conditions.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along

with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.

- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black gum, black oak, sugar maple, white oak, yellow poplar

Some trees preferred for planting: Eastern white pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that have a moderately deep root system, can tolerate both wet and dry conditions, and are able to withstand heavy foot or vehicular traffic.
- Installation of a drainage system helps to overcome the wetness and the slow permeability in the subsoil affecting camp areas and playgrounds.
- See table 8 for additional information.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand both wet and dry conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for dwellings and roads.
- Installing a drainage system around building foundations minimizes the damage caused by wetness.

- Constructing roads and buildings on well compacted fill material and properly designing foundations help to prevent the damage caused by low strength and by shrinking and swelling of the subsoil.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for septic tank absorption fields.
- Increasing the size of the absorption field helps to overcome the slow permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to overcome the wetness and the moderate depth to the fragipan.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

OtC—Otwell silt loam, 6 to 12 percent slopes

Setting

Landform: River and stream valleys

Landscape position: Terraces

Size of areas: 5 to 350 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Otwell soil and similar components: 85 to 95 percent

Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that have more clay or more sand throughout than the Otwell soil
- Soils that do not have a fragipan or have a weakly expressed fragipan
- The Otwell soils that are subject to rare flooding and in the lower landscape positions

Contrasting components:

- The well drained Elk soils that do not have a fragipan
- The somewhat poorly drained Lawrence soils

Typical Profile

Surface layer:

0 to 9 inches; dark brown, very friable silt loam

Subsoil:

9 to 24 inches; yellowish brown, friable silty clay loam

24 to 51 inches; a fragipan of yellowish brown and pale brown, mottled, firm and brittle silty clay loam

Substratum:

51 to 62 inches; yellowish brown and pale brown, mottled, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Depth to the fragipan: 20 to 31 inches

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Moderately well drained

Rock fragments at the surface: Extent of surface covered—0 to 3 percent; kind—rounded quartz pebbles

Seasonal high water table: Depth—2.0 to 3.5 feet; kind—perched

Available water capacity: Moderate

Permeability: Moderately slow above the fragipan and very slow in the fragipan

Parent material: Mixed alluvium derived from loess, limestone, siltstone, calcareous shale, and, in a few areas along the Ohio River, glacial drift; Quaternary System

Runoff: Medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Severe

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Because of the perched seasonal high water table and the fragipan, the crops selected for planting should be those that can withstand the wetness and have a moderate root system.
- Planting and harvesting may need to be delayed because of the seasonal high water table.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderately deep root system, and can tolerate both wet and dry conditions.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black gum, black oak, sugar maple, white oak, yellow poplar

Some trees preferred for planting: Eastern white pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that have a moderately deep root system, can tolerate both wet and dry conditions, and are able to withstand heavy foot or vehicular traffic.
- Installing a drainage system in camp areas helps to overcome the wetness and the slow permeability in the subsoil.
- Establishing water bars on paths and trails helps to reduce the runoff rate and control erosion.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand both wet and dry conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.

- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for dwellings and roads.
- Installing a drainage system around building foundations helps to overcome the wetness.
- Constructing roads and buildings on well compacted fill material and properly designing foundations help to prevent the damage caused by low strength and by shrinking and swelling of the subsoil.
- Land shaping can help to overcome the slope.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for septic tank absorption fields.
- Increasing the size of the absorption field helps to overcome the slow permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to overcome the wetness and the moderate depth to the fragipan.
- Land shaping can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIIe

OwB—Otwell silt loam, 2 to 6 percent slopes, rarely flooded

Setting

Landform: River and stream valleys

Landscape position: Low terraces

Size of areas: 5 to 100 acres

Major uses: Cultivated crops, hayland, pasture, and a few small areas of woodland

Composition

Otwell soil and similar components: 85 to 95 percent

Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that do not have a fragipan or have a weakly expressed fragipan
- The Otwell soils that are in the slightly higher landscape positions and are not subject to flooding

Contrasting components:

- The well drained Elk soils that do not have a fragipan
- The somewhat poorly drained Lawrence soils
- The Newark and Nolin soils that are in the lower landscape positions on flood plains and are subject to frequent flooding

Typical Profile

Surface layer:

0 to 9 inches; dark brown, very friable silt loam

Subsoil:

9 to 24 inches; yellowish brown, friable silty clay loam
24 to 51 inches; a fragipan of yellowish brown and pale brown, mottled, firm and brittle silty clay loam

Substratum:

51 to 62 inches; yellowish brown and pale brown, mottled, friable silty clay loam

Soil Properties and Qualities

Depth: Very deep

Depth to the fragipan: 20 to 31 inches

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Moderately well drained

Rock fragments at the surface: Extent of surface covered—0 to 3 percent; kind—rounded quartz pebbles

Seasonal high water table: Depth—2.0 to 3.5 feet; kind—perched

Available water capacity: Moderate

Permeability: Moderately slow above the fragipan and very slow in the fragipan

Parent material: Mixed alluvium derived from loess, limestone, siltstone, calcareous shale, and, in a few areas along the Ohio River, glacial drift; Quaternary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Moderate

Flooding: Frequency—rare; duration—brief

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Suited (fig. 11)



Figure 11.—An area of Otwell silt loam, 2 to 6 percent slopes, rarely flooded, used for corn and tobacco.

Management considerations:

- Installing berms or levees can help to control the flooding.
- Because of the perched water table and the fragipan, the crops selected for planting should be those that can withstand the wetness and have a moderate root system.
- Planting and harvesting may need to be delayed because of the seasonal high water table.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.

- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover, have a moderately deep root system, and can tolerate both wet and dry conditions.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.

- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black gum, black oak, sugar maple, white oak, yellow poplar

Some trees preferred for planting: Eastern white pine, white ash, white oak, yellow poplar.

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- Recreational development should be restricted to picnic areas, playgrounds, paths and trails, and other noncamping uses because of the hazard of flooding.
- The species selected for planting should be those that have a moderately deep root system, can tolerate both wet and dry conditions, and are able to withstand heavy foot or vehicular traffic.
- Installing a drainage system in playground areas helps to overcome the wetness and the slow permeability in the subsoil.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that can withstand both wet and dry conditions, have a moderately deep root system, and meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to frequent flooding are unsuitable as sites for dwellings and roads.

- Installing a drainage system around building foundations helps to overcome the wetness.
- Constructing roads and buildings on elevated, well compacted fill material helps to prevent the damage caused by low strength, shrinking and swelling of the subsoil, and flooding.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for septic tank absorption fields.
- Increasing the size of the absorption field helps to overcome the slow permeability of the subsoil.
- Constructing absorption fields in raised areas or on elevated fill material helps to prevent inundation by floodwater and to overcome the wetness and the moderate depth to the fragipan.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

SaB—Sandview silt loam, 2 to 6 percent slopes

Setting

Landform: Uplands

Landscape position: Ridgetops

Size of areas: 5 to 50 acres

Major uses: Cultivated crops, pasture, and hayland

Composition

Sandview soil and similar components: 80 to 90 percent

Contrasting components: 10 to 20 percent

Minor Components

Similar components:

- Soils that have a darker surface layer than that of the Sandview soil
- Soils that are moderately eroded

Contrasting components:

- The Lowell soils that have a fine textured particle-size control section
- The moderately well drained Nicholson soils that have a fragipan

Typical Profile

Surface layer:

0 to 9 inches; dark brown, very friable silt loam

Subsurface layer:

9 to 14 inches; dark yellowish brown, very friable silty clay loam

Subsoil:

14 to 26 inches; yellowish brown, friable silty clay loam

26 to 36 inches; yellowish brown, friable silt loam

36 to 50 inches; yellowish brown and strong brown, mottled, friable silty clay loam

50 to 74 inches; yellowish brown and pale brown, firm silty clay

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: Medium

Drainage class: Well drained

Available water capacity: High

Permeability: Moderate in the upper part of the solum and moderately slow in the lower part of the solum

Parent material: Silty material over clayey residuum derived from limestone and shale of the Grant Lake Formation; Ordovician System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.

- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: American elm, black cherry, black locust, black walnut, hackberry, hickory, sugar maple, white ash, white oak

Some trees preferred for planting: Black walnut, eastern white pine, northern red oak, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Suited

Management considerations:

- Properly designing building foundations helps to overcome the moderate shrink-swell potential.
- Constructing roads on well compacted fill material helps to overcome the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to overcome the moderately slow permeability of the lower part of the subsoil.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

W—Water

Setting

This map unit consists mostly of the Ohio River in Bracken County and other small bodies of water scattered throughout the survey area. The Brooksville Reservoir is included in this map unit.

Interpretive Groups

This map unit has not been assigned a land capability classification.

WhB—Wheeling loam, 2 to 6 percent slopes

Setting

Landform: River valleys

Landscape position: Terraces

Size of areas: 5 to 50 acres

Major uses: Cropland, hayland, pasture, and a few small areas of woodland

Composition

Wheeling soil and similar components: 85 to 90 percent

Contrasting components: 10 to 15 percent

Minor Components

Similar components:

- Soils that have a darker surface layer than that of the Wheeling soil
- Soils that have more sand throughout than the Wheeling soil
- A few areas of soils that are in the lower landscape positions and subject to rare flooding

Contrasting components:

- The moderately well drained Otwell soils that have a fragipan
- Elk soils that have a fine-silty particle-size control section
- Small areas of Newark and Nolin soils that are in the lower landscape positions on flood plains and are subject to frequent flooding

Typical Profile

Surface layer:

0 to 14 inches; dark brown, firm loam

Subsoil:

14 to 23 inches; dark brown, friable loam

23 to 45 inches; dark brown and dark yellowish brown, firm silty clay loam

45 to 57 inches; dark yellowish brown, friable sandy clay loam

57 to 80 inches; dark yellowish brown, friable sandy loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—rounded pebbles

Available water capacity: High

Permeability: Moderate

Parent material: Mixed alluvium derived from sandstone, siltstone, shale, and limestone and some mixed alluvium from small areas of glacial drift; Quaternary System

Runoff: Medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities,

and livestock water to aid in the distribution of grazing.

- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black walnut, northern red oak, white oak, yellow poplar

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- The included soils that are in the lower landscape positions and subject to flooding are unsuited to campgrounds and playgrounds and should be restricted to other uses.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Well suited

Management considerations:

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for dwellings and roads.

- Constructing roads on well compacted fill material helps to prevent the damage caused by heavy vehicular traffic.

- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Suited

Management considerations:

- Increasing the size of the absorption field and adding fill material help to improve the effectiveness of absorption fields.
- If absorption fields are built in areas of the included soils that are in the lower landscape positions and subject to flooding, they should be constructed on elevated fill material to help prevent inundation by floodwater.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

WhC—Wheeling loam, 6 to 12 percent slopes

Setting

Landform: River valleys

Landscape position: Terraces

Size of areas: 5 to 105 acres

Major uses: Cropland, hayland, pasture, and a few minor areas of woodland

Composition

Wheeling soil and similar components: 85 to 90 percent

Contrasting components: 10 to 15 percent

Minor Components

Similar components:

- Soils that have a darker surface layer than that of the Wheeling soil
- Soils that have more sand throughout than the Wheeling soil
- A few areas of soils that are in the lower landscape positions and are subject to rare flooding

Contrasting components:

- The moderately well drained Otwell soils that have a fragipan
- The Elk soils that have a fine-silty particle-size control section
- Small areas of Newark and Nolin soils that are in the lower landscape positions on flood plains and are subject to frequent flooding

Typical Profile

Surface layer:

0 to 14 inches; dark brown, firm loam

Subsoil:

14 to 23 inches; dark brown, friable loam

23 to 45 inches; dark brown and dark yellowish brown, firm silty clay loam

45 to 57 inches; dark yellowish brown, friable sandy clay loam

57 to 80 inches; dark yellowish brown, friable sandy loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 5 percent; kind—rounded pebbles

Available water capacity: High

Permeability: Moderate

Parent material: Mixed alluvium derived from sandstone, siltstone, shale, and limestone and some mixed alluvium from small areas of glacial drift; Quaternary System

Runoff: Medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Well suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- Proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.

- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black walnut, northern red oak, white oak, yellow poplar

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Suited

Management considerations:

- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- This soil is poorly suited to playgrounds unless the site is leveled or graded during construction.
- The included soils that are in the lower landscape positions and subject to flooding are unsuited to campgrounds and should be restricted to other uses.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Well suited*Management considerations:*

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as sites for dwellings and roads.
- Constructing roads on well compacted fill material helps to prevent the damage caused by heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields*Suitability:* Suited*Management considerations:*

- Increasing the size of the absorption field and adding fill material improve the effectiveness of absorption fields.
- If absorption fields are built in areas of the included soils that are in the lower landscape positions and subject to flooding, they should be constructed on elevated fill material to help prevent inundation by floodwater.
- Land shaping can help to overcome the slope and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups*Land capability classification:* IIIe**WhF—Wheeling loam, 12 to 55 percent slopes****Setting***Landform:* River valleys*Landscape position:* Terraces and sloughs*Size of areas:* 5 to 80 acres*Major uses:* Pasture and woodland**Composition**

Wheeling soil and similar components: 85 to 90 percent

Contrasting components: 10 to 15 percent

Minor Components*Similar components:*

- Soils that have a darker surface layer than that of the Wheeling soil
- Soils that have more sand throughout than the Wheeling soil

Contrasting components:

- The Elk soils that have a fine-silty particle-size control section
- Small areas of Nolin soils that are on flood plains of sloughs, have slopes of 0 to 4 percent, and are

subject to frequent flooding by backwater from the Ohio River

Typical Profile*Surface layer:*

0 to 14 inches; dark brown, firm loam

Subsoil:

14 to 23 inches; dark brown, friable loam

23 to 45 inches; dark brown and dark yellowish brown, firm silty clay loam

45 to 57 inches; dark yellowish brown, friable sandy clay loam

57 to 80 inches; dark yellowish brown, friable sandy loam

Soil Properties and Qualities*Depth:* Very deep*Organic matter content:* Moderate*Natural fertility:* High*Drainage class:* Well drained*Rock fragments at the surface:* Extent of surface covered—0 to 5 percent; kind—rounded pebbles*Available water capacity:* High*Permeability:* Moderate*Parent material:* Mixed alluvium derived from sandstone, siltstone, shale, and limestone and some mixed alluvium from small areas of glacial drift; Quaternary System*Runoff:* Rapid or very rapid*Shrink-swell potential:* Moderate*Erosion hazard:* Very severe**Use and Management****Cropland***Suitability:* Unsited*Management considerations:*

- If the slope is less than 20 percent and the soil is only occasionally cultivated, this soil is poorly suited to cropland.
- Terracing, contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to reduce the runoff rate and control erosion in areas where the slope is less than 20 percent and the soil is only occasionally cultivated.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture*Suitability:* Suited

Management considerations:

- This soil is unsuited to hay if the slope is more than 20 percent because it limits the use of equipment.
- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland*Suitability:* Well suited*Some common trees:* Black walnut, northern red oak, white oak, yellow poplar*Some trees preferred for planting:* Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar**Management considerations:**

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cutting or applying appropriate herbicides in a timely manner.
- Because the surface layer of the soil is loose, it should be disturbed as little as possible.
- See table 7 for additional information on woodland.

Recreation*Suitability:* Suited**Management considerations:**

- Recreational development should be restricted to paths and trails and to areas used for viewing natural scenery or wildlife.
- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- Establishing water bars on trails and roads helps to reduce the runoff rate and control erosion.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat*Suitability:* Suited**Management considerations:**

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts

and berries for food and help to provide cover for wildlife.

- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Unsited**Management considerations:**

- Constructing roads on well compacted fill material helps to prevent the damage caused by heavy vehicular traffic.
- Flooding by backwater from the Ohio River is a very severe hazard affecting these uses on flood plains in sloughs.
- See table 10 for additional information.

Septic Tank Absorption Fields*Suitability:* Unsited**Management considerations:**

- Absorption fields should not be built in areas of included soils that are in the lower landscape positions and subject to frequent inundation by floodwater from the Ohio River.
- See table 11 for additional information.

Interpretive Groups*Land capability classification:* Vle**WnB—Wheeling loam, 2 to 6 percent slopes, rarely flooded****Setting***Landform:* River valleys*Landscape position:* Low terraces*Size of areas:* 5 to 70 acres*Major uses:* Cropland, hayland, and pasture**Composition**

Wheeling soil and similar components: 85 to 90 percent

Contrasting components: 10 to 15 percent

Minor Components**Similar components:**

- Soils that have a darker surface layer than that of the Wheeling soil
- Soils that have more sand throughout than the Wheeling soil

Contrasting components:

- The moderately well drained Otwell soils that have a fragipan

- The Elk soils that have a fine-silty particle-size control section
- Small areas of Newark and Nolin soils that are in the lower landscape positions on flood plains and are subject to frequent flooding

Typical Profile

Surface layer:

0 to 14 inches; dark brown, firm loam

Subsoil:

14 to 23 inches; dark brown, friable loam

23 to 45 inches; dark brown and dark yellowish brown, firm silty clay loam

45 to 57 inches; dark yellowish brown, friable clay loam

57 to 80 inches; dark yellowish brown, friable sandy loam

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 15 percent; kind—rounded pebbles

Available water capacity: High

Permeability: Moderate

Parent material: Mixed alluvium derived from sandstone, siltstone, shale, and limestone and some mixed alluvium from small areas of glacial drift; Quaternary System

Runoff: Slow or medium

Tilth: Good

Shrink-swell potential: Moderate

Hazard of flooding: Frequency—rare; duration—brief

Erosion hazard: Moderate

Use and Management

Cropland

Suitability: Suited

Management considerations:

- This soil is well suited to cropland if it is protected from the flooding.
- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation on streambanks and in drainageways helps to prevent excessive erosion.

- In places diversions can help to control runoff and overwash from adjacent, higher terraces and upland side slopes.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The species selected for planting should be those that provide high-quality forage and satisfactory ground cover and can tolerate rare periods of flooding.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- Building fences along streams to restrict livestock access helps to control streambank erosion.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland

Suitability: Well suited

Some common trees: Black walnut, northern red oak, white oak, yellow poplar

Some trees preferred for planting: Black walnut, eastern white pine, shortleaf pine, white ash, white oak, yellow poplar

Management considerations:

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation

Suitability: Poorly suited

Management considerations:

- Recreational development should be restricted to picnic areas, playgrounds, ballfields, and other noncamping uses because of the hazard of flooding.
- The species selected for planting should be those that can tolerate heavy foot or vehicular traffic.
- See table 8 for additional information concerning recreational development.

Wildlife Habitat

Suitability: Well suited

Management considerations:

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.

- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- Adding liners, clay, or other well compacted fill material during construction of ponds for water or fish management minimizes water loss caused by piping or seepage.
- Installing berms around ponds helps to prevent inundation during periods of flooding.
- See table 9 for additional information.

Dwellings and Roads

Suitability: Poorly suited

Management considerations:

- Constructing roads and buildings on elevated, well compacted fill material helps to prevent the damage caused by flooding.
- See table 10 for additional information.

Septic Tank Absorption Fields

Suitability: Poorly suited

Management considerations:

- Constructing absorption fields in raised areas or on elevated fill material helps to prevent inundation by floodwater, overcome the moderate depth to bedrock, and improve the effectiveness of absorption fields.
- See table 11 for additional information.

Interpretive Groups

Land capability classification: IIe

WoC—Woolper silty clay loam, 4 to 12 percent slopes

Setting

Landform: Uplands

Landscape position: Side slopes and footslopes

Size of areas: 5 to 15 acres

Major uses: Cultivated crops, pasture, hayland, and a few small areas of woodland

Composition

Woolper soil and similar components: 85 to 95 percent
Contrasting components: 5 to 15 percent

Minor Components

Similar components:

- Soils that are moderately eroded
- Small areas of soils that have slopes of 12 to 20 percent
- Soils that have a thicker mollic epipedon than that of the Woolper soil

Contrasting components:

- The Lowell soils that do not have a mollic epipedon

- The Elk soils that have a fine-silty particle-size control section and do not have a mollic epipedon
- The Boonesboro and Nolin soils that are in the lower landscape positions along streams on flood plains and are subject to frequent flooding

Typical Profile

Surface layer:

0 to 10 inches; dark brown, firm silty clay loam

Subsoil:

10 to 20 inches; dark yellowish brown, mottled, very firm silty clay

20 to 48 inches; brown, mottled, firm clay

48 to 71 inches; brown and olive, very firm clay

Soil Properties and Qualities

Depth: Very deep

Organic matter content: Moderate

Natural fertility: High

Drainage class: Well drained

Rock fragments at the surface: Extent of surface covered—0 to 15 percent; kind—limestone channers

Available water capacity: High

Permeability: Moderately slow or slow

Parent material: Clayey colluvium and residuum derived from the hard limestones of the Point Pleasant Formation, the Grier and Tanglewood Members of the Lexington Limestone Formation, and the Clays Ferry Formation; Ordovician System

Runoff: Medium

Tilth: Good

Shrink-swell potential: Moderate

Erosion hazard: Moderate or severe

Use and Management

Cropland

Suitability: Suited

Management considerations:

- Contour farming, stripcropping, applying a conservation tillage system, planting cover crops, including grasses and legumes in the cropping sequence, and returning crop residue to the soil help to improve and maintain soil tilth, maintain the organic matter content, improve the fertility of the soil, reduce the runoff rate, and control erosion.
- Keeping a permanent cover of vegetation in drainageways helps to prevent excessive erosion.
- See table 5 for yield estimates of various crops.

Hay and Pasture

Suitability: Well suited

Management considerations:

- The proper selection of plant species helps to provide high-quality forage and satisfactory ground cover.
- Pasture renovation should be frequent enough to maintain the desired species.
- A good grazing system should include proper stocking rates and a rotation grazing system, along with properly located fences, salting facilities, and livestock water to aid in the distribution of grazing.
- A well planned mowing and harvesting schedule should be established.
- See table 5 for yield estimates of grasses and legumes.

Woodland*Suitability:* Well suited*Some common trees:* Black oak, black walnut, chinkapin oak, hickory, white ash, white oak*Some trees preferred for planting:* Black walnut, eastern white pine, northern red oak, white ash, white oak, yellow poplar*Management considerations:*

- Weeds and undesirable grasses that compete with trees for moisture can be controlled by cultivating with conventional equipment, cutting, or applying appropriate herbicides in a timely manner.
- See table 7 for additional information on woodland.

Recreation*Suitability:* Suited*Management considerations:*

- The species selected for planting should be those that can withstand heavy foot or vehicular traffic.
- Playgrounds should be restricted to the included areas with slopes of less than 6 percent, or the playground site should be leveled during construction.

- See table 8 for additional information concerning recreational development.

Wildlife Habitat*Suitability:* Well suited*Management considerations:*

- The plants selected for food plots, forage, or cover should be those that meet the needs of the wildlife species for which they are managed.
- If native trees and shrubs are reintroduced in areas of this map unit, they will produce nuts and berries for food and help to provide cover for wildlife.
- See table 9 for additional information.

Dwellings and Roads*Suitability:* Suited*Management considerations:*

- Properly designing building foundations helps to overcome the moderate shrink-swell potential of the subsoil.
- Constructing roads on well compacted fill material helps to prevent the damage caused by low strength of the subsoil and heavy vehicular traffic.
- See table 10 for additional information.

Septic Tank Absorption Fields*Suitability:* Suited*Management considerations:*

- The included soils that are in the lower landscape positions and subject to flooding are unsuitable as a site for septic tank absorption fields.
- Increasing the size of the absorption field and adding fill material help to overcome the moderately slow or slow permeability of the subsoil.
- If slope is more than 6 percent, it can be overcome by land shaping and leveling.
- See table 11 for additional information.

Interpretive Groups*Land capability classification:* IIIe

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 to prevent 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 behavioral 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 recreational 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 (SSSA and ASA 1966).

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

General management needed for crops and pasture is suggested in this section. The estimated yields of the main crops and pasture plants are listed for each soil, the system of land capability classification used

by the Natural Resources Conservation Service is explained, and prime farmland and farmland of statewide importance are described.

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

In 1992, more than 29,920 acres in Bracken and Robertson Counties was used for crops (Kentucky Agricultural Statistics Service 1993). Of this acreage, about 4,600 acres was used for alfalfa, 19,610 acres for other hay crops, 4,310 acres for tobacco, and 1,400 acres for corn.

The soils and climate of Bracken and Robertson Counties are suited to a variety of field crops, including many that are not now commonly grown. Burley tobacco, corn, and soybeans are the dominant row crops. Grain sorghum, sunflowers, sweet peppers, popcorn, and similar crops can be grown if economic conditions are favorable.

Wheat is the most common close-grown crop. Wheat, barley, oats, and rye are generally grown as cover on tobacco fields in winter. Grass seed could be produced from fescue, red clover, orchardgrass, brome grass, and timothy if the market for grass seed is favorable.

Specialty crops grown in the survey area are vegetables, tree fruits, and nursery plants. In addition, other specialty crops such as Christmas trees, strawberries, small fruits, grapes, melons, and other vegetables, can be adapted to the area.

Deep and very deep, well drained soils that warm up early in the spring are especially well suited to many vegetables and small fruits. The Allegheny, Elk, Lowell, Sandview, and Wheeling soils that have slopes of less than 6 percent are in this category. These soils make up about 3,572 acres in the survey area. Generally, crops can be planted and harvested earlier on these soils than crops that are grown on other soils in the survey area.

Most of the well drained soils are suited to orchards and nursery plants. Soils in low positions on the

landscape, where frost is frequent and air drainage is poor, generally are poorly suited to early vegetables, small fruits, and orchard crops.

The local offices of the Natural Resources Conservation Service and the Kentucky Cooperative Extension Service can provide the latest information and suggestions for growing specialty crops.

Less than 7 percent of the soils in the survey area are well suited to row crops. Most of these soils are on bottom land and stream terraces, with only a limited acreage in the uplands. The soils on broad, nearly level terraces and broad ridges are suited to grain crops. Deep, well drained soils, such as Allegheny, Elk, Lowell, Sandview, and Wheeling, are suited to tobacco and alfalfa. During years of normal rainfall, the moderately well drained Monongahela, Nicholson, and Otwell soils produce high yields of tobacco. The more sloping areas of Allegheny, Eden, Elk, Faywood, Lowell, Monongahela, Nicholson, Otwell, and Wheeling soils are commonly used for hay and pasture. In addition to the land currently being cropped, some of the acreage in the survey area is idle land, woodland, or pasture, and this acreage has potential for use as cropland (Kentucky Conservation Needs Committee 1970). Food production could be increased by applying the latest technology to all of the cropland in the survey area. The information in this soil survey can facilitate the application of such technology.

Managing Cropland

The main management needs on the cropland and pasture in the survey area are measures that help to control erosion, overcome wetness, maintain or improve soil fertility and tilth, and minimize water pollution caused by runoff containing soil particles, nutrients, organic matter, pesticides, and herbicides.

Water erosion is the primary management concern on most of the cropland and pasture in Bracken and Robertson Counties. It is a hazard if the slope is more than 2 percent. Except for some nearly level areas on flood plains and stream terraces, such as those of the Boonesboro, Elk, Newark, and Nolin soils, nearly all areas of cropland and pasture in the two counties have slopes ranging from 2 to 60 percent. As slope increases, the hazard of erosion and the difficulty in controlling that erosion also increase.

Erosion of the surface layer is damaging because it reduces the productivity of the soils and can result in sedimentation of streams, ponds, and lakes. Soil productivity is reduced as organic matter and plant nutrients are lost and part of the subsoil is incorporated into the plow layer. Erosion is especially damaging in areas of Lowell soils that have a clayey

subsoil; in areas of soils that have a layer in or below the subsoil that limits the root zone, such as the fragipan in the Monongahela, Nicholson, and Otwell soils; and in areas of Faywood and Eden soils that are moderately deep over bedrock. The pollution caused by erosion reduces the quality of water for municipal and recreation uses and for livestock, fish, and wildlife.

Erosion-control measures generally help to provide a protective surface cover, reduce the rate of runoff, and increase the rate of water infiltration. A cropping system that keeps vegetation on the soil for extended periods can generally keep soil losses to an amount that does not reduce the productivity of the soil. On livestock farms, a cropping system that includes grasses and legumes helps to control erosion on sloping land and to provide nitrogen and improve tilth for subsequent crops.

Erosion is mainly controlled in the survey area through cultural practices, such as conservation tillage systems, a cropping system that includes grasses and legumes, cover crops, and a rotation grazing system, rather than through structural measures, such as construction of terraces and diversions. Soils that have irregularly shaped slopes, such as many of the Eden soils, which generally dominant the survey area, are better suited to these cultural practices. Soils that have smooth, uniform slopes, such as Lowell, Nicholson, and Sandview soils, are better suited to contour farming and contour stripcropping. Information about erosion-control measures for each kind of soil in the county is available at the local office of the Natural Resources Conservation Service.

Soil drainage is a major management concern on about 3.5 percent of the soils used for crops or pasture in the survey area. Special permits and extra planning may be required in order to conform with regulations involving the management of drainage in wetlands. The somewhat poorly drained soils in the survey area are so wet that the production of crops is restricted unless the soils are drained. Lawrence and Newark soils are examples of such soils. They make up about 516 acres in the survey area.

Small areas of wetter soils in depressions and along drainageways are commonly included with the moderately well drained Monongahela, Nicholson, and Otwell soils. A drainage system generally is not installed in these moderately well drained soils or their wetter inclusions or in the somewhat poorly drained Lawrence soils. These soils have a hard, compact, brittle fragipan in the subsoil, which limits the depth to which tile drains will function. Open ditches are used in some areas of the somewhat poorly drained Lawrence soils to remove excess water. In areas of the moderately well drained soils, a drainage system

generally is not needed, but the crops that can tolerate slight wetness should be selected for planting.

The maintenance problems and needs of both surface and subsurface drainage systems vary with the kind of soil. A combination of open ditches and tile drainage is used in areas of the somewhat poorly drained Newark soils that are intensively row cropped.

Soil fertility is medium or high in all of the soils in the survey area. Although many of the upland soils formed in parent material high in bases, leaching has resulted in the surface layer and upper part of the subsoil of many of these soils becoming acid. Applications of ground limestone are needed to raise the pH level sufficiently for the production of many crops on these upland soils and also on the soils on flood plains and terraces. The levels of phosphorus and potassium are naturally low in most of the soils in the survey area. Additions of lime and fertilizer should be based on the results of soil tests, the needs of the crop, and the expected level of yields. The Cooperative Extension Service can help to determine the kind and amount of fertilizer and lime needed and the proper method of application.

Tilth is an important factor affecting the germination of seeds and the infiltration of water into the soil. Soils that have good tilth have a surface layer that is granular and porous. Some of the soils in the survey area that are used for crops have a surface layer of silt loam that is light in color and low in organic matter content. Generally, the structure of such soils is weak. A surface crust forms during periods of heavy rainfall. The crust is hard when dry and nearly impervious to water. It reduces the rate of water infiltration and increases the runoff rate. Some of the soils in sloping areas have lost part of their original surface layer through erosion. When the remainder of the plow layer is mixed with the clayey subsoil, the content of clay in the soils increases and, as a result, tilth deteriorates. Other soils have been cropped continuously for long periods. Much of the organic matter has been removed from these soils, and the surface structure has been destroyed. A conservation tillage system, crop residue management, cover crops, a crop rotation system, and applications of manure and other organic material to the soils help to control erosion and improve soil structure, permeability, and soil tilth.

Managing Pasture and Hayland

In 1992, there were more than 22,000 cattle and calves in Bracken and Robertson Counties (Kentucky Agricultural Statistics Service 1993). Although not present in large numbers, sheep and hogs are also raised in the survey area. Most of the hayland and

pasture in the survey area supports a mixture of grasses and legumes. Much of the hay is grown in a hay and pasture rotation system. Most of the hay is rolled into large, round bales when it is harvested.

Because about 34 percent of the total farm income in Bracken and Robertson Counties is derived from the sale of livestock or livestock products, a high-quality forage program is necessary. A successful livestock program depends on a large supply of good-quality, farmgrown feed. A good forage program can furnish as much as 78 percent of the feed required for beef cattle and 66 percent of that required for dairy cattle (Evans and Lacefield 1977). Renovation, brush control, and measures that prevent overgrazing are needed on much of the pasture in the survey area.

The suitability of the soils in the survey area to produce grasses and legumes varies widely because of differences in the depth to bedrock or other root limiting layers, drainage, the available water capacity, and many other properties. The selection of forage species is important and should include those species that are suitable to be planted on the different kinds of soils.

The nearly level and gently sloping soils that are deep and well drained should be used for the most productive crops, such as corn silage, alfalfa, or a mixture of alfalfa and orchardgrass or of alfalfa and timothy. Growing sod-forming grasses, such as tall fescue and bluegrass, in areas of the steeper soils helps to control erosion. Well drained soils that are at least 2 feet deep over bedrock are suited to alfalfa grown with cool-season grasses. The more poorly drained soils and soils that are less than 2 feet deep over bedrock are suited to clover-grass mixtures or to pure stands of clover or grasses. Legumes can be established through renovation in areas that support sod-forming grasses.

The forage species selected for planting should be those that are suited not only to the soil but also to the intended use. They should be those species that provide the maximum quality and versatility in the forage program. Since legumes generally produce higher quality feed than grasses, they should be grown to the maximum extent possible. The taller legumes, such as alfalfa and red clover, are more versatile than legumes used primarily for grazing, such as white clover. Orchardgrass, timothy, and tall fescue are best suited to use as hay and silage.

Tall fescue is an important cool-season grass that is suited to a wide range of soil conditions. It is grown for both hay and pasture. As it grows during the period August through November, the fescue commonly is permitted to accumulate in the field without cutting or grazing. It is then grazed in late fall and in winter.

Applications of nitrogen fertilizer help to achieve the maximum production when the fescue is being allowed to accumulate in the field.

Warm-season grasses, which are planted from early April through late May, alleviate the “summer slump” of cool-season grasses, such as tall fescue and Kentucky bluegrass. They grow well during warm periods, especially from mid-June through September, when the cool-season grasses taper off. Examples of warm-season grasses are switchgrass, big bluestem, indiangrass, and Caucasian bluestem.

Renovation can increase forage yields in areas that have a good stand of grass. It involves partially destroying the sod, applying lime and fertilizer, and seeding desirable forage species (Evans and others 1978). Adding legumes to these grass stands provides high-quality feed. Legumes increase summer production and take nitrogen from the air. Under growing conditions in Kentucky, alfalfa can fix 200 to 300 pounds of nitrogen per acre per year; red clover, 100 to 200 pounds; and ladino clover, 100 to 150 pounds. An acre of Korean lespedeza, vetch, or other annual forage legumes can fix 75 to 100 pounds of nitrogen per year (Evans and others 1978).

Additional information about managing pasture and hayland can be obtained from offices of the Natural Resources Conservation Service and the Kentucky Cooperative Extension 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 5. 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 land capability classification of each map unit also is shown in the table.

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 ensures 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 5 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 Natural Resources 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 (USDA 1961). The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include 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.

Capability classes, the broadest groups, are designated by 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 hazard is the 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, rangeland, woodland, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in the yields table.

Prime Farmland

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. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forest land, or other land, but it is not urban or built-up land or water areas. The soil qualities, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an

acceptable salt and sodium content, and few or no rocks. It is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. The slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

About 12,656 acres in the survey area, or only 6.4 percent of the total acreage, meets the soil requirements for prime farmland. Of this prime farmland acreage, 74 percent, or 9,386 acres, is in Bracken County and 26 percent, or 3,270 acres, is in Robertson County.

The prime farmland is scattered throughout the survey area. In Bracken County, most areas of prime farmland are in the eastern and northern parts of the county, and in Robertson County, most are on flood plains and along the ancient Licking River stream channel, which is from the Pliocene epoch, in the southern part of the county. In both counties, the prime farmland is mainly in general soil map units 1 and 2, which are described under the headings "Soil Descriptions of Bracken County" and "Soil Descriptions of Robertson County" in the section entitled "General Soil Map Units."

Most of this prime farmland is used for crops. The crops grown on this land are mainly tobacco, corn, and hay (fig. 12).

A recent trend in land use in some parts of the survey area has been the loss of some prime farmland to industrial and urban uses. In Robertson County, most of the loss of prime farmland is to residential use, while in Bracken County, it is to both residential and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated. It is magnified by the fact that there is so little prime farmland in the survey area.

The map units in the survey area that are considered prime farmland are listed at the end of the next paragraph. This list does not constitute a recommendation for a particular land use. On some soils included in the list, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps at the back of this publication. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."



Figure 12.—Burley tobacco being harvested in an area of prime farmland. The soil is Otwell silt loam, 2 to 6 percent slopes.

The soil map units in the survey area that meet the requirements for prime farmland are:

AIB	Allegheny loam, 2 to 6 percent slopes	LwB	Lowell silt loam, shale substratum, 2 to 6 percent slopes
AnB	Allegheny loam, 2 to 6 percent slopes, rarely flooded	MgB	Monongahela loam, 2 to 6 percent slopes
Bo	Boonesboro silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)	Ne	Newark silt loam, frequently flooded (where drained and either protected from flooding or not frequently flooded during the growing season)
EkB	Elk silt loam, 2 to 6 percent slopes	NhB	Nicholson silt loam, 2 to 6 percent slopes
ErA	Elk silt loam, 0 to 2 percent slopes, occasionally flooded	No	Nolin silt loam, frequently flooded (where protected from flooding or not frequently flooded during the growing season)
ErB	Elk silt loam, 2 to 6 percent slopes, rarely flooded	OtB	Otwell silt loam, 2 to 6 percent slopes
FwB	Faywood silt loam, 2 to 6 percent slopes	OwB	Otwell silt loam, 2 to 6 percent slopes, rarely flooded
La	Lawrence silt loam, rarely flooded (where drained)	SaB	Sandview silt loam, 2 to 6 percent slopes
LoB	Lowell silt loam, 2 to 6 percent slopes	WhB	Wheeling loam, 2 to 6 percent slopes
		WnB	Wheeling loam, 2 to 6 percent slopes, rarely flooded

Farmland of Statewide Importance

This is land, in addition to prime farmland, that is of statewide importance for the production of food, feed, fiber, and oilseed crops. Generally, farmland of statewide importance includes those soils that almost meet the requirements for prime farmland and that economically produce a high yield of crops when treated and managed according to acceptable farming methods. It is not urban or built-up land or water areas. Some of this farmland may produce as high a yield as prime farmland if conditions are favorable. Generally, this farmland must meet the same criteria as prime farmland, with the exception of slope. Slopes range mainly from 6 to 12 percent. More detailed information about the criteria for farmland of statewide importance is available at the local office of the Natural Resources Conservation Service.

In Bracken County, about 8,651 acres, or 6.5 percent of the total acreage in the county, meets the requirements for farmland of statewide importance. In Robertson County, about 2,677 acres, or 4.2 percent of the total acreage in the county, meets the requirements.

This farmland is scattered throughout the survey area. In Bracken County, most areas are in general soil map units 1, 2, 3, and 5, and in Robertson County, most are in general soil map units 1, 2, and 3, which are described under the headings "Soil Descriptions of Bracken County" and "Soil Descriptions of Robertson County" in the section entitled "General Soil Map Units."

Most of this farmland is used for crops or pasture. The crops grown on this land are mainly tobacco, corn, soybeans, and hay.

An increasing trend in recent years has been the loss of some of this farmland to residential uses or the substitution of this farmland for prime farmland that has been lost to residential or commercial uses. The main loss of this farmland is to residential uses, with several large tracts set aside for future industrial development. The loss is magnified by the fact that there is so little of this farmland in the survey area.

The map units in the survey area that are considered farmland of statewide importance are listed at the end of the next paragraph. This list does not constitute a recommendation for a particular land use. The extent of each listed map unit is shown in table 4. The location is shown on the detailed soil maps. The soil qualities that affect use and management are described under the heading "Detailed Soil Map Units."

The map units that meet the requirements for farmland of statewide importance are:

AiC	Allegheny loam, 6 to 12 percent slopes
EkC	Elk silt loam, 6 to 12 percent slopes
LoC	Lowell silt loam, 6 to 12 percent slopes
LwC2	Lowell silt loam, shale substratum, 6 to 12 percent slopes, eroded
MgC	Monongahela loam, 6 to 12 percent slopes
NhC	Nicholson silt loam, 6 to 12 percent slopes
OtC	Otwell silt loam, 6 to 12 percent slopes
WhC	Wheeling loam, 6 to 12 percent slopes
WoC	Woolper silty clay loam, 4 to 12 percent slopes

Woodland Management and Productivity

About 66,000 acres in Bracken and Robertson Counties, or about 34 percent of the land area, is commercial woodland (Kinsley and Powell 1978). The survey area is in the Western Mesophytic Forest Region. The characteristic trees in this region are American beech, American sycamore, black locust, black oak, black walnut, chestnut oak, chinkapin oak, hickory, northern red oak, pin oak, red maple, sugar maple, white ash, white oak, and yellow poplar. The dominant forest types are oak-hickory, which makes up about 45 percent of the forest land; central mixed hardwoods, 24 percent; elm-ash, 14 percent; redcedar-hardwoods, 11 percent; and willows, white ash, and maple-beech, 6 percent.

The wooded tracts in the survey area are mostly private holdings varying in size from a few acres to 100 or more acres. Much of this woodland is part of a farming operation and is essentially unmanaged for wood production. With the exception of small areas along the Ohio River in the northern part of Bracken County, livestock access is restricted in few areas and woodland is generally overgrazed. Many stands are not well stocked with high-quality trees but are a mixture of eastern redcedar, black locust, and previously cutover hardwoods. The woodland can be improved by restricting livestock access, removing low-quality trees and shrubs, replanting suitable seedlings, or applying other woodland management practices common to the area.

The wood industry in the survey area consists mainly of small, private loggers, who harvest timber for landowners for sale to sawmills in other counties. Several small mills are operated from time to time in Robertson County. These small outfits mostly harvest and process eastern redcedar for fenceposts and some lumber.

Table 7 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. In

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

Erosion hazard is the probability that damage will occur as a result of site preparation and cutting where the soil is exposed along roads, skid trails, and fire lanes and in log-handling areas. Forests that have been burned or overgrazed are also subject to erosion. Ratings of the erosion hazard are based on the percent of the slope. A rating of *slight* indicates that no particular prevention measures are needed under ordinary conditions. A rating of *moderate* indicates that erosion-control measures are needed in certain silvicultural activities. A rating of *severe* indicates that special precautions are needed to control erosion in most silvicultural activities.

Equipment limitation reflects the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. The chief characteristics and conditions considered in the ratings are slope, stones on the surface, rock outcrops, soil wetness, and texture of the surface layer. A rating of *slight* indicates that under normal conditions the kind of equipment and season of use are not significantly restricted by soil factors. Soil wetness can restrict equipment use, but the wet period does not exceed 1 month. A rating of *moderate* indicates that equipment use is moderately restricted because of one or more soil factors. If the soil is wet, the wetness restricts equipment use for a period of 1 to 3 months. A rating of *severe* indicates that equipment use is severely restricted either as to the kind of equipment that can be used or the season of use. If the soil is wet, the wetness restricts equipment use for more than 3 months.

Seedling mortality refers to the death of naturally occurring or planted tree seedlings, as influenced by the kinds of soil, soil wetness, or topographic conditions. The factors used in rating the soils for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, effective rooting depth, and slope aspect. A rating of *slight* indicates that seedling mortality is not likely to be a problem under normal conditions. Expected mortality is less than 25 percent. A rating of *moderate* indicates that some problems from seedling mortality can be expected. Extra precautions are advisable. Expected mortality is 25 to 50 percent. A rating of *severe* indicates that seedling mortality is a serious problem. Extra precautions are important. Replanting may be necessary. Expected mortality is more than 50 percent.

Plant competition ratings indicate the degree to which undesirable species are expected to invade and grow when openings are made in the tree canopy. The main factors that affect plant competition are depth to the water table and the available water capacity. A rating of *slight* indicates that competition from undesirable plants is not likely to prevent natural regeneration or suppress the more desirable species. Planted seedlings can become established without undue competition. A rating of *moderate* indicates that competition may delay the establishment of desirable species. Competition may hamper stand development, but it will not prevent the eventual development of fully stocked stands. A rating of *severe* indicates that competition can be expected to prevent regeneration unless precautionary measures are applied.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index* and as a *volume* number. The site 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 (Applequist 1959; Beck 1962; Boisen and Newlin 1910; Broadfoot 1960, 1963, 1964; Broadfoot and Krinard 1959; Coile and Schumacher 1953; Doolittle 1960; Nelson, Clutter, and Chaiken 1961; Olson 1959; Schnur 1937; TVA unpublished; USDA 1976). 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.

The *volume*, a number, is the yield likely to be produced by the most important trees. This number, expressed as cubic feet per acre per year, indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand.

The first species listed under *common trees* for a soil is the indicator species for that soil. It generally is the most common species on the soil and is the one that determines the ordination class.

Trees to plant are those that are suitable for commercial wood production.

Recreation

The soils of the survey area are rated in table 8 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 sewer lines. 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 recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In the table, 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 a combination of these measures.

The information in the table can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 11 and interpretations for dwellings without basements and for local roads and streets in table 10.

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

The principal kinds of wildlife in Bracken and Robertson Counties are cottontail rabbit, gray squirrel, fox squirrel, raccoon, opossum, skunk, red fox, gray fox, white-tailed deer, wild turkey, coyote, bobwhite quail, grouse, and mourning dove. A number of predatory birds also are in the survey area. They include barn owl, screech owl, sparrow hawk, Cooper's hawk, red-tailed hawk, and the occasional osprey and bald eagle along the Ohio River. The survey area also includes many other species of birds and mammals. It has about 34 species of mammals, 110 species of birds, and 33 species of reptiles and amphibians. Although the types of habitat required by wildlife vary, deer and squirrels generally use woodland habitat; rabbit, quail, and dove use openland habitat; and duck and geese use wetland habitat.

Photographers, birdwatchers, sportsmen, and others are interested in the flora and fauna of Bracken and Robertson Counties. The ponds and streams in the survey area are inhabited by a variety of fish, including warm-water game fish, panfish, and rough fish. Examples are largemouth bass and bluegill.

Successful management of wildlife habitat requires a suitable combination of food, cover, and water. Lack of any one of these necessities, an imbalance between them, or an inadequate distribution of them can severely limit or eliminate the population of desirable wildlife species.

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 9, the soils in the survey area are rated according to their potential for providing habitat for

various kinds of wildlife (Wildlife Management Institute 1963). 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 flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, 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, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, orchardgrass, 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 flooding. Soil temperature and soil moisture are also considerations. Examples

of wild herbaceous plants are chicory, goldenrod, beggarweed, aster, and ragweed.

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, available water capacity, and wetness. Examples of these plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, and blackberry. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants furnish browse 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 Virginia pine, white pine, and red cedar.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, cattail, 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. Wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and red fox.

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, deer, and black bear.

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, muskrat, mink, and beaver.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for 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 should 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 or 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 kinds 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 evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways,

pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and 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 10 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 or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and 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, shrinking and swelling, and organic layers can cause the movement of footings. A high water table, depth to bedrock, large stones, slope, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 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, 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, 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, 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 11 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. 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.

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, and flooding affect absorption of the effluent. Large stones and bedrock 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.

The table 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, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in 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 and bedrock 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 should be considered.

The ratings in the table 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, and soil reaction affect trench 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 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 wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 12 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 to 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, a 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 a 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 have a water table at a depth of 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. They are used in many kinds of construction. Specifications for each use vary widely. In the table, 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 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 or stones, 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 or stones, have slopes of more than 15 percent, or have a seasonal high 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 13 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 and for embankments, dikes, and levees. 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, boulders, or organic matter. A high water table affects the amount of usable material. It also affects trafficability.

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; and susceptibility to flooding. 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 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 control 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 erosion 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 affect the construction of grassed waterways. A hazard of erosion, low available water capacity, restricted rooting depth, 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 (Karathanasis and others 1986; USDA 1967). Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, 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 14 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 the heading "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 about 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 (ASTM 1993) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO 1986).

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, CL-ML.

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 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than

3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

Table 15 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, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $\frac{1}{3}$ -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 and septic tank absorption fields (Uhland and O'Neal 1951).

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 the basis of 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 classes are *low*, a change of less than 3 percent;

moderate, 3 to 6 percent; *high*, 6 to 9 percent; and *very high*, more than 9 percent.

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 0.02 to 0.64. Other factors being equal, 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.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In the table, 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 in 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 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, 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 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, and water standing in swamps and marshes is considered ponding rather than flooding.

The table 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, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 days to 1 month, and *very long* if more than 1 month. Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

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 little or no horizon development.

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 estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. Indicated in the table are the

depth to the seasonal high water table; the kind of water table—that is, perched 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 the table.

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. 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.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

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 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.

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 results in a severe hazard of corrosion. 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.

Physical and Chemical Analyses of Selected Soils

The results of physical analyses of several typical pedons in the survey area are given in table 17 and the results of chemical analyses in table 18. The data are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are typical of the series. They are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Kentucky Agricultural Experiment Station, Lexington, Kentucky.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an oven-dry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods (Karathanasis and others 1986; USDA 1996).

Coarse materials—(2-75 mm fraction) weight estimates of the percentages of all material less than 75 mm (3B1a).

Coarse materials—(2-250 mm fraction) volume estimates of the percentages of all material greater than 2 mm (2A2).

Sand—(0.05-2.0 mm fraction) weight percentages of material less than 2 mm (3A1).

Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).

Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1).

Organic carbon—dichromate, carbon dioxide evolution (6A1a).

Extractable cations—ammonium acetate pH 7.0, atomic absorption; calcium (6N2z), magnesium (6O2z), sodium (6P2z), potassium (6Q2z).

Extractable cations—ammonium acetate pH 7.0, uncorrected; calcium (6N2a), magnesium (6O2a); flame photometry; sodium (6P2a), potassium (6Q1a).

Extractable acidity—barium chloride-triethanolamine I (6H1a).

Cation-exchange capacity—ammonium acetate, pH 7.0 (5A1a).

Cation-exchange capacity—sum of cations (5A3a).

Base saturation—ammonium acetate, pH 7.0 (5C1).

Base saturation—sum of cations, TEA, pH 8.2 (5C3).

Reaction (pH)—potassium chloride (8C1c).

Available phosphorus—Bray P-1 (6S6).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff 1975). 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. Eleven 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; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalf*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup 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 taxonomic class. 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. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle size, mineral content, soil temperature regime, soil depth, and reaction. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, mixed, mesic Typic Hapludalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each 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" (Soil Survey Division Staff 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (Soil Survey Staff 1975) and in "Keys to Soil Taxonomy" (Soil Survey Staff 1992). Unless otherwise indicated, 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."

Allegheny Series

Depth: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: River valleys and uplands

Landscape position: Stream terraces and on ridgetops above the Licking River

Parent material: On uplands—old loamy alluvium that is derived from sandstone, siltstone, and shales

from the eastern part of Kentucky and follows along an ancient Pliocene river channel of the Tertiary System; on stream terraces—alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Slope: 2 to 20 percent

Associated soils: On terraces—Elk, Lawrence, Monongahela, Otwell, Woolper; on ridgetops—Cynthiana, Eden, Faywood, Lowell, Monongahela

Taxonomic class: Fine-loamy, mixed, mesic Typic Hapludults

Typical Pedon

Allegheny loam, 6 to 12 percent slopes, in Robertson County (soil atlas sheet 23); 1.5 miles southeast of an old church in Kentontown, 0.4 mile west of the confluence of Cedar Creek and the Licking River, 500 feet east of the Licking River, 400 feet south of barn; USGS Shady Nook Quadrangle; lat. 38 degrees 28 minutes 43 seconds N. and long. 84 degrees 7 minutes 47 seconds W.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) and brown (10YR 4/3) loam; moderate medium granular structure; very friable; common fine roots; 1 percent rounded quartz pebbles; neutral; abrupt smooth boundary.

Bt1—9 to 22 inches; strong brown (7.5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; 1 percent rounded quartz pebbles; moderately acid; clear smooth boundary.

Bt2—22 to 45 inches; strong brown (7.5YR 5/6 and 4/6) sandy clay loam; moderate medium subangular blocky structure; friable; common faint clay films on faces of peds; 1 percent rounded quartz pebbles; strongly acid; clear smooth boundary.

Bt3—45 to 65 inches; strong brown (7.5YR 5/8) clay loam; few medium distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; common faint clay films on faces of peds; 1 percent rounded quartz pebbles; strongly acid.

Range in Characteristics

Thickness of the solum: 40 to 70 inches

Depth to bedrock: More than 60 inches

Content of clay in the control section: 18 to 35 percent

Kind of rock fragments: Rounded quartz pebbles

Reaction: Unless limed, strongly acid to slightly acid throughout the profile

Ap horizon:

Hue—10YR

Value—4 or 5

Chroma—3 or 4

Texture of the fine-earth fraction—loam

Content of rock fragments—0 to 15 percent

Bt horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—6 to 8

Texture of the fine-earth fraction—clay loam, loam, or sandy clay loam

Content of rock fragments—0 to 30 percent

BC horizon (if it occurs):

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—6 to 8

Texture of the fine-earth fraction—clay loam or sandy loam

Content of rock fragments—10 to 35 percent

Boonesboro Series

Depth: Moderately deep

Drainage class: Well drained

Permeability: Moderate in the A horizon and rapid in the B horizon

Landform: Stream valleys

Landscape position: Low flood plains in narrow valleys

Parent material: Loamy alluvium derived from calcareous shale and limestone and deposited over the limestone bedrock of the Point Pleasant Formation in Bracken County and, of minor extent, over the Lexington Limestone Formation in Robertson County; Ordovician System

Slope: 0 to 2 percent

Associated soils: Newark, Nolin, Woolper

Taxonomic class: Fine-loamy, mixed, mesic Fluventic Hapludolls

Typical Pedon

Boonesboro silt loam, frequently flooded, in Bracken County (soil atlas sheet 4); 2 miles southeast of the junction of Kentucky Highway 8 and Kentucky Highway 435, about 800 feet south of the confluence of Bee Run and Bracken Creek, 240 feet north of the junction of a gravel road and Kentucky Highway 435, about 200 feet west of a gravel road crossing at Bracken Creek; USGS Higginsport Quadrangle; lat. 38 degrees 45 minutes 05 seconds N. and long. 83 degrees 58 minutes 52 seconds W.

Ap—0 to 8 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate fine and medium granular structure; very friable; common fine roots;

2 to 5 percent limestone channers and flagstones; neutral; clear smooth boundary.

A—8 to 16 inches; dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; moderate medium granular structure; friable; few fine roots; 2 to 5 percent limestone channers and flagstones; slightly alkaline; clear smooth boundary.

B—16 to 26 inches; dark yellowish brown (10YR 4/4) flaggy silt loam; moderate medium subangular blocky structure; friable; few fine roots; 25 percent limestone channers and flagstones; moderately alkaline; abrupt smooth boundary.

R—26 inches; hard limestone bedrock.

Range in Characteristics

Thickness of the solum: 20 to 40 inches

Depth to bedrock: 20 to 40 inches

Content of clay in the control section: 18 to 35 percent

Kind of rock fragments: Limestone channers and flagstones

Reaction: Unless limed, slightly acid to moderately alkaline

Ap and A horizons:

Hue—10YR

Value—3 (5 dry)

Chroma—3 (3 dry)

Texture of the fine-earth fraction—silt loam

Content of rock fragments—2 to 14 percent

B horizon:

Hue—10YR or 7.5YR

Value—3 or 4

Chroma—3 or 4

Texture of the fine-earth fraction—silt loam or silty clay loam

Content of rock fragments—15 to 34 percent

Cynthiana Series

Depth: Shallow

Drainage class: Well drained or somewhat excessively drained

Permeability: Moderately slow

Landform: Uplands

Landscape position: Side slopes

Parent material: Bracken County—clayey residuum derived from the Point Pleasant Formation; Robertson County—clayey residuum derived from the Grier and Tanglewood Members of the Lexington Limestone Formation and from the Clays Ferry Formation; Ordovician System

Slope: 6 to 35 percent

Associated soils: Allegheny, Eden, Fairmount, Faywood, Lowell, Woolper

Taxonomic class: Clayey, mixed, mesic Lithic Hapludalfs

Typical Pedon

Cynthiana flaggy silty clay loam, in an area of Cynthiana-Faywood complex, rocky, 20 to 35 percent slopes, eroded, in Bracken County (soil atlas sheet 3); 0.3 mile west-northwest of the bridge at Locust Creek on Kentucky Highway 8, about 1,000 feet south of the Chesapeake and Ohio Railroad tracks, 160 feet southwest of Kentucky Highway 8; USGS Felicity Quadrangle; lat. 38 degrees 46 minutes 29 seconds N. and long. 84 degrees 07 minutes 26 seconds W.

A—0 to 4 inches; dark yellowish brown (10YR 4/4) flaggy silty clay loam; weak medium and fine subangular blocky structure; firm; many fine roots; 20 percent limestone flagstones; neutral; clear smooth boundary.

Bt1—4 to 10 inches; light olive brown (2.5Y 5/4 and 5/6) flaggy clay; moderate medium and fine subangular blocky structure; firm; common fine roots; few faint clay films on faces of peds; 15 percent limestone flagstones; moderately alkaline; clear smooth boundary.

Bt2—10 to 17 inches; yellowish brown (10YR 5/6) flaggy clay; firm; moderate medium subangular blocky structure; few fine roots; few faint clay films on faces of peds; 20 percent limestone flagstones and channers; moderately alkaline; abrupt smooth boundary.

R—17 inches; hard limestone bedrock.

Range in Characteristics

Thickness of the solum: 10 to 20 inches

Depth to bedrock: 10 to 20 inches

Content of clay in the control section: 40 to 60 percent

Kind of rock fragments: Limestone flagstones and channers

Reaction: Unless limed, neutral to moderately alkaline

A horizon:

Hue—10YR

Value—3 or 4

Chroma—3 or 4

Texture of the fine-earth fraction—silty clay loam

Content of rock fragments—15 to 30 percent

Bt horizon:

Hue—2.5Y or 10YR

Value—4 or 5

Chroma—4 to 6

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—5 to 34 percent

C horizon (if it occurs):

Hue—2.5Y or 10YR

Value—4 or 5

Chroma—4 to 6

Lithochromic mottles—in shades of brown, olive, or gray

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—5 to 35 percent

Eden Series*Depth:* Moderately deep*Drainage class:* Well drained*Permeability:* Slow*Landform:* Uplands*Landscape position:* Ridgetops and side slopes*Parent material:* Clayey residuum derived from interbedded calcareous shale, siltstone, and limestone of the Kope and Clays Ferry Formations; Ordovician System*Slope:* 6 to 35 percent*Associated soils:* Allegheny, Cynthiana, Fairmount, Faywood, Lowell, Monongahela, Nicholson, Woolper*Taxonomic class:* Fine, mixed, mesic Typic Hapludalfs**Typical Pedon**

Eden flaggy silty clay loam, 20 to 35 percent slopes, eroded, in Bracken County (soil atlas sheet 7); 4.1 miles north of Germantown, 1.4 miles west of the Bracken-Mason County line, 625 feet west of Bracken Creek, 250 feet southwest of Kentucky Highway 546; USGS Germantown Quadrangle; lat. 38 degrees 42 minutes 52 seconds N. and long. 84 degrees 57 minutes 36 seconds W.

A—0 to 3 inches; dark yellowish brown (10YR 4/4) flaggy silty clay loam; moderate medium subangular blocky structure parting to moderate medium granular; firm; many fine roots; 15 percent limestone flagstones; slightly alkaline; gradual smooth boundary.

Bt1—3 to 11 inches; light olive brown (2.5Y 5/3) silty clay; common medium prominent yellowish brown (10YR 5/6) lithochromic mottles; moderate medium angular blocky and subangular blocky structure; firm; common fine and few coarse roots; 10 percent limestone flagstones; common distinct clay films on faces of peds; moderately alkaline; gradual smooth boundary.

Bt2—11 to 20 inches; light olive brown (2.5Y 5/3) channery silty clay; moderate medium angular blocky and subangular blocky structure with some relict platy; firm; common fine and few coarse

roots; 20 percent limestone channers; many distinct clay films on faces of peds; moderately alkaline; diffuse smooth boundary.

Bt3—20 to 27 inches; light olive brown (2.5Y 5/3) silty clay; few fine faint grayish brown (2.5Y 5/2) lithochromic mottles; weak medium angular blocky and subangular blocky structure with some relict platy; firm; few fine and medium roots; 10 percent shale fragments; many distinct clay films on faces of peds; moderately alkaline; gradual smooth boundary.

BC—27 to 36 inches; olive (5Y 5/3) extremely channery silty clay; common fine and medium distinct light olive brown (2.5Y 5/4) lithochromic mottles; moderate medium and fine platy structure with some moderate medium angular blocky; very firm; few fine roots; 60 percent shale fragments; common distinct clay films on faces of peds; moderately alkaline; clear smooth boundary.

Cr—36 inches; olive (5Y 5/3), soft, layered, calcareous shale; moderately alkaline.

Range in Characteristics*Thickness of the solum:* 14 to 40 inches*Depth to paralithic contact:* 20 to 40 inches*Content of clay in the control section:* 40 to 60 percent*Kind of rock fragments:* Limestone channers and flagstones*Reaction:* Unless limed, strongly acid to moderately alkaline in the solum and slightly alkaline or moderately alkaline in the substratum*A horizon:*

Hue—10YR

Value—3 to 5

Chroma—3 or 4

Texture of the fine-earth fraction—silty clay loam

Content of rock fragments—15 to 20 percent

Bt horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—3 to 6

Lithochromic mottles—in shades of brown, gray, and olive

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—10 to 30 percent

BC and C horizons:

Hue—2.5Y or 5Y

Value—5

Chroma—3 or 4

Lithochromic mottles—in shades of gray, olive, or brown

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—25 to 75 percent

Elk Series

Depth: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: River and stream valleys and uplands

Landscape position: Terraces throughout the survey area and ridgetops in the southern part of Robertson County

Parent material: On terraces—mixed alluvium derived from limestone, siltstone, shale, and sandstone of the Quaternary System; upland deposits in the southern part of Robertson County—mixed alluvium that is derived from sandstone, siltstone, shale, and limestone from the eastern part of Kentucky and follows an ancient Pliocene river channel of the Tertiary System

Slope: 0 to 12 percent

Associated soils: Allegheny, Lawrence, Lowell, Monongahela, Otwell, Wheeling, Woolper

Taxonomic class: Fine-silty, mixed, mesic Ultic Hapludalfs

Typical Pedon

Elk silt loam, 2 to 6 percent slopes, rarely flooded, in Bracken County (soil atlas sheet 17); 0.5 mile southeast of Milford, 400 yards south of Kentucky Highway 539, about 200 feet north of the North Fork of the Licking River; USGS Claysville Quadrangle; lat. 38 degrees 34 minutes 40 seconds N. and long. 84 degrees 08 minutes 57 seconds W.

Ap—0 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular and weak medium subangular blocky structure; very friable; few fine roots; slightly alkaline; clear smooth boundary.

BA—9 to 14 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium subangular blocky structure; friable; neutral; clear smooth boundary.

Bt1—14 to 27 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; few faint clay films on faces of ped; moderately acid; gradual smooth boundary.

Bt2—27 to 65 inches; yellowish brown (10YR 5/6) silty clay loam; few fine faint dark yellowish brown (10YR 5/4) lithochromic mottles; moderate medium subangular blocky structure; friable; common distinct clay films on faces of ped; strongly acid.

Range in Characteristics

Thickness of the solum: 40 to 60 inches or more

Depth to bedrock: More than 60 inches

Content of clay in the control section: 18 to 34 percent
Kind of rock fragments: Small, rounded quartz pebbles

Reaction: Unless limed, very strongly acid to slightly acid

Ap horizon:

Hue—10YR

Value—4 or 5

Chroma—2 to 4

Texture of the fine-earth fraction—silt loam

Content of rock fragments—0 to 5 percent

BA horizon:

Hue—10YR

Value—4 or 5

Chroma—3 or 4

Texture of the fine-earth fraction—silt loam or loam

Content of rock fragments—0 to 5 percent

Bt horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—4 to 6

Lithochromic mottles—in shades of gray in the lower part

Texture of the fine-earth fraction—silt loam or silty clay loam

Content of rock fragments—0 to 5 percent

C horizon (if it occurs):

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—4 to 6

Lithochromic mottles—in shades of gray or brown

Texture of the fine-earth fraction—silt loam or silty clay loam

Content of rock fragments—0 to 35 percent

Fairmount Series

Depth: Shallow

Drainage class: Well drained

Permeability: Moderately slow

Landform: Uplands

Landscape position: Side slopes

Parent material: Clayey residuum derived from the limestone of the Grier and Tanglewood Members of the Lexington Limestone Formation and from the limestone and shale of the Fairview Formation; Ordovician System

Slope: 20 to 60 percent

Associated soils: Cynthiana, Eden, Faywood, Woolper

Taxonomic class: Clayey, mixed, mesic Lithic Hapludolls

Typical Pedon

Fairmount flaggy silty clay loam, very rocky, 20 to 60 percent slopes, in Robertson County (soil atlas sheet 23); 2 miles south of the junction of Hiett Road and U.S. Highway 62 near Kentontown, 400 feet south of a gravel road, 200 feet north of the Licking River; USGS Shady Nook Quadrangle; lat. 38 degrees 29 minutes 12 seconds N. and long. 84 degrees 09 minutes 42 seconds W.

A—0 to 11 inches; dark brown (10YR 3/3) flaggy silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure parting to weak fine granular; friable and firm; common fine and medium roots; 30 percent limestone flagstones; moderately alkaline; clear wavy boundary.

Bw—11 to 17 inches; dark yellowish brown (10YR 4/4) flaggy clay; weak medium subangular blocky and angular blocky structure; firm and very firm; few fine and coarse roots; 30 percent limestone flagstones; neutral; abrupt smooth boundary.

R—17 inches; hard limestone bedrock.

Range in Characteristics

Thickness of the solum: 10 to 20 inches

Depth to bedrock: 10 to 20 inches

Content of clay in the control section: 40 to 60 percent

Kind of rock fragments: Limestone channers and flagstones

Reaction: Neutral to moderately alkaline

A horizon:

Hue—10YR

Value—3 (4 dry)

Chroma—2 or 3 (2 dry)

Texture of the fine-earth fraction—silty clay loam

Content of rock fragments—15 to 35 percent

Bw horizon:

Hue—10YR or 2.5Y

Value—4 or 5

Chroma—2 to 4

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—5 to 35 percent

Faywood Series

Depth: Moderately deep

Drainage class: Well drained

Permeability: Moderately slow and slow

Landform: Uplands

Landscape position: Ridgetops and side slopes

Parent material: On ridgetops—clayey residuum derived from limestone and shale of the Grant

Lake and Fairview Formations; on side slopes in Bracken County—clayey residuum derived from limestone of the Point Pleasant Formation; on side slopes in Robertson County—clayey residuum derived from limestone and shale of the Grier and Tanglewood Members of the Lexington Limestone and Clays Ferry Formations; Ordovician System

Slope: 2 to 35 percent

Associated soils: Allegheny, Cynthiana, Eden, Fairmount, Lowell, Nicholson, Woolper

Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Faywood silt loam, in an area of Cynthiana-Faywood complex, rocky, 20 to 35 percent slopes, eroded, in Bracken County (soil atlas sheet 3); 1.4 miles north-northwest of Kentucky Highway 546 at Woolcott, 0.9 mile southwest of the junction of Kentucky Highway 1159 and Kentucky Highway 1838, about 1,000 feet southeast of the confluence of Big Run Creek and Locust Creek, 120 feet south of a paved road; USGS Felicity Quadrangle; lat. 38 degrees 45 minutes 03 seconds N. and long. 84 degrees 06 minutes 45 seconds W.

A—0 to 4 inches; dark brown (10YR 4/3) silt loam; moderate medium granular structure; very friable; many fine and medium roots; moderately alkaline; clear smooth boundary.

BA—4 to 7 inches; dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/6) silty clay loam; moderate medium and fine subangular blocky structure; firm; common fine roots; slightly acid; clear smooth boundary.

Bt1—7 to 13 inches; yellowish brown (10YR 5/4) clay; moderate medium subangular blocky structure; firm; common fine roots; many distinct clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—13 to 20 inches; yellowish brown (10YR 5/6) clay; weak medium angular blocky and subangular blocky structure; very firm; few fine roots; 15 percent limestone channers; many distinct clay films on faces of peds; neutral; gradual wavy boundary.

C—20 to 32 inches; brownish yellow (10YR 6/6) and light yellowish brown (2.5Y 6/3) very channery silty clay; massive; very firm; 35 percent limestone channers; slightly alkaline; clear wavy boundary.

R—32 inches; hard limestone bedrock.

Range in Characteristics

Thickness of the solum: 20 to 40 inches

Depth to bedrock: 20 to 40 inches

Content of clay in the control section: 35 to 60 percent

Kind of rock fragments: Limestone channers and flagstones

Reaction: Unless limed, moderately acid to mildly alkaline

A and Ap horizons:

Hue—10YR

Value—4 or 5

Chroma—2 or 3

Texture of the fine-earth fraction—silt loam

Content of rock fragments—0 to 15 percent

BA horizon:

Hue—10YR

Value—4 or 5

Chroma—3 to 5

Texture of the fine-earth fraction—silty clay loam

Content of rock fragments—0 to 15 percent

Bt horizon:

Hue—7.5YR or 10YR

Value—4 to 6

Chroma—3 to 6

Lithochromic mottles in the lower part of the horizon—in shades of brown or olive

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—0 to 15 percent

C horizon:

Hue—10YR or 2.5Y

Value—4 to 6

Chroma—3 to 6

Lithochromic mottles—in shades of brown, olive, or gray

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—0 to 35 percent

Lawrence Series

Depth: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderate above the fragipan and slow in the fragipan

Landform: River valleys

Landscape position: Stream terraces along the Ohio River, North Fork of the Licking River, and Licking River

Parent material: Mixed alluvium derived from limestone, siltstone, and shale of the Quaternary System

Slope: 0 to 4 percent

Associated soils: Allegheny, Elk, Monongahela, Otwell, Wheeling

Taxonomic class: Fine-silty, mixed, mesic Aquic Fragiudalfs

Typical Pedon

Lawrence silt loam, rarely flooded, in Bracken County (soil atlas sheet 1); 2.0 miles west of Milford, 0.7 mile west of the junction of Gurell Lane and Riley Mill Road, 320 feet south of Gurell Lane, 150 feet east of a farm fence; USGS Claysville Quadrangle; lat. 38 degrees 34 minutes 58 seconds N. and long. 84 degrees 11 minutes 44 seconds W.

Ap—0 to 8 inches; yellowish brown (10YR 5/4) silt loam; moderate medium granular structure; friable; slightly acid; clear smooth boundary.

Bt1—8 to 18 inches; dark yellowish brown (10YR 4/6) and strong brown (7.5YR 4/6) silty clay loam; common fine distinct grayish brown (10YR 5/2) redox depletions; moderate medium subangular blocky structure; friable; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

Btx—18 to 32 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 4/6) silty clay loam; common fine distinct grayish brown (10YR 5/2) redox depletions; strong coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle; common faint silt coatings on faces of peds and prisms; common distinct clay films on faces of peds; strongly acid; gradual smooth boundary.

2Bt2—32 to 52 inches; yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) silty clay loam; common medium distinct dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) redox depletions; moderate medium subangular blocky structure; firm; common faint clay films on faces of peds; common medium manganese concretions; neutral; gradual smooth boundary.

2BC—52 to 80 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) redox depletions; weak medium subangular blocky structure; firm; few medium manganese concretions; neutral.

Range in Characteristics

Thickness of the solum: 40 to 80 inches

Depth to bedrock: More than 80 inches

Depth to the fragipan: 18 to 32 inches

Content of clay in the control section: 18 to 35 percent

Kind of rock fragments: Rounded quartz pebbles

Reaction: Unless limed, very strongly acid to slightly acid above the fragipan, strongly acid or very strongly acid in the fragipan, and very strongly acid to neutral below the fragipan

Ap horizon:

Hue—10YR
 Value—4 or 5
 Chroma—2 to 4
 Texture of the fine-earth fraction—silt loam
 Content of rock fragments—0 to 2 percent

Bt horizon:

Hue—7.5YR and 10YR
 Value—4 or 5
 Chroma—6 to 8
 Redoximorphic features—chroma of 2 or less and shades of brown
 Texture of the fine-earth fraction—silt loam or silty clay loam
 Content of rock fragments—0 to 2 percent

Btx horizon:

Hue—7.5YR to 2.5Y
 Value—4 to 6
 Chroma—1 to 8
 Redoximorphic features—in shades of gray and brown
 Texture of the fine-earth fraction—silt loam or silty clay loam
 Content of rock fragments—0 to 2 percent

2Bt horizon:

Hue—7.5YR to 2.5Y
 Value—4 to 6
 Chroma—1 to 8
 Redoximorphic features—in shades of gray and brown
 Texture of the fine-earth fraction—silty clay loam or silty clay
 Content of rock fragments—0 to 3 percent

2BC horizon:

Hue—7.5YR to 2.5Y
 Value—4 to 6
 Chroma—1 to 8
 Redoximorphic features—in shades of gray and brown
 Texture of the fine-earth fraction—silty clay or clay
 Content of rock fragments—0 to 5 percent

Lowell Series

Depth: Deep and very deep

Drainage class: Well drained

Permeability: Moderately slow

Landform: Uplands

Landscape position: Ridgetops and side slopes

Parent material: Clayey residuum derived from calcareous shales, siltstone, and limestone of the Fairview Formation; Bracken County—clayey

residuum derived from the limestone of the Grant Lake and Point Pleasant Formations; Robertson County—clayey residuum derived from the limestone of the Grier and Tanglewood Members of the Lexington Limestone Formation; Ordovician System

Slope: 2 to 20 percent

Associated soils: Allegheny, Cynthiana, Eden, Elk, Faywood, Nicholson, Sandview, Woolper

Taxonomic class: Fine, mixed, mesic Typic Hapludalfs

Typical Pedon

Lowell silt loam, shale substratum, 6 to 12 percent slopes, eroded, in Bracken County (soil atlas sheet 9); 1.5 miles southwest of Brooksville, 0.5 mile north of the junction of Kentucky Highway 19 and Kelly Ridge Road, 300 feet east of Kelly Ridge Road; USGS Brooksville Quadrangle; lat. 38 degrees 40 minutes 28 seconds N. and long. 84 degrees 05 minutes 45 seconds W.

Ap—0 to 5 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine and medium granular structure; very friable; common fine roots; neutral; clear smooth boundary.

Bt1—5 to 15 inches; yellowish brown (10YR 5/6) silty clay; moderate medium subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; slightly acid; clear smooth boundary.

Bt2—15 to 28 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct yellowish brown (10YR 5/8) and brownish yellow (10YR 6/6) lithochromic mottles; moderate medium subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

Bt3—28 to 46 inches; yellowish brown (10YR 5/6 and 5/8) clay; common medium faint brownish yellow (10YR 6/6) and common medium distinct pale brown (10YR 6/3) lithochromic mottles; weak medium angular blocky structure; very firm; common faint clay films on faces of peds; strongly acid; clear smooth boundary.

C—46 to 62 inches; yellowish brown (10YR 5/6 and 5/8) silty clay; massive; firm; 10 percent siltstone fragments, 3 to 6 inches in length; slightly acid; abrupt smooth boundary.

Cr—62 to 66 inches; soft, weathered siltstone and shale interbedded with thin layers of hard limestone.

Range in Characteristics

Thickness of the solum: 30 to 60 inches

Depth to bedrock: 40 to 80 inches or more

Content of clay in the control section: 35 to 60 percent

Kind of rock fragments: Limestone and siltstone channers and flagstones

Reaction: Unless limed, slightly acid to very strongly acid to a depth of about 30 inches and strongly acid to slightly alkaline below 30 inches

Ap horizon:

Hue—10YR

Value—4

Chroma—2 to 4

Texture of the fine-earth fraction—silt loam

Content of rock fragments—0 to 5 percent

Bt horizon:

Hue—7.5YR or 10YR

Value—4 to 6

Chroma—3 to 8

Lithochromic mottles—in shades of brown, red, or gray in the lower part of the horizon

Texture of the fine-earth fraction—silty clay loam, silty clay, or clay

Content of rock fragments—0 to 5 percent

C horizon:

Hue—7.5YR to 2.5Y

Value—5

Chroma—4 to 8

Lithochromic mottles—in shades of brown, olive, or gray

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—0 to 40 percent

Cr horizon:

Interbedded siltstone, shale, and limestone

R horizon (if it occurs):

Unweathered limestone bedrock with thin layers of shale

Monongahela Series

Depth: Very deep

Drainage class: Moderately well drained

Permeability: Moderately slow and slow

Landform: River valleys and uplands

Landscape position: Stream terraces and on ridgetops above the Licking River in Robertson County

Parent material: On uplands—loamy alluvium that is derived from sandstone, siltstone, and shale of eastern Kentucky and follows an ancient Pliocene river channel of the Tertiary System; stream terraces—loamy alluvium derived from sandstone, siltstone, shale, and limestone of the Quaternary System

Slope: 2 to 12 percent

Associated soils: Allegheny, Eden, Elk, Lawrence, Otwell

Taxonomic class: Fine-loamy, mixed, mesic Typic Fragiudults

Typical Pedon

Monongahela loam, 2 to 6 percent slopes, in Bracken County (soil atlas sheet 17); 2.0 miles west-southwest of Milford, 1.0 mile southeast of the confluence of the North Fork of the Licking River and the Licking River, 50 feet east of Riley Mill Road; USGS Claysville Quadrangle; lat. 38 degrees 34 minutes 11 seconds N. and long. 84 degrees 11 minutes 35 seconds W.

Ap—0 to 7 inches; dark brown (10YR 4/3) loam; moderate fine and medium granular structure; very friable; common fine roots; moderately acid; clear smooth boundary.

Bt1—7 to 17 inches; dark yellowish brown (10YR 4/6) clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—17 to 27 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; very strongly acid; abrupt smooth boundary.

Btx—27 to 41 inches; yellowish brown (10YR 5/6) loam; few medium distinct light brownish gray (10YR 6/2) redox depletions; moderate coarse prismatic structure parting to moderate medium subangular blocky; very firm and brittle; few faint discontinuous clay films on faces of peds; 1 percent quartz pebbles; very strongly acid; clear smooth boundary.

Bt3—41 to 50 inches; yellowish brown (10YR 5/6) loam; few fine distinct pale brown (10YR 6/3) redox depletions and few fine prominent yellowish red (5YR 4/6) iron masses; weak and moderate medium subangular blocky structure; friable; few faint discontinuous clay films on faces of peds; 1 percent quartz pebbles; very strongly acid; clear smooth boundary.

C—50 to 74 inches; strong brown (7.5YR 4/6) sandy clay loam; massive; friable; 10 percent quartz pebbles; very strongly acid.

Range in Characteristics

Thickness of the solum: 40 to 72 inches

Depth to bedrock: More than 72 inches

Depth to the fragipan: 18 to 34 inches

Content of clay in the control section: 18 to 35 percent

Kind of rock fragments: Rounded quartz pebbles

Reaction: Unless limed, strongly acid or very strongly acid

Ap horizon:

Hue—10YR
Value—4
Chroma—3 or 4
Texture of the fine-earth fraction—loam
Content of rock fragments—0 to 14 percent

Bt horizon:

Hue—7.5YR or 10YR
Value—4 to 6
Chroma—6 to 8
Texture of the fine-earth fraction—clay loam, silty clay loam, or loam
Content of rock fragments—0 to 14 percent

Btx horizon:

Hue—7.5YR or 10YR
Value—4 to 6
Chroma—2 to 6
Redoximorphic features—in shades of gray or brown
Texture of the fine-earth fraction—loam, sandy clay loam, or silt loam
Content of rock fragments—0 to 14 percent

C horizon:

Hue—10YR or 7.5YR
Value—4 to 6
Chroma—6 to 8
Redoximorphic features—in shades of gray and brown
Texture of the fine-earth fraction—sandy clay loam or loam
Content of rock fragments—10 to 30 percent

Newark Series

Depth: Very deep

Drainage class: Somewhat poorly drained

Permeability: Moderate

Landform: River valleys

Landscape position: Flood plains

Parent material: Mixed alluvium derived from limestone, siltstone, sandstone, and shale of the Quaternary System

Slope: 0 to 1 percent

Associated soils: Boonesboro, Nolin, Woolper

Taxonomic class: Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents

Typical Pedon

Newark silt loam, frequently flooded, in Bracken County (soil atlas sheet 3); 800 feet southwest of

Augusta, 200 feet north of Kentucky Highway 8, about 100 feet south of the Chesapeake and Ohio Railroad, 75 feet east of a fence; USGS Felicity Quadrangle; lat. 38 degrees 46 minutes 12 seconds N. and long. 84 degrees 00 minutes 53 seconds W.

A—0 to 10 inches; dark brown (10YR 4/3) silt loam; moderate medium subangular blocky structure parting to moderate medium granular; friable; many fine and medium roots; slightly acid; clear smooth boundary.

Bw—10 to 20 inches; brown (10YR 5/3) and yellowish brown (10YR 5/4) silt loam; common medium faint pale brown (10YR 6/3) redox depletions; moderate medium subangular blocky structure; friable; common fine roots; slightly acid; gradual smooth boundary.

Bg—20 to 32 inches; light brownish gray (2.5Y 6/2) silty clay loam; many medium prominent strong brown (7.5YR 4/6) iron masses; moderate medium subangular blocky structure; firm; few fine roots; moderately acid; gradual smooth boundary.

Cg—32 to 62 inches; light brownish gray (2.5Y 6/2) silty clay loam; common medium prominent strong brown (7.5YR 4/6) iron masses; massive; very firm; moderately acid.

Range in Characteristics

Thickness of the solum: 20 to 50 inches

Depth to bedrock: More than 60 inches

Content of clay in the control section: 18 to 35 percent

Reaction: Unless limed, moderately acid to mildly alkaline

Ap horizon:

Hue—10YR
Value—4 or 5
Chroma—2 to 4
Redoximorphic features—in shades of brown or gray
Texture of the fine-earth fraction—silt loam

Bw horizon:

Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Redoximorphic features—in shades of brown or gray
Texture of the fine-earth fraction—silt loam or silty clay loam

Bg horizon:

Hue—10YR or 2.5Y
Value—4 to 7
Chroma—1 or 2
Redoximorphic features—in shades of brown

Texture of the fine-earth fraction—silt loam or silty clay loam

Cg horizon:

Hue—10YR or 2.5Y

Value—4 to 7

Chroma—0 to 2

Mottles—in shades of brown

Texture of the fine-earth fraction—silt loam or silty clay loam

Nicholson Series

Depth: Very deep

Drainage class: Moderately well drained

Permeability: Moderate above the fragipan and slow in the fragipan

Landform: Uplands

Landscape position: Ridgetops

Parent material: Silty material over clayey residuum derived from limestone of the Grant Lake Formation and from shale, limestone, and siltstone of the Fairview Formation; Ordovician System

Slope: 0 to 12 percent

Associated soils: Eden, Faywood, Lowell, Sandview

Taxonomic class: Fine-silty, mixed, mesic Typic Fragiudalfs

Typical Pedon

Nicholson silt loam, 2 to 6 percent slopes, in Bracken County (soil atlas sheet 10); 1.0 mile west of Germantown, 1,100 feet northeast of the junction of Kentucky Highway 10 and Kentucky Highway 875, about 40 feet south of a farm road; USGS Germantown Quadrangle; lat. 38 degrees 39 minutes 57 seconds N. and long. 88 degrees 58 minutes 54 seconds W.

Ap—0 to 7 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable; common fine roots; moderately alkaline; clear smooth boundary.

Bt1—7 to 21 inches; dark yellowish brown (10YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; common faint clay films on faces of peds; neutral; clear smooth boundary.

Btx—21 to 38 inches; yellowish brown (10YR 5/4) silty clay loam; common medium distinct light brownish gray (2.5Y 6/2) redox depletions and strong brown (7.5YR 5/8) Fe masses; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle; few fine roots between prisms; common faint silt coatings on prism faces; few dark brown and black

concretions; strongly acid; gradual smooth boundary.

2Bt2—38 to 72 inches; yellowish brown (10YR 5/6) silty clay; common medium distinct light brownish gray (10YR 6/2) and pale brown (10YR 6/3) redox depletions; weak medium angular blocky structure; firm; few dark brown and black concretions; strongly acid.

Range in Characteristics

Thickness of the solum: 40 to 80 inches

Depth to bedrock: More than 60 inches

Depth to the fragipan: 16 to 30 inches

Content of clay in the control section: 18 to 35 percent

Reaction: Unless limed, very strongly acid to slightly acid above and in the fragipan and strongly acid to mildly alkaline below the fragipan

Ap horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—2 to 4

Texture of the fine-earth fraction—silt loam

Bt horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—4 to 6

Redoximorphic features—Chroma of 2 or less below the upper 10 inches of the argillic horizon

Texture of the fine-earth fraction—silt loam or silty clay loam

Btx horizon:

Hue—7.5YR to 2.5Y

Value—4 or 5

Chroma—4 to 8

Redoximorphic features—Chroma of 2 or less

Texture of the fine-earth fraction—silt loam or silty clay loam

2Bt horizon:

Hue—10YR or 2.5Y

Value—5

Chroma—4 to 6

Redoximorphic features—Chroma of 2 or less

Texture of the fine-earth fraction—silty clay or clay

Nolin Series

Depth: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: River and stream valleys

Landscape position: Flood plains

Parent material: Loamy alluvium derived from limestone, siltstone, and shale of the Quaternary System

Slope: 0 to 3 percent

Associated soils: Boonesboro, Newark, Woolper

Taxonomic class: Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts

Typical Pedon

Nolin silt loam, frequently flooded, in Robertson County (soil atlas sheet 18); 4.5 miles northwest of Mount Olivet, 0.7 mile south of the confluence of Mud Lick and the North Fork of the Licking River, 0.5 mile northwest of Bratton, 80 feet southwest of Mud Lick; USGS Mount Olivet Quadrangle; lat. 38 degrees 34 minutes 14 seconds N. and long. 84 degrees 06 minutes 17 seconds W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; common fine roots; mildly alkaline; clear smooth boundary.

Bw1—9 to 30 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine subangular blocky structure; friable; few fine roots; common fine tubular pores; neutral; gradual smooth boundary.

Bw2—30 to 62 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; few fine tubular pores; neutral.

Range in Characteristics

Thickness of the solum: 40 inches or more

Depth to bedrock: More than 60 inches

Content of clay in the control section: 18 to 35 percent

Kind of rock fragments: Subrounded chert and quartz pebbles

Reaction: Unless limed, moderately acid to moderately alkaline

Ap horizon:

Hue—10YR

Value—4 or 5

Chroma—2 or 3

Texture of the fine-earth fraction—silt loam

Content of rock fragments—0 to 5 percent

Bw horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—3 to 5

Redoximorphic features—in shades of gray below a depth of 24 inches

Texture of the fine-earth fraction—silt loam or silty clay loam

Content of rock fragments—0 to 5 percent

C horizon (if it occurs):

Hue—7.5YR to 2.5Y

Value—4 or 5

Chroma—2 to 4

Redoximorphic features—in shades of brown, yellow, or gray

Texture of the fine-earth fraction—silt loam or silty clay loam

Content of rock fragments—0 to 35 percent

Otwell Series

Depth: Very deep

Drainage class: Moderately well drained

Permeability: Moderately slow above the fragipan and very slow in the fragipan

Landform: River and stream valleys

Landscape position: Terraces

Parent material: Mixed alluvium derived from loess, limestone, siltstone, calcareous shale, and, in a few areas along the Ohio River, glacial drift; Quaternary System

Slope: 2 to 12 percent

Associated soils: Allegheny, Elk, Lawrence, Monongahela, Wheeling

Taxonomic class: Fine-silty, mixed, mesic Typic Fragiudalfs

Typical Pedon

Otwell silt loam, 2 to 6 percent slopes, rarely flooded, in Bracken County (soil atlas sheet 17); 0.5 mile southeast of Milford, 0.4 mile south of Kentucky Highway 539, about 520 feet west of the North Fork of the Licking River; USGS Claysville Quadrangle; lat. 38 degrees 34 minutes 27 seconds N. and long. 84 degrees 09 minutes 18 seconds W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; common fine roots; slightly alkaline; clear smooth boundary.

Bt—9 to 24 inches; yellowish brown (10YR 5/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint light yellowish brown (10YR 6/4) clay films on faces of peds; slightly alkaline; clear smooth boundary.

Btx—24 to 51 inches; yellowish brown (10YR 5/6) and pale brown (10YR 6/3) silty clay loam; few fine faint light brownish gray (10YR 6/2) redox depletions; moderate coarse prismatic structure parting to moderate medium subangular blocky; firm and brittle; few very fine roots along prism faces; 2 percent soft, dark brown concretions; strongly acid; gradual smooth boundary.

C—51 to 62 inches; yellowish brown (10YR 5/6) and pale brown (10YR 6/3) silty clay loam; few fine faint light brownish gray (10YR 6/2) redox depletions; massive; friable; common fine and medium black concretions; strongly acid; clear smooth boundary.

Range in Characteristics

Thickness of the solum: 40 to 80 inches

Depth to bedrock: More than 60 inches

Depth to the fragipan: 20 to 31 inches

Content of clay in the control section: 18 to 35 percent

Kind of rock fragments: Rounded quartz pebbles

Reaction: Unless limed, very strongly acid to neutral in the Ap horizon, strongly acid or very strongly acid in the Bt and Bx horizons, and strongly acid to neutral in the C horizon

Ap horizon:

Hue—10YR

Value—4 or 5

Chroma—2 to 4

Texture of the fine-earth fraction—silt loam

Content of rock fragments—0 to 3 percent

Bt horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—3 to 6

Mottles—in shades of gray below the upper 10 inches of the argillic horizon

Texture of the fine-earth fraction—silt loam or silty clay loam

Content of rock fragments—0 to 3 percent

Btx horizon:

Hue—7.5YR to 2.5Y

Value—4 to 6

Chroma—2 to 6

Redoximorphic features—in shades of brown, gray, olive, or yellow

Texture of the fine-earth fraction—silt loam or silty clay loam

Content of rock fragments—0 to 5 percent

C horizon:

Hue—7.5YR to 2.5Y

Value—4 to 6

Chroma—2 to 8

Redoximorphic features—in shades of brown, gray, olive, or yellow

Texture of the fine-earth fraction—silt loam, silty clay loam, or clay loam

Content of rock fragments—0 to 15 percent

Sandview Series

Depth: Very deep

Drainage class: Well drained

Permeability: Moderate in the upper part of the solum and moderately slow in the lower part

Landform: Uplands

Landscape position: Ridgetops

Parent material: Silty material over clayey residuum derived from limestone of the Grant Lake Formation; Ordovician System

Slope: 2 to 6 percent

Associated soils: Lowell, Nicholson

Taxonomic class: Fine-silty, mixed, mesic Typic Hapludalfs

Typical Pedon

Sandview silt loam, 2 to 6 percent slopes, in Bracken County (soil atlas sheet 10); 3.0 miles northwest of Germantown, 800 feet south of the junction of Kentucky Highway 875 and Pea Ridge Road, 240 feet east of Kentucky Highway 875; USGS Germantown Quadrangle; lat. 38 degrees 41 minutes 35 seconds N. and long. 83 degrees 58 minutes 40 seconds W.

Ap—0 to 9 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; very friable; common fine roots; slightly acid; clear smooth boundary.

BA—9 to 14 inches; dark yellowish brown (10YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; neutral; clear smooth boundary.

Bt1—14 to 26 inches; yellowish brown (10YR 5/4) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; few fine black concretions; neutral; clear smooth boundary.

Bt2—26 to 36 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; few faint clay films on faces of peds; common fine black concretions; strongly acid; gradual smooth boundary.

Bt3—36 to 50 inches; yellowish brown (10YR 5/4) and strong brown (7.5YR 4/6) silty clay loam; common medium faint pale brown (10YR 6/3) lithochromic mottles; moderate medium subangular blocky structure; friable; few faint clay films on faces of peds; common medium black concretions; strongly acid; gradual smooth boundary.

2Bt4—50 to 74 inches; yellowish brown (10YR 5/8) and pale brown (10YR 6/3) silty clay; weak medium subangular blocky structure; firm; 3 percent limestone fragments; few faint clay films

on faces of peds; common medium black concretions and stains; slightly acid.

Range in Characteristics

Thickness of the solum: More than 60 inches

Depth to bedrock: More than 60 inches

Content of clay in the control section: 18 to 34 percent

Kind of rock fragments: Limestone chert

Reaction: Unless limed, strongly acid to neutral in the upper part of the solum and strongly acid to mildly alkaline in the lower part of the solum and in the substratum

Ap horizon:

Hue—10YR or 7.5YR

Value—4

Chroma—2 to 4

Texture of the fine-earth fraction—silt loam

BA horizon:

Hue—10YR

Value—4 or 5

Chroma—3 or 4

Texture of the fine-earth fraction—silt loam or silty clay loam

Bt horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—4 to 6

Lithochromic mottles—in shades of brown in the lower part of the horizon

Texture of the fine-earth fraction—silt loam or silty clay loam

2Bt horizon:

Hue—7.5YR to 2.5Y

Value—4 to 6

Chroma—4 to 8

Lithochromic mottles—in shades of gray, brown, or olive

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—0 to 10 percent

2BC horizon (if it occurs):

Hue—10YR to 2.5Y

Value—4 to 6

Chroma—3 to 8

Lithochromic mottles—in shades of brown or gray

Texture of the fine-earth fraction—silty clay or clay

Content of rock fragments—0 to 10 percent

Wheeling Series

Depth: Very deep

Drainage class: Well drained

Permeability: Moderate

Landform: Ohio River valley

Landscape position: Terraces and some ridgetops above the Ohio River

Parent material: Mixed alluvium derived from sandstone, siltstone, shale, limestone, and, in some small areas, glacial drift; Quaternary System

Slope: 2 to 55 percent

Associated soils: Elk, Lawrence, Otwell

Taxonomic class: Fine-loamy, mixed, mesic Ultic Hapludalfs

Typical Pedon

Wheeling loam, 2 to 6 percent slopes, rarely flooded, in Bracken County (soil atlas sheet 3); 0.25 mile west of the Augusta water tower, 150 feet south of the Ohio River, 100 feet north of a paved road; USGS Felicity Quadrangle; lat. 38 degrees 46 minutes 20 seconds N. and long. 84 degrees 01 minute 19 seconds W.

Ap—0 to 14 inches; dark brown (10YR 3/3) loam, yellowish brown (10YR 5/4) dry; moderate medium subangular blocky and moderate medium and fine granular structure; firm; few fine roots; 1 or 2 percent quartz gravel; mildly alkaline; gradual wavy boundary.

A/B—14 to 23 inches; dark brown (10YR 4/3 and 3/3) loam; weak medium subangular blocky and weak medium and fine granular structure; friable; few fine roots; mildly alkaline; clear wavy boundary.

Bt1—23 to 34 inches; dark brown (10YR 4/3 and 7.5YR 4/4) silty clay loam; moderate medium angular blocky and subangular blocky structure; firm; few fine roots; many faint clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—34 to 45 inches; dark yellowish brown (10YR 4/4) and dark brown (7.5YR 4/4) silty clay loam; moderate medium angular blocky structure parting to moderate fine subangular blocky; firm; few fine roots; many distinct clay films on faces of peds; moderately alkaline; gradual smooth boundary.

Bt3—45 to 57 inches; dark yellowish brown (10YR 4/4) clay loam; weak medium and fine subangular blocky structure; friable; common faint clay films on faces of peds; moderately alkaline; gradual smooth boundary.

BC—57 to 80 inches; dark yellowish brown (10YR 4/4) sandy loam; weak medium subangular blocky structure; friable; moderately alkaline.

Range in Characteristics

Thickness of the solum: 40 to 80 inches

Depth to bedrock: More than 80 inches

Content of clay in the control section: 18 to 30 percent

Kind of rock fragments: Rounded quartz pebbles

Reaction: Unless limed, strongly acid to moderately alkaline

Ap horizon:

Hue—10YR

Value—3 or 4 (5 or 6 dry)

Chroma—3 or 4 (4 dry)

Texture of the fine-earth fraction—loam

Content of rock fragments—0 to 5 percent

A/B horizon:

Hue—10YR

Value—3 or 4 (5 or 6 dry)

Chroma—3 or 4 (4 dry)

Texture of the fine-earth fraction—loam

Content of rock fragments—0 to 5 percent

Bt horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—3 to 6

Texture of the fine-earth fraction—loam, silty clay loam, or sandy clay loam

Content of rock fragments—0 to 10 percent

BC horizon:

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—3 to 6

Texture of the fine-earth fraction—very fine sandy loam, fine sandy loam, or sandy loam

Content of rock fragments—0 to 20 percent

C horizon (if it occurs):

Hue—10YR or 7.5YR

Value—4 or 5

Chroma—3 to 6

Texture of the fine-earth fraction—very fine sand to sand

Content of rock fragments—0 to 65 percent

Woolper Series

Depth: Very deep

Drainage class: Well drained

Permeability: Moderately slow and slow

Landform: Uplands

Landscape position: Side slopes and footslopes

Parent material: Clayey colluvium and residuum derived from the harder limestones of the Point Pleasant Formation, the Grier and Tanglewood Members of the Lexington Limestone Formation, and the Clays Ferry Formation; Ordovician System

Slope: 4 to 12 percent

Associated soils: Allegheny, Boonesboro, Cynthiana, Eden, Elk, Fairmount, Faywood, Lowell, Newark, Nolin

Taxonomic class: Fine, mixed, mesic Typic Argiudolls

Typical Pedon

Woolper silty clay loam, 4 to 12 percent slopes, in Robertson County (soil atlas sheet 23); 2.0 miles south of the junction of Heitt Road and Kentucky Highway 62 near Kentontown, 720 feet south of a gravel road, 100 feet north of the Licking River; USGS Shady Nook Quadrangle; lat. 38 degrees 29 minutes 12 seconds N. and long. 83 degrees 09 minutes 39 seconds W.

Ap—0 to 10 inches; dark brown (10YR 3/3) silty clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; firm; common fine roots; 2 percent limestone channers; slightly alkaline; clear wavy boundary.

Bt1—10 to 20 inches; dark yellowish brown (10YR 3/4) silty clay; common medium faint brown (10YR 4/3) lithochromic mottles; moderate medium subangular blocky structure; very firm; few fine and medium roots; many faint clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt2—20 to 27 inches; brown (10YR 4/3) clay; common fine and medium distinct brown (7.5YR 4/4) lithochromic mottles; moderate medium subangular blocky structure with some moderate medium angular blocky; firm; few fine and medium roots; many distinct clay films on faces of peds; slightly alkaline; clear wavy boundary.

Bt3—27 to 48 inches; brown (7.5YR 4/4) clay; many medium and coarse prominent olive gray (5Y 5/2) lithochromic mottles; columnar structure parting to moderate medium subangular and angular blocky; firm; few fine roots; many distinct clay films on faces of peds; few fine black concretions; slightly acid; gradual wavy boundary.

BC—48 to 71 inches; brown (10YR 4/3 and 7.5YR 4/4) and olive (5Y 5/3) clay; weak fine and medium subangular and angular blocky structure; very firm; many faint clay films on faces of peds; common fine black concretions; slightly acid.

Range in Characteristics

Thickness of the solum: 40 to 80 inches

Depth to bedrock: 60 to 100 inches or more

Content of clay in the control section: 35 to 60 percent

Kind of rock fragments: Limestone and chert channers

Reaction: Slightly acid to moderately alkaline

Ap horizon:

Hue—10YR or 7.5YR
Value—2 or 3 (4 dry)
Chroma—2 or 3 (2 dry)
Texture of the fine-earth fraction—silty clay loam
Content of rock fragments—0 to 15 percent

Bt horizon:

Hue—10YR or 7.5YR
Value—3 to 5
Chroma—2 to 4
Lithochromic mottles—in shades of brown and gray in the lower part of the horizon
Texture of the fine-earth fraction—silty clay loam, silty clay, or clay
Content of rock fragments—0 to 15 percent

BC horizon:

Hue—7.5YR to 2.5Y
Value—3 to 5
Chroma—2 to 4
Lithochromic mottles—in shades of brown, gray, and olive
Texture of the fine-earth fraction—silty clay or clay
Content of rock fragments—0 to 15 percent

C horizon (if it occurs):

Hue—7.5YR to 2.5Y
Value—3 to 5
Chroma—2 to 4
Lithochromic mottles—in shades of gray or olive
Texture of the fine-earth fraction—silty clay or clay
Content of rock fragments—0 to 15 percent

Formation of the Soils

This section relates the factors of soil formation and processes of horizon differentiation to the soils of Bracken and Robertson Counties. It also describes the physiography and geology of the survey area.

Factors of Soil Formation

Soil is a three-dimensional natural body on the Earth's surface consisting of mineral and organic matter that can support plant growth. Soil is formed through the interaction of five major factors—climate, parent material, relief, plant and animal life, and time (Buol, Hole, and McCracken 1973). Climate and plant and animal life have an effect on parent material that is modified by relief over time.

All five factors are active in the formation of soils in Bracken and Robertson Counties. The relative influence of each factor differs from place to place and accounts for the varying characteristics of the soils. Theoretically, if the influence or action of these factors were identical at different sites, the soils at these sites would be identical. In reality, one factor may dominate the formation of soil characteristics at one site, while a different factor may dominate at another site. Each factor may modify the effect of the other four.

In Bracken and Robertson Counties, climate and plant and animal life are not likely to vary greatly, and their influence is relatively constant. Though there are differences in relief, parent material has been the most influential factor in the formation of the soils in these counties.

Parent Material

Parent material is the unconsolidated mass in which soil forms. In the early stages of soil formation, a soil has properties similar to those of the parent material. As weathering takes place, these properties are modified and the soil develops its own characteristics. The nature of the parent material affects the rate of weathering, and it also determines the texture and mineral composition of the soil. These properties affect the permeability, shrink-swell potential, and porosity of the soil.

In Bracken and Robertson Counties, soils formed in residuum, colluvium, river and stream alluvium, high

level fluvial deposits, and a thin, loesslike silt mantle. These parent materials weathered from limestone, shale, and siltstone of the Ordovician System or have been transported into the area from other areas by wind, water, or, to a minor extent, ice.

Most of the soils in the survey area formed in residuum, or material weathered in place, from the various sedimentary layers of the Ordovician System. Cynthiana, Eden, Fairmount, Faywood, and Lowell soils are examples. Soils formed in this parent material have a clayey subsoil.

Some soils, such as Nicholson and Sandview, formed in a thin mantle of loess, or silty material, over residuum derived from limestone and shale. The upper part of the solum, which formed in the loesslike material, is loamy, and the lower part, which formed in residuum, is clayey.

Some soils formed in recent stream alluvium on flood plains. They include the Boonesboro, Newark, and Nolin soils. Other soils formed in stream alluvium and fluvial deposits on terraces. Examples of these soils are the Elk, Otwell, and Wheeling soils. These alluvial soils are generally loamy throughout. Allegheny and Monongahela soils formed in very old alluvium of high level fluvial deposits. They have a loamy subsoil and less clay in the substratum than soils formed in residuum.

Other soils formed in colluvium over residuum. They include the Woolper soils on footslopes at the base of steep side slopes. These soils have a clayey subsoil.

Some soils in the survey area formed in material deposited by glaciers or by meltwater from glaciers. These deposits were laid down thousands of years ago and are limited to the northernmost parts of the survey area, along the Ohio River. Glacial outwash, the primary meltwater deposit in Bracken County, is of both Wisconsinan and Illinoian age. Soils that formed in these materials are of minor extent in the survey area. They include the Allegheny, Elk, and Wheeling soils.

Climate

Climatic factors, mainly temperature and rainfall, affect the physical, chemical, and biological properties of soils. Temperature affects the rate of chemical and

physical changes in the soils and thus the rate of soil formation. For every 10 degree C increase in temperature, the rate of chemical reaction doubles. Moisture and temperature affect biochemical reactions. Moisture is essential in soil formation. Climate significantly influences the natural vegetation and animal life. Because of its effect on physical weathering of geologic material through erosion and deposition, it also influences the relief of an area and the degree of profile development (Buol, Hole, and McCracken 1973).

Changes in climate over long periods affect the soils. Soil formation is affected by the average climatic condition, but extremes in the weather probably have had more influence on particular soil properties than on soil formation. The soils in the survey area formed in a temperate, moist climate that was probably similar to the present day climate. The average annual temperature is 54 degrees F, and the average annual precipitation is about 43 inches. Periods of extremely low temperatures during winter are short, and periods of high temperatures in summer are brief. Precipitation is fairly evenly distributed throughout the year.

Because the soils in the survey area are not dry or frozen for long periods, the processes of soil formation are active throughout the year. As water percolates downward through the soil, it leaches soluble bases, including calcium and magnesium, and clay minerals from the upper horizons to the lower horizons or out of the soils. As a result, many soils that formed in material high in content of carbonates and clay minerals are acid and have a loamy surface layer and an accumulation of clay in the subsoil. They include the Lowell soils.

Plant and Animal Life

The vegetation under which a soil forms influences soil properties, such as color, structure, reaction, and content of organic matter. Vegetation extracts water from the soil, recycles nutrients, and adds organic matter to the soil. Gases derived from root respiration combine with water to form acids that influence the weathering of minerals. Organic matter on the surface retards soil erosion and influences soil temperature. Organic matter in the soil helps to improve soil structure, add nutrients, and increase the available water capacity.

Most of the soils in Bracken and Robertson Counties formed under hardwood forests. These soils are characterized by a thin, dark surface layer and a brighter colored subsoil. Some soils that have a thick, dark surface layer, such as Sandview soils, probably formed under canebrakes or grasses.

Bacteria, fungi, and many other micro-organisms help to decompose organic matter and release nutrients to growing plants. Earthworms, insects, and small, burrowing animals mix the soil and create small channels that influence soil aeration and permeability. Earthworms help to incorporate plant residue and other organic matter into the soil.

Changes caused by human activity have been significant. Native forests have been cleared and developed for farming and other uses, and wet areas have been drained. Cultivation and overgrazing have accelerated erosion on sloping soils. New plants have been introduced, and manure, lime, chemical fertilizer, herbicides, and pesticides have been applied in farmed areas. Cultivation has affected soil structure and compaction and lowered the content of organic matter. The development of land for urban uses has significantly influenced the soils in some areas.

Relief and Aspect

Relief, or the position, shape, and slope of the landscape, affects the formation of soils through its influence on drainage, erosion, plant cover, and soil temperature. Because relief varies widely in the survey area, it accounts for many differences among the soils. It tends to modify the effects of climate and vegetation. For example, Newark soils, which formed on nearly level flood plains, had an excessive amount of water in the profile during formation because they are in a landscape position that does not allow surface water to drain easily and that may keep the water table at or near the soil surface. The wetness resulted in a lack of oxidation and the formation of a gray subsoil. In other nearly level and gently sloping soils, along with the excess water, a fragipan may form under certain conditions. An example is the Lawrence series.

Gently sloping and sloping soils commonly show most clearly the influence of all five soil-forming factors. Although excess water runs off these soils, erosion is not excessive and enough water moves into and through the soils to cause leaching of bases and the downward movement of clay particles. As the surface is relatively stable, this downward clay movement formed an argillic horizon. Lowell and Sandview soils are examples.

Some steep soils are shallow and exhibit only slight evidence of profile development because geologic erosion takes place almost as rapidly as soil formation. Cynthiana and Fairmount soils are examples. Some sloping soils are deep or very deep because the parent material moves down the slopes slowly and accumulates at the lower end of the slopes. An example is the Woolper series on footslopes below

steep and very steep slopes. Other steep and very steep soils are moderately deep because weathering of the underlying rock occurs at a faster rate than geologic erosion. Faywood and Eden soils are examples.

The soil temperature and plant cover are somewhat different on cool aspects than on warm ones, but these differences generally are slight and have changed because of past and current farming practices.

Time

The time required for a soil to form depends on the other soil-forming factors. Less time is required for a soil to form in a warm, moist climate than in a cool, dry climate. Also, some parent material is more resistant to weathering than others. For example, quartz sand may change very little even if it is exposed for long periods. Other parent material is more porous, and thus more intense weathering can take place. The age of a soil is determined by the relative degree of profile development rather than by the number of years that the soil has been subject to the soil-forming processes.

Immature soils have little profile development and have retained many of the characteristics of the original parent material. In Bracken and Robertson Counties, the immature soils are on the flood plains where the seasonal high water table and deposition of fresh material prevent the development of distinct soil horizons. Newark and Nolin soils are examples.

Mature soils have well developed soil horizons. Lowell and Sandview soils are examples. These soils are generally on relatively stable surfaces and are deep and very deep to bedrock. Weathering has translocated minerals and finer material into the subsoil and has developed well defined soil horizons.

Processes of Horizon Differentiation

The formation of a succession of layers, or horizons, in soils is the result of one or more of the following soil-forming processes—accumulation of organic matter; leaching of carbonates and other soluble minerals; chemical weathering of primary minerals into silicate clay minerals, mainly by hydrolysis; translocation of the silicate clays, and probably some silt-sized particles, from one horizon to another; and reduction and transfer of iron.

Several of these processes have been active in the formation of most of the soils in Bracken and

Robertson Counties. The interaction of the first four processes is reflected in the strongly expressed horizons of Sandview soils. All five processes have probably been active in the formation of the moderately well drained Monongahela, Nicholson, and Otwell soils.

Some organic matter has accumulated in all the soils of the survey area. Most soils contain moderate amounts of organic matter in the surface layer. The organic matter content ranges from low in Eden soils to high in Woolper soils.

Most of the soils in the survey area are acid in the upper layers unless the surface has been limed. Although most of the soils formed in material that has a high content of carbonates, the carbonates and other soluble materials have been partially leached into the lower layers or out of the soil profile. Faywood and Lowell are examples of soils in which this process occurs.

The translocation of clay minerals is an important process in the horizon development of many soils in the survey area. As clay minerals are removed from the A horizon (eluviation), they accumulate as clay films on faces of peds, in pores, and in root channels in the B horizon (illuviation).

A fragipan has formed in the B horizons of some of the moderately well drained and somewhat poorly drained soils on uplands and stream terraces. The fragipan is a dense, compact layer that is hard or very hard when dry and is brittle when moist. It is slowly permeable or very slowly permeable and has few to many bleached fracture planes that form polygons. It tends to rupture suddenly rather than break down slowly when lateral pressure is applied. Examples are the Nicholson soils on uplands and Monongahela, Otwell, and Lawrence soils on stream terraces.

The reduction and transfer of iron has occurred in all soils that do not have good natural drainage. This process, known as gleying, is identified by the gray matrix color and mottles. Some of the iron may be reoxidized and segregated, forming yellowish brown, strong brown, and other brightly colored mottles in an essentially gray matrix in the subsoil. Nodules or concretions of iron or manganese commonly form as a result of this process.

As silicate clay forms from primary minerals, some iron is commonly freed as hydrated oxides. These oxides are more or less red. Even if they occur in small amounts, they give the soil material a brownish color. They are largely responsible for the strong brown or yellowish brown colors that dominate the subsoil of many soils in Bracken and Robertson Counties.

Physiography and Geology

Douglas H. Hines, soil and water resource specialist, Natural Resources Conservation Service, helped to prepare this section.

The survey area lies within two physiographic regions—the Hills of the Bluegrass, which is commonly known as Eden Hills, and the Outer Bluegrass (Bailey and Winsor 1964). The northernmost and southernmost parts of Bracken County and almost all of Robertson County are in the Hills of the Bluegrass Physiographic Region. This region comprises about 93 percent of the survey area. The central and northeastern parts of Bracken County and a small area in the east-central part of Robertson County are in the Outer Bluegrass Physiographic Region, which makes up the remaining 7 percent.

The bedrock underlying the soils in the survey area are of Ordovician age in the Paleozoic era (USGS 1971a-b, 1973a-d, 1975a-b, 1976, 1977, 1978a-b). These strata were deposited in shallow seas 425 million to 500 million years ago and dominantly consist of interbedded shales and limestones.

This rock is comprised of many whole or broken fossils, which include brachiopods, bryozoans, crinoid columnals, triloites, cephalopods, gastropods, and pelecypods (figs. 13 and 14). Some of the upland ridges in the southern part of the survey area, near



Figure 13.—Fossilized crinoid columnal embedded in a fragment of limestone from the Kope Formation.

the Licking River, are capped with thin deposits of loamy and gravelly sediments of the Quaternary and Tertiary Systems. In other parts of the survey area, broad ridgetops are capped with silty material, or a loesslike mantle.

The valleys consist of alluvial materials of the Quaternary System. There are several small deposits of glacial drift and glacial outwash along the Ohio River in northern Bracken County.

Table 20 shows the relationship of the geologic systems, formations, members, and deposits to the predominant soils that formed in these materials in Bracken and Robertson Counties.

The Ordovician System is subdivided into a number of formations and members that are identified within the survey area. These materials have influenced the landscape and the soils that have formed in them. For discussion purposes, these different formations and members are listed in the table in downward sequence of youngest to oldest. The formations are the Grant Lake, Fairview, Kope, Clays Ferry (including the Point Pleasant Tongue), Point Pleasant, and Lexington Limestone. The Lexington Limestone Formation is further divided into the Tanglewood Member and the Grier Member.

The Grant Lake Formation is at elevations ranging from 830 to 970 feet, the highest elevations in Bracken County (USGS 1971b, 1973d). This formation does not occur in Robertson County. It forms the broad, rolling ridgetops in the central and eastern parts of Bracken County. It is the dominant bedrock material of the Outer Bluegrass Physiographic Region in the survey area. It is 85 percent limestone and 15 percent interbedded shale or mudstone (fig. 15). Generally, the soils that developed on the Grant Lake Formation in these areas are deep and very deep and have a strongly acid to slightly alkaline, clayey or loamy subsoil. The dominant soils are the gently sloping or sloping Lowell, Nicholson, and Sandview soils.

The Fairview Formation is at elevations ranging from 830 to 1,009 feet. It caps many of the narrow to moderately broad ridgetops in both Bracken and Robertson Counties. The highest point in the survey area, at 1,009 feet, is on this formation at Riggs School, near Mount Olivet in Robertson County (USGS 1977). The Fairview Formation underlies the Grant Lake Formation in Bracken County and is the underlying bedrock for all of the Outer Bluegrass Physiographic Region in both counties. It is 50 to 60 percent limestone. The remaining 40 to 50 percent is calcareous shale and thin layers of calcareous siltstone. Since the amount of shale decreases with increasing depth, there is more shale in the upper part



Figure 14.—Fossilized brachiopods in a fragment of limestone from the Kope Formation. Limestones of the Ordovician System contain many whole or broken fossils.

of the formation. Generally, the soils on this formation are moderately deep to very deep and have a strongly acid to slightly alkaline, clayey subsoil. The dominant soils are the gently sloping to moderately steep Lowell, Fairmount, Faywood, and Nicholson soils.

The Kope Formation is the dominant underlying bedrock of the Hills of the Bluegrass Physiographic Region in the survey area. It is at elevations ranging from 590 to 900 feet throughout the survey area. The rock strata of the Kope Formation is made up of 70 to 80 percent calcareous shale interbedded with 20 to 30 percent thin layers of limestone and calcareous siltstone (fig. 16). Erosion of this formation forms highly dissected, long, narrow ridgetops with short shoulder slopes and moderately steep to very steep side slopes. The soils that formed on this formation are

almost exclusively the moderately deep, sloping to very steep, clayey Eden soils.

The Clays Ferry Formation underlies the Kope Formation. It is at elevations ranging from 580 to 840 feet and is along the North Fork of the Licking River in the southern part of Bracken County and throughout much of Robertson County (USGS 1976, 1977 1978b). Bedrock of the Clays Ferry Formation is comprised of limestone and shale in about equal proportions. Landforms on the Clays Ferry Formation are similar to those of the Kope Formation in much of the survey area but are not as steep in some areas. Included near the base of this formation is the Point Pleasant Tongue, a bedrock unit comprised of limestone and minor amounts of shale. The area underlain by this unit is small and could not be



Figure 15.—Exposed limestone of the Grant Lake Formation. Note the thin, interbedded layers of shale between the limestone layers.

separated during mapping. Generally, the soils formed in these materials are moderately deep to very deep and have a strongly acid to moderately alkaline, clayey subsoil. The dominant soils are the very steep to gently sloping Eden, Lowell, Faywood, and Woolper soils.

The Point Pleasant Formation is exposed at elevations ranging from 500 to 590 feet in the northern part of Bracken County, along the Ohio River (USGS 1973a-c). This formation underlies the Kope Formation in northern Bracken County because the Clays Ferry Formation does not extend to that part of the survey area. This formation is comprised of 60 to 70 percent limestone and 30 to 40 percent shale. These gently

sloping to very steep, shallow to very deep soils have a strongly acid to moderately alkaline, clayey subsoil. Cynthiana, Faywood, Lowell, and Woolper soils are the dominant soils.

The Lexington Limestone Formation (USGS 1975b, 1976, 1978a-b) underlies the Clays Ferry Formation. It is at the lower elevations in the southern part of Robertson County, along the Licking River, but is not exposed at the surface in Bracken County. In the survey area this formation consists primarily of the Tanglewood and Grier Members (fig. 17).

The Tanglewood Member is at elevations ranging from 670 to 740 feet. It occurs in two positions or strata, separated by a thin interval of the Clays Ferry

Formation. It consists of 90 percent limestone and 10 percent shale. The Grier Member is at elevations ranging from 570 to 670 feet. It consists of 75 to 85 percent limestone and 15 to 25 percent shale. The soils that formed from these two members are generally shallow to very deep and have a strongly acid to moderately alkaline, clayey subsoil. The gently sloping to very steep Cynthiana, Fairmount, Faywood, Lowell, and Woolper soils are the dominant soils.

In many areas, the broader ridgetops are capped with a thin mantle of loesslike silt. The upper part of



Figure 16.—An example of rock strata of the Kope Formation. Note the dominance of shale.

the soils on these ridgetops formed in silty material and the lower part in clayey material weathered from the underlying limestone, shale, and siltstone. Most of these soils are gently sloping or sloping and have a strongly acid to mildly alkaline subsoil. The very deep Nicholson and Sandview soils are dominant.

Older, high level fluvial deposits of the Tertiary and Quaternary Systems extend from the southern part of Robertson County into the southwestern part of Bracken County (USGS 1975b, 1976, 1978a-b). These are remnants of the flood plain and channel deposits of the ancestral Licking River system of the Pliocene epoch. These fluvial materials are deposited over the Clays Ferry and Lexington Limestone Formations at elevations ranging from 670 to 780 feet. The deposits consist of clay, silt, gravel, and sand. Rounded to subrounded pebbles of white, yellow, and pink quartz, rarely more than 1¼ inches in diameter, occur in these deposits. They are probably derived from conglomeratic sandstone of Pennsylvanian age found in the eastern part of Kentucky. Within the survey area, the presence of such quartz pebbles in a soil is generally indicative of this parent material. Most of these soils are very deep and have a very strongly acid to slightly acid, loamy subsoil. The gently sloping to moderately steep Allegheny, Elk, and Monongahela soils are the dominant soils in these areas.

Young terrace deposits and alluvial deposits of the Quaternary System are along streams in Bracken and Robertson Counties. The largest areas of these deposits are along the Ohio River and the North Fork of the Licking River in Bracken County and along the Licking River, North Fork of the Licking River, Johnson Creek, and Cedar Creek in Robertson County. The soils in these areas are generally nearly level to sloping and very deep and have a very strongly acid to mildly alkaline, loamy subsoil. Along the Ohio River, the few areas of flood plains remaining since construction of the locks and dams are dominated by Nolin and Newark soils. The Ohio River terraces are dominated by Wheeling, Otwell, Elk, and Lawrence soils. Allegheny and Elk soils are dominant on the terraces of the Licking River, and Elk, Otwell, and Lawrence soils are dominant on the terraces of the smaller streams. Generally, Nolin soils are the dominant soils on flood plains throughout the survey area; however, the moderately deep Boonesboro soils are dominant in areas of flood plain deposits over the Point Pleasant Formation in the northern part of Bracken County.

Scattered among the Ohio River deposits are small areas of glacial outwash of the Illinoian and Wisconsinan glaciers (USGS 1973b-c). This material



Figure 17.—A rock fence made from limestone flagstones of the Lexington Limestone Formation. The Tanglewood Member is exposed at the top of the hill. The Grier Member is exposed as rock ledges on the side slope.

consists of sand, gravel, silt, and clay. The Wisconsinan outwash is at elevations of about 510 to 520 feet. It underlies the Illinoian outwash and drift at elevations ranging from 520 to 600 feet. There is one area of Illinoian drift on an upland ridgetop above

Bradford, Kentucky. It is at elevations ranging from 565 to 650 feet and includes a large glacial conglomerate (USGS 1973c). The dominant soils in these glacial areas are the gently sloping or sloping, very deep Allegheny, Wheeling, and Otwell soils.

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Glossary

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.

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

Alluvial fan. The fanlike deposit of a stream where it issues from a gorge upon a plain or of a tributary stream near or at its junction with its main stream.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Animal unit month (AUM). The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

Aquic conditions. Current soil wetness characterized by saturation, reduction, and redoximorphic features.

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Argillic horizon. A subsoil horizon characterized by an accumulation of illuvial clay.

Aspect. The direction in which a slope faces. Warm aspects have slope of more than 15 percent and face an azimuth of 135 to 315 degrees. Cool aspects have slope of more than 15 percent and face an azimuth of 315 to 135 degrees.

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:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9

High	9 to 12
Very high	more than 12

Backslope. The geomorphic component that forms the steepest inclined surface and principal element of many hillsides. Backslopes in profile are commonly steep, are linear, and may or may not include cliff segments.

Basal area. The area of a cross section of a tree, generally referring to the section at breast height and measured outside the bark. It is a measure of stand density, commonly expressed in square feet.

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and 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.

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Breast height. An average height of 4.5 feet above the ground surface; the point on a tree where diameter measurements are ordinarily taken.

Brush management. Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

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

Canopy. The leafy crown of trees or shrubs. (See Crown.)

Capillary water. Water held as a film around soil particles and in tiny spaces between particles.

Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity.

The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

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 material. Soil material that is, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

Chemical treatment. Control of unwanted vegetation through the use of chemicals.

Chert. A hard, dense or compact, dull to semivitreous, cryptocrystalline sedimentary rock, consisting of cryptocrystalline silica (microcrystalline fibrous quartz; i.e., chalcedony) with lesser amounts of microcrystalline or cryptocrystalline quartz and amorphous silica (opal). It has a tough, splintery to conchoidal fracture and may be white or variously colored gray, green, blue, pink, yellow, brown, and black. It commonly occurs as nodular or concretionary segregations in limestones and dolomites.

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 depletions. Low-chroma zones having a low content of iron, manganese, and clay because of the chemical reduction of iron and manganese and the removal of iron, manganese, and clay. A type of redoximorphic depletion.

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.

Climax plant community. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

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

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas 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 or miscellaneous areas are somewhat similar in all areas.

Concretions. Cemented bodies with crude internal symmetry organized around a point, a line, or a plane. They typically take the form of concentric layers visible to the naked eye. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up concretions. If formed in place, concretions of iron oxide or manganese oxide are generally considered a type of redoximorphic concentration.

Conglomerate. A coarse grained, clastic rock composed of rounded or subangular rock fragments more than 2 millimeters in diameter. It commonly has a matrix of sand and finer textured material. Conglomerate is the consolidated equivalent of gravel.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to

penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

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.

Corrosion. Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

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.

Cropping system. Growing crops according to a planned system of rotation and management practices.

Crop residue management. Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

Cross-slope farming. Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

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

Depth, soil. Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

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 wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively*

drained, well drained, moderately well drained, somewhat poorly drained, poorly drained, and very poorly drained. These classes are defined in the "Soil Survey Manual."

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.

Endosaturation. A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Ephemeral stream. A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

Episaturation. A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

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 human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

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

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grain is grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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 oven-dry 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, or clay.
- First bottom.** The normal flood plain of a stream, subject to frequent or occasional flooding.
- Flaggy soil material.** Material that is, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.
- Flagstone.** A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.
- Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.
- Fluvial.** Of or pertaining to rivers; produced by river action, as a fluvial plain.
- Footslope.** The inclined surface at the base of a hill.
- Forage.** Food for browsing or grazing animals.
- Forb.** Any herbaceous plant not a grass or a sedge.
- Forest cover.** All trees and other woody plants (underbrush) covering the ground in a forest.
- Forest type.** A stand of trees similar in composition and development because of given physical and biological factors by which it may be differentiated from other stands.
- Formation.** The basic rock-stratigraphic unit in the local classification of rock (commonly a sedimentary stratum or strata but also igneous and metamorphic rocks) generally characterized by some degree of internal lithologic homogeneity of distinctive lithologic features (such as chemical composition, structures, texture, or general kind of fossils), by a prevailing (but not necessarily tabular) shape, and by mappability at the Earth's surface (at scales of the order of 1:25,000) or traceability in the subsurface.
- 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.
- Geomorphology.** The science that treats the general configuration of the Earth's surface; specifically, the study of the classification, description, nature, origin, and development of landforms and their relationships to underlying structures and of the history of geologic changes as recorded by these surface features.
- Glacial drift.** Pulverized and other rock material transported by glacial ice and then deposited. Also, the sorted and unsorted material deposited by streams flowing from glaciers.
- Glacial outwash.** Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.
- Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.
- 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 as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.
- Gravelly soil material.** Material that is 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 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.** Water filling all the unblocked pores of the 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.
- Hard bedrock.** Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.
- High-residue crops.** Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established.

These crops return large amounts of organic matter to the soil.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and is dependent on local usage.

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 uppercase letter represents the major horizons. Numbers or lowercase 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.

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, aluminum, or some combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

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 overlying soil material. 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, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it 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 potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

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.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Iron depletions. Low-chroma zones having a low content of iron and manganese oxide because of chemical reduction and removal, but having a clay content similar to that of the adjacent matrix. A type of redoximorphic depletion.

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

Lacustrine deposit. Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

Landform. Any physical, recognizable form or feature of the Earth's surface, having a characteristic shape and produced by natural causes; it includes major forms, such as plain, plateau, and mountain, and minor forms, such as hill, valley, and slope.

Landscape (geology). The distinct association of landforms, especially as modified by geologic forces, that can be seen in a single view.

Landslide. The rapid downhill movement of a mass of soil and loose rock, generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones (in tables). Rock fragments 3 inches (7.6 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.

Limestone. A sedimentary rock consisting chiefly of calcium carbonate, primarily in the form of calcite. Limestones are generally formed by a combination of organic and inorganic processes and include soluble and insoluble constituents; many limestones contain fossils.

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-residue crops. Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

Low strength. The soil is not strong enough to support loads.

Masses. Concentrations of substances in the soil matrix that do not have a clearly defined boundary with the surrounding soil material and cannot be removed as a discrete unit. Common compounds making up masses are calcium carbonate, gypsum or other soluble salts, iron oxide, and manganese oxide. Masses consisting of iron oxide or manganese oxide generally are considered a type of redoximorphic concentration.

Mechanical treatment. Use of mechanical equipment for seeding, brush management, and other management practices.

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. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Mollic epipedon. A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

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. 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 three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

Nodules. Cemented bodies lacking visible internal structure. Calcium carbonate, iron oxide, and manganese oxide are common compounds making up nodules. If formed in place, nodules of iron oxide or manganese oxide are considered types of redoximorphic concentrations.

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.

Ordovician. The second earliest period of the Paleozoic era of geologic time extending from the end of the Cambrian period (about 500 million years ago) to the beginning of the Silurian period (about 425 million years ago).

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of

organic matter in the surface layer is described as follows:

- Low less than 2 percent
- Moderate 2 to 4 percent
- High more than 4.0 percent

Paleozoic. The geologic era between the Precambrian and Mesozoic; it covers the period between 600 million years and 230 million years ago and was characterized by the development of the first fishes, amphibians, reptiles, and land plants.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Paralithic contact. A boundary between soil and continuous, coherent underlying material. The mineral material below the contact has a hardness of less than 3 (Mohs scale) and can be dug with difficulty with a spade.

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.

Percolates slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Perennial stream. A creek or stream that has flowing water throughout the year.

Permeability. The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

- Extremely slow 0.0 to 0.01 inch
- Very slow 0.01 to 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, such as slope, stoniness, and flooding.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Pliocene. The fifth and last epoch of the Tertiary period (Cenozoic era) of geologic time extending from the Miocene epoch (about 13 million years ago) to the beginning of the Pleistocene epoch of the Quaternary period (about 1.8 million years ago).

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Prescribed burning. Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

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.

Proper grazing use. Grazing at an intensity that maintains enough cover to protect the soil and maintain or improve the quantity and quality of the desirable vegetation. This practice increases the vigor and reproduction capacity of the key plants and promotes the accumulation of litter and mulch necessary to conserve soil and water.

Quaternary. The second period of the Cenozoic era of geologic time, extending from the end of the Tertiary period (about 1.8 million years ago) to the present.

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 degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	less than 3.5
Extremely acid	3.5 to 4.4
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly 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

Redoximorphic concentrations. Nodules, concretions, soft masses, pore linings, and other features resulting from the accumulation of iron or manganese oxide. An indication of chemical reduction and oxidation resulting from saturation.

Redoximorphic depletions. Low-chroma zones from which iron and manganese oxide or a combination of iron and manganese oxide and clay has been removed. These zones are indications of the chemical reduction of iron resulting from saturation.

Redoximorphic features. Redoximorphic concentrations, redoximorphic depletions, reduced matrices, a positive reaction to alpha,alpha-dipyridyl, and other features indicating the chemical reduction and oxidation of iron and manganese compounds resulting from saturation.

Reduced matrix. A soil matrix that has low chroma in situ because of chemically reduced iron (Fe II). The chemical reduction results from nearly continuous wetness. The matrix undergoes a change in hue or chroma within 30 minutes after exposure to air as the iron is oxidized (Fe III). A type of redoximorphic feature.

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 generally is a few inches deep and not wide enough to be an obstacle to farm machinery.

Road cut. A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

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-sized particles.

Saturation. Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

Second bottom. The first terrace above the normal flood plain (or first bottom) of a river.

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. 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 (in tables). 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.

Similar soils. Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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. In this survey, classes for simple slopes are as follows:

Nearly level	0 to 2 percent
Gently sloping	2 to 6 percent
Sloping	6 to 12 percent
Moderately steep	12 to 20 percent
Steep	20 to 30 percent
Very steep	30 to 60 percent

Classes for complex slopes are as follows:

Nearly level	0 to 2 percent
Undulating	2 to 6 percent
Rolling	6 to 12 percent
Hilly	12 to 20 percent
Steep	20 to 30 percent
Very steep	30 percent and higher

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soft bedrock. Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

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, in millimeters, of separates recognized in the United States are as follows:

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 material below the solum. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stratified. Arranged in layers (strata). The term refers to geologic material. Layers in soils that result from soil formation processes are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion 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).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

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

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. Any surface soil horizon (A, E, AB, or EB) below the surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

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."

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. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Tertiary. The first period of the Cenozoic era of geologic time, following the Mesozoic era and preceding the Quaternary period (beginning approximately 63 million years ago and ending about 1.8 million years ago).

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 that is 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.

Toeslope. The outermost inclined surface at the base of a hill; part of a footslope.

Topography. The general configuration of a land surface or any part of the Earth's surface, including its relief and the position of its natural and constructed features.

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.

Trace elements. Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Upland. Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley. An elongated, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion.

Variation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water bars. Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

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.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which a plant (specifically a sunflower) wilts so

much that it does not recover when placed in a humid, dark chamber.

Windthrow. The uprooting and tipping over of trees by the wind.

Tables

Table 1.--Temperature and Precipitation
(Recorded in the period 1951-90 at Falmouth, Kentucky.)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	Average	2 years in 10 will have--		Average number of days with 0.10 inch or more	Average snow- fall
				Maximum temperature higher than--	Minimum temperature lower than--			Less than--	More than--		
<u>°</u> <u>F</u>	<u>°</u> <u>F</u>	<u>°</u> <u>F</u>	<u>°</u> <u>F</u>	<u>°</u> <u>F</u>	<u>Units</u>	<u>In</u>	<u>In</u>	<u>In</u>		<u>In</u>	
January--	39.8	19.1	29.5	68	-13	12	2.89	1.52	4.08	7	3.4
February-	43.9	21.5	32.7	72	-6	15	2.94	1.25	4.36	6	3.2
March----	54.8	30.5	42.7	82	9	47	4.18	2.29	5.84	8	2.0
April----	67.0	39.9	53.5	86	21	159	3.82	2.09	5.33	8	.0
May-----	76.3	49.3	62.8	92	30	405	4.25	2.28	5.98	8	.0
June-----	83.5	57.5	70.5	95	40	615	3.88	1.89	5.60	7	.0
July-----	86.9	62.5	74.7	98	48	766	4.73	2.98	6.30	7	.0
August---	85.9	60.8	73.4	97	45	725	3.56	1.83	5.05	6	.0
September	80.3	53.8	67.1	94	34	513	3.27	1.40	4.85	5	.0
October--	68.9	40.8	54.9	87	21	201	2.78	1.21	4.10	5	.0
November-	55.8	32.5	44.2	79	11	22	3.64	2.10	5.00	7	.6
December-	44.5	23.9	34.2	70	-2	26	3.30	1.70	4.68	7	1.5
Yearly:											
Average	65.6	41.0	53.4	---	---	---	---	---	---	---	---
Extreme	---	---	---	99	-15	---	---	---	---	---	---
Total--	---	---	---	---	---	3,506	43.24	36.47	49.41	81	10.7

* 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 degrees F).

Table 2.--Freeze Dates in Spring and Fall
(Recorded in the period 1951-90 at Falmouth, Kentucky.)

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	Apr. 21	May 1	May 15
2 years in 10 later than	Apr. 14	Apr. 25	May 8
5 years in 10 later than	Mar. 31	Apr. 13	Apr. 25
First freezing temperature in fall:			
1 year in 10 earlier than	Oct. 2	Sept. 26	Sept. 10
2 years in 10 earlier than	Oct. 14	Oct. 7	Sept. 23
5 years in 10 earlier than	Nov. 5	Oct. 29	Oct. 18

Table 3.--Growing Season
(Recorded in the period 1951-90 at Falmouth, Kentucky.)

Probability	Daily minimum temperature during growing season		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	188	167	142
8 years in 10	197	177	152
5 years in 10	215	195	171
2 years in 10	234	213	190
1 year in 10	245	224	202

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Bracken County	Robertson County	Total--	
				Area	Extent
		Acres	Acres	Acres	Pct
AlB	Allegheny loam, 2 to 6 percent slopes-----	17	163	180	0.1
AlC	Allegheny loam, 6 to 12 percent slopes-----	105	567	672	0.3
AlD	Allegheny loam, 12 to 20 percent slopes-----	61	259	320	0.2
AnB	Allegheny loam, 2 to 6 percent slopes, rarely flooded----	19	231	250	0.1
Bo	Boonesboro silt loam, frequently flooded-----	845	36	881	0.5
CnE2	Cynthiana-Faywood complex, rocky, 20 to 35 percent slopes, eroded-----	2,116	1,641	3,757	1.9
DAM	Dam, large-----	3	0	3	*
EfD2	Eden flaggy silty clay loam, 6 to 20 percent slopes, eroded	15,018	11,299	26,317	13.6
EfE2	Eden flaggy silty clay loam, 20 to 35 percent slopes, eroded-----	86,576	41,865	128,441	64.8
EkB	Elk silt loam, 2 to 6 percent slopes-----	138	108	246	0.1
EkC	Elk silt loam, 6 to 12 percent slopes-----	242	229	471	0.2
ErA	Elk silt loam, 0 to 2 percent slopes, occasionally flooded-	148	71	219	0.1
ErB	Elk silt loam, 2 to 6 percent slopes, rarely flooded-----	581	467	1,048	0.5
FrF	Fairmount flaggy silty clay loam, very rocky, 20 to 60 percent slopes-----	67	796	863	0.4
FwB	Faywood silt loam, 2 to 6 percent slopes-----	36	28	64	*
FyD2	Faywood-Cynthiana complex, 6 to 20 percent slopes, eroded--	177	1,435	1,612	0.8
La	Lawrence silt loam, rarely flooded-----	247	23	270	0.1
LoB	Lowell silt loam, 2 to 6 percent slopes-----	125	6	131	0.1
LoC	Lowell silt loam, 6 to 12 percent slopes-----	790	29	819	0.4
LwB	Lowell silt loam, shale substratum, 2 to 6 percent slopes--	134	253	387	0.2
LwC2	Lowell silt loam, shale substratum, 6 to 12 percent slopes, eroded-----	5,791	1,359	7,150	3.7
LwD2	Lowell silt loam, shale substratum, 12 to 20 percent slopes, eroded-----	6,618	582	7,200	3.7
MgB	Monongahela loam, 2 to 6 percent slopes-----	10	311	321	0.2
MgC	Monongahela loam, 6 to 12 percent slopes-----	25	334	359	0.2
Ne	Newark silt loam, frequently flooded-----	162	52	214	0.1
Ng	Newark silt loam, ponded-----	32	0	32	*
NhB	Nicholson silt loam, 2 to 6 percent slopes-----	3,536	37	3,573	1.8
NhC	Nicholson silt loam, 6 to 12 percent slopes-----	1,337	54	1,391	0.7
No	Nolin silt loam, frequently flooded-----	1,662	1,399	3,061	1.6
OtB	Otwell silt loam, 2 to 6 percent slopes-----	156	8	164	0.1
OtC	Otwell silt loam, 6 to 12 percent slopes-----	125	49	174	0.1
OwB	Otwell silt loam, 2 to 6 percent slopes, rarely flooded----	466	70	536	0.3
SaB	Sandview silt loam, 2 to 6 percent slopes-----	295	7	302	0.2
W	Water-----	4,970	397	5,367	2.2
WhB	Wheeling loam, 2 to 6 percent slopes-----	204	0	204	0.1
WhC	Wheeling loam, 6 to 12 percent slopes-----	150	0	150	0.1
WhF	Wheeling loam, 12 to 55 percent slopes-----	149	10	159	0.1
WnB	Wheeling loam, 2 to 6 percent slopes, rarely flooded-----	605	0	605	0.3
WoC	Woolper silty clay loam, 4 to 12 percent slopes-----	86	56	142	0.1
	Total-----	133,824	64,231	198,055	100.0

* Less than 0.1 percent.

Table 5.--Land Capability and 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	Land capability	Corn	Soybeans	Tobacco	Wheat	Alfalfa hay	Grass-legume hay	Pasture
		Bu	Bu	Lb	Bu	Ton	Ton	AUM*
AlB----- Allegheny	IIe	115	40	2,800	45	4.0	3.5	7.0
AlC----- Allegheny	IIIe	105	35	2,500	40	4.0	3.5	7.0
AlD----- Allegheny	IVe	90	30	2,400	35	3.5	3.0	6.0
AnB----- Allegheny	IIe	115	40	3,000	45	4.0	3.5	7.0
Bo----- Boonesboro	IIw	100	35	2,700	40	3.5	3.0	6.0
CnE2----- Cynthiana----- Faywood-----	VIIIs VIe	---	---	---	---	---	---	3.5
Efd2----- Eden	IVe	65	20	1,950	20	3.5	2.5	5.0
Efe2----- Eden	VIe	---	---	---	---	---	---	3.5
EkB----- Elk	IIe	130	40	3,200	50	4.5	4.5	9.0
EkC----- Elk	IIIe	110	35	2,900	40	4.0	4.0	8.0
ErA----- Elk	IIw	130	45	3,200	50	4.5	4.5	9.0
ErB----- Elk	IIe	125	45	3,200	50	4.5	4.5	9.0
FrF----- Fairmount	VIIe	---	---	---	---	---	---	---
FwB----- Faywood	IIe	90	30	2,300	25	3.5	3.5	7.0
FyD2----- Faywood----- Cynthiana-----	IVe VIS	65	---	---	20	---	2.5	4.5
La----- Lawrence	IIIw	80	35	1,700	30	---	3.0	5.5
LoB----- Lowell	IIe	115	35	2,900	40	4.0	4.5	8.0
LoC----- Lowell	IIIe	100	30	2,600	35	4.0	4.0	8.0

See footnote at end of table.

Table 5.--Land Capability and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Tobacco	Wheat	Alfalfa hay	Grass- legume hay	Pasture
		Bu	Bu	Lb	Bu	Ton	Ton	AUM*
LwB----- Lowell	IIE	115	35	2,900	40	4.5	4.5	8.0
LwC2----- Lowell	IIIIE	100	30	2,500	35	4.0	4.0	7.5
LwD2----- Lowell	IVE	90	25	2,400	30	3.5	3.5	5.0
MgB----- Monongahela	IIE	105	40	2,700	40	---	4.0	7.0
MgC----- Monongahela	IIIIE	90	30	2,500	35	---	3.0	7.0
Ne----- Newark	IIW	95	35	2,250	35	---	4.5	7.5
Ng----- Newark	VW	---	---	---	---	---	---	---
NhB----- Nicholson	IIE	130	40	3,000	40	---	4.5	7.0
NhC----- Nicholson	IIIIE	110	35	2,700	35	---	3.5	6.5
No----- Nolin	IIW	120	35	2,700	40	4.0	4.0	8.0
OtB----- Otwell	IIE	105	35	2,700	40	---	4.0	8.0
OtC----- Otwell	IIIIE	95	30	2,400	35	---	3.5	7.0
OwB----- Otwell	IIE	105	35	2,700	40	---	4.0	8.0
SaB----- Sandview	IIE	130	45	3,200	50	5.5	4.5	9.0
WhB----- Wheeling	IIE	130	40	3,100	45	4.5	4.5	8.0
WhC----- Wheeling	IIIIE	115	35	2,800	40	4.5	4.0	7.0
WhF----- Wheeling	VIIE	---	---	---	---	---	---	5.0
WnB----- Wheeling	IIE	130	40	3,100	45	4.5	4.5	8.5
WoC----- Woolper	IIIIE	110	35	2,600	40	4.0	3.5	7.0

* 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 6.--Capability Classes and Subclasses
(Miscellaneous areas are excluded. Dashes indicate no acreage.)

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e) <u>Acres</u>	Wetness (w) <u>Acres</u>	Soil problem (s) <u>Acres</u>
I:				
Bracken County-----	---	---	---	---
Robertson County-----	---	---	---	---
II:				
Bracken County-----	9,139	6,322	2,817	---
Robertson County-----	3,247	1,689	1,558	---
III:				
Bracken County-----	8,898	8,651	247	---
Robertson County-----	2,700	2,677	23	---
IV:				
Bracken County-----	21,803	21,803	---	---
Robertson County-----	13,001	13,001	---	---
V:				
Bracken County-----	32	---	32	---
Robertson County-----	---	---	---	---
VI:				
Bracken County-----	87,814	87,743	---	71
Robertson County-----	43,121	42,547	---	574
VII:				
Bracken County-----	1,231	67	---	1,164
Robertson County-----	1,699	796	---	903
VIII:				
Bracken County-----	---	---	---	---
Robertson County-----	---	---	---	---

Table 7.--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	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
AlB, AlC----- Allegheny	Slight	Moderate	Slight	Severe	Shortleaf pine-----	80	130	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white oak, white ash, northern red oak.
					Yellow poplar-----	93	95	
					Virginia pine-----	72	112	
					Sugar maple-----	---	---	
					White ash-----	---	---	
					Northern red oak----	---	---	
					American elm-----	---	---	
					Red maple-----	---	---	
					Pignut hickory-----	---	---	
					Black oak-----	78	60	
					White oak-----	70	52	
					Eastern redcedar----	---	---	
					Black cherry-----	---	---	
Osage orange-----	---	---						
AlD----- Allegheny	Moderate	Moderate	Slight	Severe	Shortleaf pine-----	80	130	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white oak, white ash, northern red oak.
					Yellow poplar-----	93	95	
					Virginia pine-----	72	112	
					Sugar maple-----	---	---	
					White ash-----	---	---	
					Northern red oak----	---	---	
					American elm-----	---	---	
					Red maple-----	---	---	
					Pignut hickory-----	---	---	
					Black oak-----	78	60	
					White oak-----	70	52	
					Eastern redcedar----	---	---	
					Black cherry-----	---	---	
Osage orange-----	---	---						
AnB----- Allegheny	Slight	Moderate	Slight	Severe	Shortleaf pine-----	80	130	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white oak, white ash, northern red oak.
					Yellow poplar-----	93	95	
					Virginia pine-----	72	112	
					Sugar maple-----	---	---	
					White ash-----	---	---	
					Northern red oak----	---	---	
					American elm-----	---	---	
					Red maple-----	---	---	
					Pignut hickory-----	---	---	
					Black oak-----	78	60	
					White oak-----	70	52	
					Eastern redcedar----	---	---	
					Black cherry-----	---	---	
Bo----- Boonesboro	Slight	Slight	Slight	Severe	Yellow poplar-----	90	90	Eastern cottonwood, sweetgum, yellow poplar, white ash.
					White ash-----	---	---	
					Sweetgum-----	---	---	
					American elm-----	---	---	
					Hackberry-----	---	---	
					American sycamore----	---	---	
Black willow-----	---	---						

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
CnE2**: Cynthiana-----	Moderate	Moderate	Moderate	Slight	White oak----- Eastern redcedar---- White ash----- Black walnut----- Hackberry----- Chinkapin oak----- American elm----- Honeylocust----- Black locust----- Black cherry-----	--- 42 --- --- --- --- --- --- --- ---	--- 46 --- --- --- --- --- --- --- ---	Eastern redcedar, Virginia pine, white oak, white ash.
Faywood-----	Moderate	Moderate	Slight	Moderate	Northern red oak---- Scarlet oak----- White oak----- Hickory----- Black locust----- White ash----- Eastern redcedar---- Chinkapin oak----- Sugar maple----- Southern red oak---- Osage orange-----	70 72 60 --- --- --- --- --- --- --- ---	52 54 43 --- --- --- --- --- --- --- ---	Eastern white pine, white oak, white ash, northern red oak.
EfD2----- Eden	Slight	Moderate	Moderate	Moderate	Black oak----- Black locust----- White oak----- Osage orange----- White ash----- Hickory----- Scarlet oak----- Black walnut----- Eastern redcedar---- Chinkapin oak-----	69 --- 61 --- 60 --- 70 74 41 78	51 --- --- --- --- --- 52 --- 44 60	Northern red oak, white oak, white ash, eastern white pine, Norway spruce.
EfE2----- Eden	Moderate	Moderate	Moderate	Moderate	Black oak----- Black locust----- White oak----- Osage orange----- White ash----- Hickory----- Scarlet oak----- Black walnut----- Eastern redcedar---- Chinkapin oak-----	69 --- 61 --- 60 --- 70 74 41 78	51 --- --- --- --- --- --- --- 44 60	Northern red oak, white oak, white ash, eastern white pine, Norway spruce.
EkB, EkC, ErA, ErB----- Elk	Slight	Slight	Slight	Severe	Yellow poplar----- Pin oak----- Hackberry----- Red maple----- American sycamore--- Black walnut----- Sweetgum-----	94 96 --- --- --- --- 98	92 93 --- --- --- --- ---	Eastern white pine, yellow poplar, black walnut, white oak, northern red oak, cherrybark oak, white ash, shortleaf pine.

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
FrF----- Fairmount	Severe	Severe	Severe	Moderate	Black locust-----	---	---	White oak, Virginia pine, eastern redcedar.
					Black oak-----	65	47	
					White oak-----	55	---	
					Eastern redcedar----	41	44	
					Scarlet oak-----	---	---	
					Chinkapin oak-----	55	38	
					Hickory-----	---	---	
FwB----- Faywood	Slight	Moderate	Slight	Moderate	Northern red oak----	70	52	White oak, eastern white pine, white ash, northern red oak.
					White oak-----	60	43	
					Hickory-----	---	---	
					White ash-----	---	---	
					Chinkapin oak-----	---	---	
					Sugar maple-----	---	---	
					Black locust-----	---	---	
FyD2**: Faywood-----	Moderate	Moderate	Slight	Moderate	Eastern redcedar----	---	---	White oak, eastern white pine, white ash, northern red oak.
					Black locust-----	---	---	
					Northern red oak----	70	52	
					White oak-----	60	43	
					Hickory-----	---	---	
					White ash-----	---	---	
					Chinkapin oak-----	---	---	
Cynthiana-----	Moderate	Moderate	Moderate	Slight	Eastern redcedar----	42	46	Eastern redcedar, Virginia pine, white ash, white oak.
					American elm-----	---	---	
					Honeylocust-----	---	---	
					Chinkapin oak-----	---	---	
					Hackberry-----	---	---	
					Black walnut-----	71	---	
					White ash-----	75	---	
La----- Lawrence	Slight	Moderate	Moderate	Severe	Yellow poplar-----	85	81	Yellow poplar, white ash, American sycamore, white oak, sweetgum, willow oak, eastern white pine, pin oak.
					Sweetgum-----	89	103	
					White oak-----	74	56	
					Black oak-----	78	60	
					Red maple-----	---	---	
					Pin oak-----	---	---	
					Hackberry-----	---	---	
LoB, LoC----- Lowell	Slight	Moderate	Slight	Severe	Black oak-----	88	70	White ash, eastern white pine, white oak, northern red oak, yellow poplar.
					White ash-----	78	---	
					Osage orange-----	---	---	
					Hickory-----	---	---	
					Virginia pine-----	78	119	
					Black locust-----	74	---	
					Sugar maple-----	---	---	
Northern red oak----	---	---						

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
LwB, LwC2----- Lowell	Slight	Moderate	Slight	Severe	Black oak----- White ash----- Black locust----- Northern red oak---- Osage orange----- Hickory----- Chinkapin oak----- Sugar maple----- Eastern redcedar----	88 75 74 --- --- --- 81 --- ---	70 --- --- --- --- --- 63 --- ---	White ash, eastern white pine, white oak, northern red oak, yellow poplar.
LwD2----- Lowell	Moderate	Moderate	Slight	Severe	Black oak----- White ash----- Black locust----- Northern red oak---- Osage orange----- Hickory----- Chinkapin oak----- Sugar maple----- Eastern redcedar----	88 75 74 --- --- --- 81 --- ---	70 --- --- --- --- --- 63 --- ---	White ash, eastern white pine, white oak, northern red oak, yellow poplar.
MgB----- Monongahela	Slight	Slight	Slight	Moderate	Northern red oak---- Yellow poplar----- Eastern white pine-- Virginia pine----- White ash----- Black walnut----- Osage orange-----	70 85 72 66 --- --- ---	52 81 126 102 --- --- ---	Eastern white pine, yellow poplar, black cherry, shortleaf pine, white ash, northern red oak.
MgC----- Monongahela	Moderate	Slight	Slight	Moderate	Northern red oak---- Yellow poplar----- Eastern white pine-- Virginia pine----- White ash----- Black walnut----- Osage orange-----	70 85 72 66 --- --- ---	52 81 126 102 --- --- ---	Eastern white pine, yellow poplar, black cherry, shortleaf pine, white ash, northern red oak.
Ne----- Newark	Slight	Moderate	Slight	Severe	Pin oak----- Eastern cottonwood-- Sweetgum----- Green ash----- River birch-----	100 94 85 --- ---	98 113 93 --- ---	Eastern cottonwood, sweetgum, American sycamore, green ash, pin oak.
Ng----- Newark	Slight	Severe	Severe	Severe	Black willow----- Eastern cottonwood-- Green ash----- Pin oak----- Silver maple----- Sweetgum----- River birch-----	--- --- --- --- --- --- ---	--- --- --- --- --- --- ---	American sycamore, eastern cottonwood, green ash, pin oak, river birch, sweetgum.

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Plant competi-tion	Common trees	Site index	Volume*	
NhB, NhC----- Nicholson	Moderate	Slight	Slight	Moderate	Black oak----- White oak----- Hickory----- Sweetgum----- Yellow poplar----- Northern red oak----	78 74 --- 84 107 79	60 56 --- 90 119 61	White oak, northern red oak, sweetgum, yellow poplar, eastern white pine, white ash.
No----- Nolin	Slight	Slight	Slight	Severe	Black walnut----- Sweetgum----- Yellow poplar----- Eastern cottonwood-- River birch----- Hickory----- Black willow----- American sycamore-- American elm-----	--- 92 107 --- --- --- --- --- ---	--- 112 119 --- --- --- --- --- ---	Eastern cottonwood, white ash, cherrybark oak, sweetgum, pin oak, black walnut, yellow poplar.
OtB, OtC, OwB--- Otwell	Moderate	Slight	Moderate	Moderate	White oak----- Yellow poplar----- Sugar maple----- Blackgum----- Black oak-----	69 95 --- --- 72	51 93 --- --- 54	Eastern white pine, yellow poplar, white ash, white oak.
SaB----- Sandview	Slight	Slight	Slight	Severe	Northern red oak---- White oak----- White ash----- Hickory----- Black walnut----- Black cherry----- Black locust----- Hackberry----- American elm-----	80 75 80 --- --- --- --- --- ---	52 57 --- --- --- --- --- --- ---	Black walnut, northern red oak, white oak, white ash, yellow poplar, eastern white pine, shortleaf pine.
WhB----- Wheeling	Slight	Slight	Slight	Severe	Northern red oak---- Yellow poplar----- White ash----- Black walnut----- White oak-----	80 90 --- --- ---	62 90 --- --- ---	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white ash, white oak.
WhC----- Wheeling	Moderate	Slight	Slight	Severe	Northern red oak---- Yellow poplar----- Black walnut----- White ash----- White oak-----	80 90 --- --- ---	62 90 --- --- ---	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white ash, white oak.

See footnotes at end of table.

Table 7.--Woodland Management and Productivity--Continued

Soil name and map symbol	Management concerns				Potential productivity			Trees to plant
	Erosion hazard	Equip-ment limita-tion	Seedling mortal-ity	Plant competi-tion	Common trees	Site index	Volume*	
WhF----- Wheeling	Severe	Moderate	Slight	Severe	Northern red oak----	80	62	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white ash, white oak.
					Yellow poplar-----	90	90	
					Black walnut-----	---	---	
					White oak-----	---	---	
					White ash-----	---	---	
WnB----- Wheeling	Slight	Slight	Slight	Severe	Northern red oak----	80	62	Eastern white pine, yellow poplar, black walnut, shortleaf pine, white ash, white oak.
					Yellow poplar-----	90	90	
					White ash-----	---	---	
					Black walnut-----	---	---	
					White oak-----	---	---	
WoC----- Woolper	Moderate	Moderate	Moderate	Severe	Black oak-----	75	57	Yellow poplar, white ash, white oak, northern red oak, eastern white pine, black walnut.
					Chinkapin oak-----	71	53	
					White ash-----	---	---	
					Hickory-----	---	---	
					Sugar maple-----	---	---	
					White oak-----	---	---	
					Yellow buckeye-----	---	---	
Black walnut-----	---	---						

* Volume is the yield in cubic feet per acre per year calculated at the age of culmination of mean annual increment for fully stocked natural stands.

** See description of the map unit for composition and behavior characteristics of the map unit.

Table 8.--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
AlB----- Allegheny	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
AlC----- Allegheny	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
AlD----- Allegheny	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
AnB----- Allegheny	Severe: flooding.	Slight-----	Moderate: slope.	Slight-----	Slight.
Bo----- Boonesboro	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
CnE2*: Cynthiana-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: slope, erodes easily.	Severe: slope, depth to rock.
Faywood-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
EfD2----- Eden	Moderate: slope, percs slowly, large stones.	Moderate: slope, large stones, percs slowly.	Severe: large stones, slope, small stones.	Slight-----	Moderate: large stones, slope, depth to rock.
EfE2----- Eden	Severe: slope.	Severe: slope.	Severe: large stones, slope, small stones.	Severe: slope.	Severe: slope.
EkB----- Elk	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
EkC----- Elk	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
ErA----- Elk	Severe: flooding.	Slight-----	Moderate: flooding.	Slight-----	Moderate: flooding.
ErB----- Elk	Severe: flooding.	Slight-----	Moderate: slope.	Slight-----	Slight.
FrF----- Fairmount	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: large stones, slope, small stones.	Severe: erodes easily, slope.	Severe: slope, depth to rock.
FwB----- Faywood	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: depth to rock, slope, percs slowly.	Slight-----	Moderate: depth to rock.

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FyD2*: Faywood-----	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, depth to rock.
Cynthiana-----	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, slope, depth to rock.	Severe: erodes easily.	Severe: depth to rock.
La----- Lawrence	Severe: flooding, wetness.	Moderate: wetness, percs slowly.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.
LoB----- Lowell	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight-----	Slight.
LoC----- Lowell	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
LwB----- Lowell	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight-----	Slight.
LwC2----- Lowell	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
LwD2----- Lowell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
MgB----- Monongahela	Moderate: wetness, percs slowly.	Moderate: wetness, perce slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
MgC----- Monongahela	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.
Ne----- Newark	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Ng----- Newark	Severe: flooding, ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, flooding, wetness.	Severe: ponding, wetness.	Severe: ponding, flooding, wetness.
NhB----- Nicholson	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.
NhC----- Nicholson	Moderate: slope, wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: wetness, slope.

See footnote at end of table.

Table 8.--Recreational Development--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
No----- Nolin	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
OtB----- Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight-----	Slight.
OtC----- Otwell	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Severe: erodes easily.	Moderate: slope.
OwB----- Otwell	Severe: flooding, percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight-----	Moderate: flooding.
SaB----- Sandview	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
WhB----- Wheeling	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
WhC----- Wheeling	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
WhF----- Wheeling	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
WnB----- Wheeling	Severe: flooding.	Slight-----	Moderate: slope.	Slight-----	Slight.
WoC----- Woolper	Moderate: percs slowly, slope.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 9.--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 herba- ceous plants	Hardwood trees	Conif- erous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
AlB----- Allegheny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
AlC----- Allegheny	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
AlD----- Allegheny	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
AnB----- Allegheny	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Bo----- Boonesboro	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Good	Good	Very poor.
CnE2*: Cynthiana-----	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Faywood-----	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
EfD2----- Eden	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
EfE2----- Eden	Very poor.	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
EkB----- Elk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
EkC----- Elk	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
ErA, ErB----- Elk	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FrF----- Fairmount	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
FwB----- Faywood	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
FyD2*: Faywood-----	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Cynthiana-----	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
La----- Lawrence	Fair	Fair	Good	Fair	Poor	Fair	Fair	Fair	Fair	Fair.
LoB----- Lowell	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LoC----- Lowell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.

See footnote at end of table.

Table 9.--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
LwB----- Lowell	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
LwC2----- Lowell	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
LwD2----- Lowell	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MgB----- Monongahela	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
MgC----- Monongahela	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Ne----- Newark	Poor	Poor	Poor	Poor	Poor	Fair	Fair	Poor	Poor	Fair.
Ng----- Newark	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
NhB----- Nicholson	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Good	Very poor.
NhC----- Nicholson	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Good	Very poor.
No----- Nolin	Fair	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
OtB----- Otwell	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
OtC----- Otwell	Fair	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
OwB----- Otwell	Fair	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
SaB----- Sandview	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WhB----- Wheeling	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WhC----- Wheeling	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
WhF----- Wheeling	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
WnB----- Wheeling	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
WoC----- Woolper	Fair	Fair	Fair	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 10.--Building Site Development

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AlB----- Allegheny	Slight-----	Slight-----	Slight-----	Moderate: slope.	Slight-----	Slight.
AlC----- Allegheny	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
AlD----- Allegheny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AnB----- Allegheny	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
Bo----- Boonesboro	Severe: depth to rock.	Severe: flooding.	Severe: flooding, depth to rock.	Severe: flooding.	Severe: flooding.	Severe: flooding.
CnE2*: Cynthiana-----	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, low strength, slope.	Severe: slope, depth to rock.
Faywood-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
EfD2----- Eden	Moderate: depth to rock, too clayey, slope.	Moderate: shrink-swell, slope, large stones.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: large stones, slope, depth to rock.
EfE2----- Eden	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
EkB----- Elk	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: low strength.	Slight.
EkC----- Elk	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope.

See footnote at end of table.

Table 10.--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
ErA----- Elk	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
ErB----- Elk	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: low strength, flooding.	Slight.
FrF----- Fairmount	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, low strength, slope.	Severe: slope, depth to rock.
FwB----- Faywood	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: low strength.	Moderate: depth to rock.
FyD2*: Faywood-----	Severe: depth to rock.	Moderate: slope, depth to rock, shrink-swell.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Moderate: slope, depth to rock.
Cynthiana-----	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, low strength, slope.	Severe: depth to rock.
La----- Lawrence	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength.	Moderate: wetness.
LoB----- Lowell	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
LoC----- Lowell	Moderate: depth to rock, too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
LwB----- Lowell	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.

See footnote at end of table.

Table 10.--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
LwC2----- Lowell	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
LwD2----- Lowell	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
MgB----- Monongahela	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness, frost action, low strength.	Moderate: wetness.
MgC----- Monongahela	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Moderate: wetness, slope, low strength.	Moderate: wetness, slope.
Ne----- Newark	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
Ng----- Newark	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: low strength, ponding, wetness.	Severe: ponding, flooding, wetness.
NhB----- Nicholson	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Severe: low strength.	Moderate: wetness.
NhC----- Nicholson	Severe: wetness.	Moderate: wetness, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: wetness, slope.
No----- Nolin	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
OtB----- Ottwell	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: low strength.	Slight.

See footnote at end of table.

Table 10.--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
OtC----- Otwell	Severe: wetness.	Moderate: wetness, shrink-swell, slope.	Severe: wetness.	Severe: slope.	Severe: low strength.	Moderate: slope.
OwB----- Otwell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: low strength.	Moderate: flooding.
SaB----- Sandview	Moderate: too clayey.	Slight-----	Slight-----	Moderate: slope.	Severe: low strength.	Slight.
WhB----- Wheeling	Slight-----	Slight-----	Slight-----	Moderate: slope.	Moderate: frost action, low strength.	Slight.
WhC----- Wheeling	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: frost action, low strength, slope.	Moderate: slope.
WhF----- Wheeling	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
WnB----- Wheeling	Slight-----	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding, frost action, low strength.	Slight.
WoC----- Woolper	Moderate: too clayey, slope.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 11.--Sanitary Facilities

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AlB----- Allegheny	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Moderate: too clayey.
AlC----- Allegheny	Moderate: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Moderate: too clayey, slope.
AlD----- Allegheny	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
AnB----- Allegheny	Moderate: flooding, percs slowly.	Moderate: seepage, slope.	Moderate: flooding, too clayey.	Moderate: flooding.	Moderate: too clayey.
Bo----- Boonesboro	Severe: flooding, depth to rock, poor filter.	Severe: seepage, depth to rock, flooding.	Severe: flooding, depth to rock, seepage.	Severe: flooding, depth to rock, seepage.	Severe: depth to rock, small stones.
CnE2*: Cynthiana-----	Severe: depth to rock, slope, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey, hard to pack.
Faywood-----	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey, hard to pack.
EfD2----- Eden	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Severe: depth to rock, too clayey, hard to pack.
EfE2----- Eden	Severe: depth to rock, slope, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey, hard to pack.
EkB----- Elk	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Moderate: too clayey.
EkC----- Elk	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Moderate: too clayey, slope.
ErA----- Elk	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: too clayey.
ErB----- Elk	Moderate: flooding, percs slowly.	Moderate: seepage, slope.	Moderate: flooding, too clayey.	Moderate: flooding.	Moderate: too clayey.

See footnote at end of table.

Table 11.--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
FrF----- Fairmount	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.	Severe: depth to rock, too clayey, hard to pack.
FwB----- Faywood	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Severe: depth to rock, too clayey, hard to pack.
FyD2*: Faywood-----	Severe: depth to rock, percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Severe: depth to rock, too clayey, hard to pack.
Cynthiana-----	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Severe: depth to rock, too clayey, hard to pack.
La----- Lawrence	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
LoB----- Lowell	Severe: percs slowly.	Moderate: seepage, depth to rock, slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Severe: too clayey, hard to pack.
LoC----- Lowell	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock, slope.	Severe: too clayey, hard to pack.
LwB----- Lowell	Severe: percs slowly.	Moderate: seepage, slope.	Severe: depth to rock, too clayey.	Slight-----	Severe: too clayey, hard to pack.
LwC2----- Lowell	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Severe: too clayey, hard to pack.
LwD2----- Lowell	Severe: percs slowly, slope.	Severe: slope.	Severe: depth to rock, slope, too clayey.	Severe: slope.	Severe: too clayey, hard to pack, slope.
MgB----- Monongahela	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: too clayey wetness.
MgC----- Monongahela	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: slope, wetness, too clayey
Ne----- Newark	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness.

See footnote at end of table.

Table 11.--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
Ng----- Newark	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.	Severe: ponding, wetness.
NhB----- Nicholson	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Severe: too clayey, hard to pack.
NhC----- Nicholson	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness, too clayey.	Moderate: wetness, slope.	Severe: too clayey, hard to pack.
No----- Nolin	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding, seepage.	Moderate: too clayey.
OtB----- Otwell	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Moderate: wetness.	Moderate: too clayey, wetness.
OtC----- Otwell	Severe: wetness, percs slowly.	Severe: slope.	Moderate: wetness, slope, too clayey.	Moderate: wetness, slope.	Moderate: too clayey, slope, wetness.
OwB----- Otwell	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: flooding, wetness, too clayey.	Moderate: flooding, wetness.	Moderate: too clayey, wetness.
SaB----- Sandview	Severe: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Moderate: too clayey.
WhB----- Wheeling	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Slight-----	Slight.
WhC----- Wheeling	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Moderate: slope.
WhF----- Wheeling	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Severe: slope.
WnB----- Wheeling	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Moderate: flooding.	Moderate: flooding.
WoC----- Woolper	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Severe: too clayey, hard to pack.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 12.--Construction Materials

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AlB----- Allegheny	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, too clayey.
AlC----- Allegheny	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, too clayey.
AlD----- Allegheny	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
AnB----- Allegheny	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, too clayey.
Bo----- Boonesboro	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
CnE2*: Cynthiana-----	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, slope.
Faywood-----	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, slope, too clayey.
EfD2----- Eden	Poor: depth to rock, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, too clayey, small stones.
EfE2----- Eden	Poor: depth to rock, slope, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, too clayey, small stones.
EkB----- Elk	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
EkC----- Elk	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
ErA, ErB----- Elk	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
FrF----- Fairmount	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, large stones.
FwB----- Faywood	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, too clayey.
FyD2*: Faywood-----	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer, too clayey.
Cynthiana-----	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, depth to rock.
La----- Lawrence	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
LoB, LoC, LwB, LwC2--- Lowell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LwD2----- Lowell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
MgB----- Monongahela	Fair: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
MgC----- Monongahela	Fair: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, slope.
Ne, Ng----- Newark	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NhB----- Nicholson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
NhC----- Nicholson	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.
No----- Nolin	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
OtB----- Otwell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
OtC----- Otwell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, slope.

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
OwB----- Otwell	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
SaB----- Sandview	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
WhB----- Wheeling	Good-----	Probable-----	Probable-----	Fair: small stones.
WhC----- Wheeling	Good-----	Probable-----	Probable-----	Fair: small stones, slope.
WhF----- Wheeling	Poor: slope.	Probable-----	Probable-----	Poor: slope.
WnB----- Wheeling	Good-----	Probable-----	Probable-----	Fair: small stones.
WoC----- Woolper	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 13.--Water Management

(Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.)

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
AlB----- Allegheny	Moderate: seepage, slope.	Severe: piping, seepage.	Deep to water, slope.	Favorable-----	Favorable.
AlC, AlD----- Allegheny	Severe: slope.	Severe: piping, seepage.	Deep to water, slope.	Slope-----	Slope.
AnB----- Allegheny	Moderate: seepage, slope.	Severe: piping, seepage.	Deep to water, slope.	Favorable-----	Favorable.
Bo----- Boonesboro	Severe: seepage.	Severe: thin layer, piping.	Deep to water, depth to rock, flooding.	Depth to rock, erodes easily.	Depth to rock, erodes easily.
CnE2*: Cynthiana-----	Severe: depth to rock, slope.	Severe: hard to pack, thin layer, large stones.	Deep to water, depth to rock, large stones.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
Faywood-----	Severe: slope.	Severe: hard to pack, thin layer.	Deep to water, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Efd2----- Eden	Severe: slope.	Severe: hard to pack, large stones, thin layer.	Deep to water, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
Efe2----- Eden	Severe: slope.	Severe: hard to pack, large stones, thin layer.	Deep to water, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
EkB----- Elk	Moderate: seepage, slope.	Severe: piping.	Deep to water, slope.	Erodes easily---	Erodes easily.
EkC----- Elk	Severe: slope.	Severe: piping.	Deep to water, slope.	Slope, erodes easily.	Slope, erodes easily.
ErA----- Elk	Moderate: seepage.	Severe: piping.	Deep to water---	Erodes easily---	Erodes easily.
ErB----- Elk	Moderate: seepage, slope.	Severe: piping.	Deep to water, slope.	Erodes easily---	Erodes easily.
FrF----- Fairmount	Severe: depth to rock, slope.	Severe: thin layer, large stones.	Deep to water, percs slowly, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
FwB----- Faywood	Moderate: depth to rock, slope.	Severe: thin layer, hard to pack.	Deep to water, percs slowly, depth to rock.	Depth to rock, erodes easily, percs slowly.	Erodes easily, depth to rock, percs slowly.

See footnote at end of table.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
FyD2*: Faywood-----	Severe: slope.	Severe: thin layer, hard to pack.	Deep to water, percs slowly, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Cynthiana-----	Severe: depth to rock, slope.	Severe: hard to pack, thin layer, large stones.	Deep to water, depth to rock, large stones.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
La----- Lawrence	Slight-----	Severe: piping, hard to pack.	Percs slowly----	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
LoB----- Lowell	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water, slope.	Erodes easily---	Erodes easily.
LoC----- Lowell	Severe: slope.	Severe: hard to pack.	Deep to water, slope.	Slope, erodes easily.	Slope, erodes easily.
LwB----- Lowell	Moderate: slope.	Severe: hard to pack.	Deep to water, slope.	Erodes easily---	Erodes easily.
LwC2, LwD2----- Lowell	Severe: slope.	Severe: hard to pack.	Deep to water, slope.	Slope, erodes easily.	Slope, erodes easily.
MgB----- Monongahela	Moderate: seepage, slope.	Severe: piping.	Percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
MgC----- Monongahela	Severe: slope.	Severe: piping.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
Ne----- Newark	Moderate: seepage.	Severe: piping, wetness.	Flooding-----	Erodes easily, wetness.	Wetness, erodes easily.
Ng----- Newark	Moderate: seepage.	Severe: piping, ponding, wetness.	Ponding-----	Ponding, wetness, erodes easily.	Wetness.
NhB----- Nicholson	Moderate: seepage, slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
NhC----- Nicholson	Severe: slope.	Moderate: hard to pack, wetness.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
No----- Nolin	Severe: seepage.	Severe: piping.	Deep to water, flooding.	Erodes easily---	Erodes easily.
OtB----- Otwell	Moderate: slope.	Moderate: thin layer, wetness, piping.	Percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.

See footnote at end of table.

Table 13.--Water Management--Continued

Soil name and map symbol	Limitations for--		Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
OtC----- Otwell	Severe: slope.	Moderate: thin layer, wetness, piping.	Percs slowly, slope.	Slope, erodes easily, wetness.	Slope, erodes easily, rooting depth.
OwB----- Otwell	Moderate: slope.	Moderate: thin layer, wetness, piping.	Percs slowly, slope.	Erodes easily, wetness, percs slowly.	Erodes easily, rooting depth, percs slowly.
SaB----- Sandview	Moderate: slope, seepage.	Severe: piping.	Deep to water, slope.	Erodes easily---	Erodes easily.
WhB----- Wheeling	Severe: seepage.	Severe: piping, seepage.	Deep to water, slope.	Erodes easily---	Erodes easily.
WhC, WhF----- Wheeling	Severe: slope, seepage.	Severe: piping, seepage.	Deep to water, slope.	Erodes easily, slope.	Slope, erodes easily.
WnB----- Wheeling	Severe: seepage.	Severe: piping, seepage.	Deep to water, slope.	Erodes easily---	Erodes easily.
WoC----- Woolper	Severe: slope.	Severe: hard to pack.	Deep to water, percs slowly, slope.	Erodes easily, percs slowly, slope.	Slope, erodes easily, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 14.--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 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
AlB, AlC, AlD, AnB----- Allegheny	0-9	Loam-----	ML, CL	A-4	0	90-100	80-100	65-100	55-95	<35	NP-10
	9-45	Clay loam, loam, sandy clay loam.	ML, CL, SM, SC	A-4, A-6	0	90-100	80-100	65-95	35-80	<35	NP-15
	45-65	Clay loam, sandy loam.	SM, GC, ML, CL	A-4, A-6, A-2, A-1	0-5	65-100	55-100	35-95	20-75	<35	NP-15
Bo----- Boonesboro	0-16	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0-5	90-100	85-100	80-100	70-95	25-35	3-11
	16-26	Gravelly silt loam, flaggy silt loam, gravelly silty clay loam, flaggy silty clay loam.	GM, GC, CL, CL-ML	A-2, A-4, A-6, A-7	0-20	50-75	40-70	35-65	25-60	25-42	3-20
	26	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CnE2*: Cynthiana-----	0-4	Flaggy silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	10-40	80-90	70-85	65-80	60-75	25-42	4-20
	4-17	Flaggy clay, flaggy silty clay, clay.	MH, CH, CL	A-7	5-30	70-100	65-100	60-100	55-100	45-75	20-45
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Faywood-----	0-4	Silt loam-----	ML, CL-ML	A-4	0-15	100	95-100	90-100	85-100	25-35	4-10
	4-32	Silty clay, clay, silty clay loam, very channery silty clay.	CH, CL	A-7	0-15	90-100	90-100	85-100	75-100	42-70	20-45
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Efd2, Efe2----- Eden	0-3	Flaggy silty clay loam.	CL, CH	A-7, A-6	0-20	75-95	70-95	70-95	65-95	35-65	12-35
	3-36	Channery silty clay, channery clay, silty clay, extremely channery silty clay.	CH, CL	A-7	10-45	75-100	55-100	50-100	50-95	45-75	20-45
	36	Weathered bedrock	---	---	---	---	---	---	---	---	---
EkB, EkC, ErA, ErB----- Elk	0-9	Silt loam-----	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	70-95	25-35	3-10
	9-65	Silty clay loam, silt loam, loam.	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	85-100	75-100	25-40	5-15
FrF----- Fairmount	0-11	Flaggy silty clay loam.	CL	A-6, A-7	10-40	80-90	70-85	65-80	60-75	35-45	15-22
	11-17	Flaggy clay, flaggy silty clay.	CH, CL	A-7	8-50	80-100	70-100	65-100	60-100	40-70	20-40
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FwB----- Faywood	0-4	Silt loam-----	ML, CL, CL-ML	A-4	0-15	100	95-100	90-100	85-100	25-35	4-10
	4-32	Silty clay, clay, silty clay loam, very channery silty clay.	CH, CL	A-7	0-15	90-100	90-100	85-100	75-100	42-70	20-45
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FyD2*: Faywood-----	0-4	Silt loam-----	ML, CL, CL-ML	A-4	0-15	100	95-100	90-100	85-100	25-35	4-10
	4-32	Silty clay, clay, silty clay loam, very channery silty clay.	CH, CL	A-7	0-15	90-100	90-100	85-100	75-100	42-70	20-45
	32	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
FyD2*: Cynthiana-----	0-4	Flaggy silty clay loam.	CL, CL-ML	A-4, A-6, A-7	10-40	80-90	70-85	65-80	60-75	25-42	4-20
	4-17	Flaggy clay, flaggy silty clay, clay.	CH, CL	A-7	5-30	70-100	65-100	60-100	55-100	45-75	20-45
	17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
La----- Lawrence	0-8	Silt loam-----	ML	A-4	0	100	95-100	90-100	80-100	25-35	2-10
	8-18	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	80-100	25-42	5-20
	18-32	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	80-100	25-42	5-20
	32-80	Silty clay, silty clay loam, clay.	ML, CL, MH, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	75-100	25-60	5-25
LoB, LoC----- Lowell	0-8	Silt loam-----	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	22-32	3-10
	8-20	Silty clay, clay, silty clay loam.	CL, CH, MH	A-7, A-6	0	100	95-100	90-100	85-100	35-65	15-32
	20-44 44	Clay, silty clay Unweathered bedrock.	CH, MH, CL ---	A-7 ---	0-10 ---	95-100 ---	90-100 ---	85-100 ---	75-100 ---	45-75 ---	20-40 ---
LwB----- Lowell	0-7	Silt loam-----	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	22-32	4-10
	7-48	Silty clay loam, silty clay, clay.	CL, CH, MH	A-7, A-6	0	100	95-100	90-100	85-100	35-65	15-32
	48-64	Silty clay, clay	CH, MH, CL	A-7	0-10	95-100	90-100	85-100	80-100	45-75	20-40
	64-68	Weathered bedrock	---	---	---	---	---	---	---	---	---
LwC2, LwD2----- Lowell	0-5	Silt loam-----	ML, CL, CL-ML	A-4	0	100	95-100	90-100	85-100	22-32	4-10
	5-46	Silty clay loam, silty clay, clay.	CL, CH, MH	A-7, A-6	0	100	95-100	90-100	85-100	35-65	15-32
	46-62 62-66	Silty clay, clay Weathered bedrock	CH, MH, CL ---	A-7 ---	0-10 ---	95-100 ---	90-100 ---	85-100 ---	80-100 ---	45-75 ---	20-40 ---

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	<u>In</u>				<u>Pct</u>					<u>Pct</u>	
MgB, MgC----- Monongahela	0-7	Loam-----	ML, SM, CL-ML, SC-SM	A-4	0-5	90-100	85-100	75-100	45-90	20-35	1-10
	7-27	Silt loam, clay loam, loam.	ML, CL, CL-ML	A-4, A-6	0-15	90-100	80-100	75-100	70-90	20-40	5-15
	27-41	Silt loam, sandy clay loam, loam.	ML, CL, SM, SC	A-4, A-6	0-10	80-100	60-100	55-95	45-95	20-40	3-15
	41-74	Sandy clay loam, loam, gravelly sandy clay loam, gravelly loam.	ML, CL, SM, SC	A-4, A-6	10-20	75-100	60-90	60-85	40-85	20-40	1-15
Ne, Ng----- Newark	0-10	Silt loam-----	ML, CL, CL-ML	A-4	0	95-100	90-100	80-100	55-95	<32	NP-10
	10-32	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0	95-100	90-100	85-100	70-100	22-42	3-20
	32-62	Silt loam, silty clay loam.	ML, CL, CL-ML	A-4, A-6, A-7	0-3	75-100	70-100	65-100	55-95	22-42	3-20
NhB, NhC----- Nicholson	0-7	Silt loam-----	ML, CL, CL-ML	A-4	0	95-100	95-100	85-100	80-95	25-35	5-10
	7-21	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	85-100	85-100	80-100	25-45	5-20
	21-38	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4, A-7	0	95-100	90-100	80-100	75-100	25-45	5-20
	38-72	Silty clay, clay	CH, CL	A-6, A-7	0-10	80-100	70-100	60-100	55-100	34-70	16-40
No----- Nolin	0-9	Silt loam-----	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	80-100	25-40	5-18
	9-30	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	85-100	75-100	25-46	5-23
	30-62	Silt loam, silty clay loam, gravelly silt loam, gravelly silty clay loam.	ML, CL, CL-ML, GM	A-4, A-6	0-10	50-100	50-100	40-95	35-95	<30	NP-15

See footnote at end of table.

Table 14.--Engineering Index Properties--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
OtB, OtC, OwB--- Otwell	0-9	Silt loam-----	CL, CL-ML	A-4, A-6	0	100	100	90-100	70-95	25-35	5-15
	9-24	Silty clay loam, silt loam.	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-95	25-40	5-20
	24-51	Silty clay loam, silt loam.	CL	A-6, A-7	0	95-100	95-100	85-100	65-90	35-50	20-30
	51-62	Silt loam, silty clay loam, clay loam.	CL	A-6, A-7	0	95-100	90-100	85-100	65-95	35-50	15-25
SaB----- Sandview	0-9	Silt loam-----	ML, CL, CL-ML	A-4	0	100	95-100	90-100	80-95	25-35	5-10
	9-50	Silt loam, silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0	100	95-100	90-100	85-100	25-45	5-20
	50-74	Silty clay, clay	CH, CL	A-7	0-10	90-100	90-100	85-100	75-100	45-75	20-45
WhB, WhC, WhF, WnB----- Wheeling	0-23	Loam-----	ML, CL, SM, SC	A-4	0	90-100	90-100	85-100	45-90	15-35	NP-10
	23-57	Silty clay loam, loam, sandy clay loam.	ML, CL, SM, SC	A-4, A-6	0-5	90-100	70-100	65-100	45-80	20-40	2-20
	57-80	Stratified very fine sand to very gravelly sand.	GM, SM, GP, GW	A-1, A-2, A-3, A-4	10-20	35-90	20-75	10-65	4-45	<20	NP-10
WoC----- Woolper	0-10	Silty clay loam	CL	A-6, A-7	0-10	95-100	90-100	85-100	75-100	34-42	15-22
	10-20	Silty clay, silty clay loam, clay.	CL, CH	A-7, A-6	0-10	95-100	90-100	85-100	75-100	35-65	15-40
	20-71	Clay, silty clay	CH, CL	A-7	0-10	95-100	90-100	85-100	75-100	45-75	20-45

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 15.--Physical and Chemical Properties of the Soils

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "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		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
AlB, AlC, AlD, AnB----- Allegheny	0-9 9-45 45-65	15-27 18-35 10-35	1.20-1.40 1.20-1.50 1.20-1.40	0.6-2.0 0.6-2.0 0.6-2.0	0.12-0.22 0.13-0.18 0.08-0.17	3.6-5.5 3.6-5.5 3.6-5.5	Low----- Low----- Low-----	0.32 0.28 0.28	4	1-4
Bo----- Boonesboro	0-16 16-26 26-30	15-27 18-35 ---	1.20-1.40 1.20-1.40 ---	0.6-2.0 6.0-20 ---	0.18-0.23 0.06-0.12 ---	6.1-8.4 6.1-8.4 ---	Low----- Low----- -----	0.37 0.17 ---	3	3-5
CnE2*: Cynthiana-----	0-4 4-17 17-21	27-40 40-60 ---	1.20-1.40 1.35-1.60 ---	0.6-2.0 0.2-0.6 ---	0.15-0.20 0.08-0.15 ---	6.1-7.8 6.1-7.8 ---	Moderate---- Moderate---- -----	0.37 0.28 ---	2	1-4
Faywood-----	0-4 4-32 32-36	15-27 35-60 ---	1.30-1.40 1.35-1.45 ---	0.6-2.0 0.06-0.6 ---	0.18-0.22 0.12-0.17 ---	5.1-7.8 5.1-7.8 ---	Low----- Moderate---- -----	0.37 0.28 ---	3	1-4
EfD2, EfeE2----- Eden	0-3 3-36 36-40	27-40 40-60 ---	1.45-1.65 1.45-1.65 ---	0.06-0.6 0.06-0.2 ---	0.11-0.17 0.08-0.13 ---	4.5-8.4 5.1-8.4 ---	Moderate---- Moderate---- -----	0.17 0.28 ---	3	.5-3
EkB, EkC, ErA, ErB----- Elk	0-9 9-65	10-27 18-34	1.20-1.40 1.20-1.50	0.6-2.0 0.6-2.0	0.19-0.23 0.18-0.22	4.5-6.5 4.5-6.5	Low----- Low-----	0.37 0.28	5	.5-3
FrF----- Fairmount	0-11 11-17 17-21	27-40 40-60 ---	1.20-1.40 1.40-1.60 ---	0.06-0.6 0.06-0.6 ---	0.12-0.20 0.10-0.18 ---	6.6-8.4 6.6-8.4 ---	Moderate---- Moderate---- -----	0.37 0.37 ---	2	3-7
FwB----- Faywood	0-4 4-32 32-36	15-27 35-60 ---	1.30-1.40 1.35-1.45 ---	0.6-2.0 0.06-0.6 ---	0.18-0.22 0.12-0.17 ---	5.1-7.8 5.1-7.8 ---	Low----- Moderate---- -----	0.37 0.28 ---	3	1-4
FyD2*: Faywood-----	0-4 4-32 32-36	15-27 35-60 ---	1.30-1.40 1.35-1.45 ---	0.6-2.0 0.06-0.6 ---	0.18-0.22 0.12-0.17 ---	5.1-7.8 5.1-7.8 ---	Low----- Moderate---- -----	0.37 0.28 ---	3	1-4
Cynthiana-----	0-4 4-17 17-21	27-40 40-60 ---	1.20-1.40 1.35-1.60 ---	0.6-2.0 0.2-0.6 ---	0.15-0.20 0.08-0.15 ---	6.1-7.8 6.1-7.8 ---	Moderate---- Moderate---- -----	0.37 0.28 ---	2	1-4
La----- Lawrence	0-8 8-18 18-32 32-80	12-27 18-35 18-35 27-60	1.20-1.40 1.40-1.60 1.50-1.70 1.50-1.70	0.6-2.0 0.6-2.0 0.06-0.2 0.06-0.6	0.19-0.23 0.18-0.22 0.08-0.12 0.08-0.12	4.5-6.5 4.5-6.5 4.5-5.5 4.5-7.3	Low----- Low----- Low----- Low-----	0.43 0.37 0.43 0.37	3	1-4
LoB, LoC----- Lowell	0-8 8-20 20-44 44-48	12-27 35-60 40-60 ---	1.20-1.40 1.30-1.60 1.50-1.60 ---	0.6-2.0 0.2-0.6 0.2-0.6 ---	0.18-0.23 0.13-0.19 0.12-0.17 ---	4.5-6.5 4.5-6.5 5.1-7.8 ---	Low----- Moderate---- Moderate---- -----	0.37 0.28 0.28 ---	3	1-4

See footnote at end of table.

Table 15.--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		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
LwB-----	0-7	12-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-7.3	Low-----	0.37	3	1-4
Lowell	7-48	35-60	1.30-1.60	0.2-0.6	0.13-0.19	5.1-7.3	Moderate----	0.28		
	48-64	40-60	1.50-1.70	0.2-0.6	0.12-0.17	5.6-7.8	Moderate----	0.28		
	64-68	---	---	---	---	---	-----			
LwC2, LwD2-----	0-5	12-27	1.20-1.40	0.6-2.0	0.18-0.23	4.5-7.3	Low-----	0.37	3	1-4
Lowell	5-46	35-60	1.30-1.60	0.2-0.6	0.13-0.19	5.1-7.3	Moderate----	0.28		
	46-62	40-60	1.50-1.70	0.2-0.6	0.12-0.17	5.6-7.8	Moderate----	0.28		
	62-66	---	---	---	---	---	-----			
MgB, MgC-----	0-7	10-27	1.20-1.40	0.6-2.0	0.18-0.24	4.5-5.5	Low-----	0.43	3	2-4
Monongahela	7-27	18-35	1.30-1.50	0.6-2.0	0.14-0.18	4.5-5.5	Low-----	0.43		
	27-41	18-35	1.30-1.60	0.06-0.6	0.08-0.12	4.5-5.5	Low-----	0.43		
	41-74	10-35	1.20-1.40	0.2-0.6	0.08-0.12	4.5-5.5	Low-----	0.37		
Ne-----	0-10	7-27	1.20-1.40	0.6-2.0	0.15-0.23	5.6-7.8	Low-----	0.43	5	1-4
Newark	10-32	18-35	1.20-1.45	0.6-2.0	0.18-0.23	5.6-7.8	Low-----	0.43		
	32-62	12-40	1.30-1.50	0.6-2.0	0.15-0.22	5.6-7.8	Low-----	0.43		
Ng-----	0-10	18-27	1.20-1.40	0.6-2.0	0.20-0.24	5.6-7.8	Low-----	0.43	5	1-4
Newark	10-32	18-35	1.20-1.45	0.6-2.0	0.16-0.22	5.6-7.8	Low-----	0.32		
	32-62	18-35	1.30-1.50	0.6-2.0	0.15-0.22	5.6-7.8	Low-----	0.32		
NhB, NhC-----	0-7	12-27	1.20-1.40	0.6-2.0	0.19-0.23	4.5-6.5	Low-----	0.43	3	2-4
Nicholson	7-21	18-35	1.40-1.60	0.6-2.0	0.18-0.22	4.5-6.5	Low-----	0.43		
	21-38	18-35	1.50-1.70	0.06-0.2	0.07-0.12	4.5-6.5	Low-----	0.43		
	38-72	35-60	1.40-1.60	0.06-0.6	0.07-0.12	5.1-7.8	Moderate----	0.37		
No-----	0-9	12-27	1.20-1.40	0.6-2.0	0.18-0.23	5.6-8.4	Low-----	0.43	5	2-4
Nolin	9-30	18-35	1.25-1.50	0.6-2.0	0.18-0.23	5.6-8.4	Low-----	0.43		
	30-62	10-30	1.30-1.55	0.6-6.0	0.10-0.23	5.1-8.4	Low-----	0.43		
OtB, OtC, OwB---	0-9	18-27	1.25-1.40	0.6-2.0	0.22-0.24	4.5-7.3	Low-----	0.43	4	.5-2
Otwell	9-24	22-35	1.30-1.45	0.2-0.6	0.18-0.22	4.5-5.5	Low-----	0.43		
	24-51	18-30	1.60-1.80	<0.06	0.06-0.08	4.5-5.5	Moderate----	0.43		
	51-62	20-30	1.55-1.65	0.06-0.2	0.19-0.21	5.1-6.5	Moderate----	0.43		
SaB-----	0-9	10-27	1.30-1.40	0.6-2.0	0.18-0.23	4.5-6.0	Low-----	0.37	5	1-4
Sandview	9-50	18-34	1.30-1.45	0.6-2.0	0.18-0.23	4.5-7.3	Low-----	0.32		
	50-74	40-65	1.35-1.60	0.2-0.6	0.12-0.18	5.1-7.8	Moderate----	0.28		
WhB, WhC, WhF, WnB-----	0-23	12-20	1.20-1.40	0.6-6.0	0.12-0.18	5.1-6.5	Low-----	0.37	4	1-3
Wheeling	23-57	18-30	1.30-1.50	0.6-2.0	0.08-0.16	5.1-6.0	Low-----	0.32		
	57-80	8-15	1.30-1.50	6.0-20	0.04-0.08	5.1-6.0	Low-----	0.20		
WoC-----	0-10	27-35	1.30-1.50	0.6-2.0	0.18-0.22	6.1-7.8	Low-----	0.37	3	4-6
Woolper	10-20	36-50	1.30-1.55	0.2-2.0	0.13-0.19	6.1-7.8	Moderate----	0.28		
	20-71	40-60	1.45-1.65	0.06-0.6	0.12-0.17	6.1-7.8	Moderate----	0.28		

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 16.--Soil and Water Features

("Flooding" and "water table" and terms such as "rare," "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		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
AlB----- Allegheny	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	High.
AlC----- Allegheny	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	High.
AlD----- Allegheny	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	High.
AnB----- Allegheny	B	Rare-----	---	---	>6.0	---	---	>60	---	Low-----	High.
Bo----- Boonesboro	B	Frequent---	Brief-----	Jan-Apr	>6.0	---	---	20-40	Hard	Low-----	Low.
CnE2*: Cynthiana	D	None-----	---	---	>6.0	---	---	10-20	Hard	Moderate	Low.
Faywood-----	C	None-----	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
EfD2, EfE2----- Eden	C	None-----	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
EkB, EkC----- Elk	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
ErA----- Elk	B	Occasional	Brief-----	Jan-Jun	>6.0	---	---	>60	---	Moderate	Moderate.
ErB----- Elk	B	Rare-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
FrF----- Fairmount	D	None-----	---	---	>6.0	---	---	10-20	Hard	Moderate	Low.
FwB----- Faywood	C	None-----	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
FyD2*: Faywood-----	C	None-----	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.

See footnote at end of table.

Table 16.--Soil and Water Features--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					<u>Ft</u>			<u>In</u>			
FyD2*: Cynthiana-----	D	None-----	---	---	>6.0	---	---	10-20	Hard	Moderate	Low.
La----- Lawrence	C	Rare-----	---	---	1.0-2.0	Perched	Dec-Apr	>60	---	High-----	High.
LoB, LoC----- Lowell	C	None-----	---	---	>6.0	---	---	40-60	Hard	High-----	Moderate.
LwB, LwC2, LwD2--- Lowell	C	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
MgB, MgC----- Monongahela	C	None-----	---	---	1.5-3.0	Perched	Dec-Apr	>60	---	High-----	High.
Ne----- Newark	C	Frequent----	Brief-----	Jan-Apr	0.5-1.5	Apparent	Dec-May	>60	---	High-----	Low.
Ng----- Newark	D	Frequent----	Very long	Oct-Jun	+1-0	Apparent	Sep-Jul	>60	---	High-----	Low.
NhB, NhC----- Nicholson	C	None-----	---	---	1.5-2.5	Perched	Jan-Apr	>60	---	High-----	Moderate.
No----- Nolin	B	Frequent----	Brief-----	Feb-May	>6.0	Apparent	Feb-Mar	>60	---	Low-----	Moderate.
OtB, OtC----- Otwell	C	None-----	---	---	2.0-3.5	Perched	Jan-Apr	>60	---	Moderate	High.
OwB----- Otwell	C	Rare-----	---	---	2.0-3.5	Perched	Jan-Apr	>60	---	Moderate	High.
SaB----- Sandview	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
WhB, WhC, WhF----- Wheeling	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate.
WnB----- Wheeling	B	Rare-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate.
WoC----- Woolper	C	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 17.--Physical Analyses of Selected Soils

(The symbol < means less than. The soils are the typical pedons for the soil series in the survey area. For location of the pedons, see the section "Soil Series and Their Morphology." Analyses by the Kentucky Agricultural Experiment Station.)

Soil name, report number horizon, and depth in inches	Total			Size class and particle diameter (mm)							Textural class*
	Sand (2- 0.05 mm)	Silt (0.05- 0.002 mm)	Clay (<0.002 mm)	Sand					Sand coarser than very fine (2-0.1 mm)	Very fine sand plus silt (0.1- 0.002 mm)	
				Very coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5- 0.25 mm)	Fine (0.25- 0.1 mm)	Very fine (0.1- 0.05 mm)			
-----Pct <2 mm-----											
Monongahela loam: (89KY-023-11)											
Ap ----- 0-7	33.5	48.7	17.8	0.7	2.9	9.0	15.2	5.7	27.8	54.4	1
Bt1 ----- 7-17	23.1	48.6	28.2	0.3	1.7	5.6	10.3	5.3	17.9	53.9	cl
Bt2 ----- 17-27	38.5	41.9	19.6	1.1	2.7	8.7	16.3	9.7	28.8	51.6	1
Btx ----- 27-41	44.6	36.3	19.0	0.8	4.1	11.6	17.1	11.1	33.6	47.4	1
Bt3 ----- 41-50	42.3	30.8	26.9	0.8	6.7	15.4	10.8	8.6	33.7	39.4	1
C ----- 50-74	72.7	7.0	20.3	1.3	16.3	38.7	15.3	1.1	71.6	8.1	scl
Sandview silt loam: (89KY-023-1)											
Ap ----- 0-9	6.80	68.64	26.56	2.7	0.8	1.6	1.1	0.6	6.2	68.70	sil
BA ----- 9-14	5.20	65.56	29.24	2.0	0.8	1.1	0.3	1.0	4.2	65.66	sicl
Bt1 ----- 14-26	4.00	66.84	29.16	2.4	0.3	0.3	0.7	0.3	3.7	66.87	sicl
Bt2 ----- 26-36	12.90	62.78	24.32	10.2	0.8	0.5	0.3	1.1	11.8	62.89	sil
Bt3 ----- 36-50	12.30	55.90	31.80	9.1	1.0	0.8	1.0	0.4	11.9	55.94	sicl
2Bt4 ----- 50-74	8.70	42.02	49.28	6.1	0.8	0.9	0.8	0.1	8.6	42.03	sic

* The letters cl mean clay loam; 1, loam; scl, sandy clay loam; sil, silt loam; sicl, silty clay loam; and sic, silty clay.

Table 18.--Chemical Analyses of Selected Soils

(The soil is the typical pedon for the soil series in the survey area. For location of the pedon, see the section "Soil Series and Their Morphology." Analyses by the Kentucky Agricultural Experiment Station.)

Soil name, sample number, horizon, and depth in inches	Soil reaction (H2O 1:1)	Extractable cations					Cation-exchange capacity		Extract- able acidity	Base saturation		Organic matter	Calcium car- bonate equiv- alent	Phos- phorus	Potas- sium	
		Ca	Mg	K	Na	Total (TEC)	Ammonium acetate	Sum of cations		Ammo- nium acetate	Sum of cations					
		-----Milliequivalents per 100 grams of soil-----														Pct
Monongahela loam: (89KY-023-11)																
Ap ----- 0-7	5.67	3.17	0.45	0.16	0.01	3.79	7.17	5.75	1.96	53	66	2.04	0.18	32	196	
Bt1 ----- 7-17	5.55	4.14	0.52	0.03	0.01	4.70	12.24	9.53	4.83	38	49	0.50	0.17	6	126	
Bt2 ----- 17-27	4.96	1.82	0.33	0.01	0.29	2.45	6.01	8.04	5.59	41	30	0.21	0.13	6	99	
Btx ----- 27-41	4.82	0.61	0.63	0.00	0.01	1.25	5.51	6.81	5.56	23	18	0.15	0.07	7	89	
Bt3 ----- 41-50	4.92	0.48	1.04	0.08	0.02	1.62	8.91	10.31	8.69	18	16	0.14	0.12	5	123	
C ----- 50-74	4.81	0.29	0.75	0.06	0.01	1.11	8.74	9.39	8.28	13	12	0.24	0.11	6	99	

Table 19.--Classification of the Soils

Soil name	Family or higher taxonomic class
Allegheny-----	Fine-loamy, mixed, mesic Typic Hapludults
Boonesboro-----	Fine-loamy, mixed, mesic Fluventic Hapludolls
Cynthiana-----	Clayey, mixed, mesic Lithic Hapludalfs
Eden-----	Fine, mixed, mesic Typic Hapludalfs
Elk-----	Fine-silty, mixed, mesic Ultic Hapludalfs
Fairmount-----	Clayey, mixed, mesic Lithic Hapludolls
Faywood-----	Fine, mixed, mesic Typic Hapludalfs
Lawrence-----	Fine-silty, mixed, mesic Aquic Fragiudalfs
Lowell-----	Fine, mixed, mesic Typic Hapludalfs
Monongahela-----	Fine-loamy, mixed, mesic Typic Fragiudults
Newark-----	Fine-silty, mixed, nonacid, mesic Aeric Fluvaquents
Nicholson-----	Fine-silty, mixed, mesic Typic Fragiudalfs
Nolin-----	Fine-silty, mixed, mesic Dystric Fluventic Eutrochrepts
Ottwell-----	Fine-silty, mixed, mesic Typic Fragiudalfs
Sandview-----	Fine-silty, mixed, mesic Typic Hapludalfs
Wheeling-----	Fine-loamy, mixed, mesic Ultic Hapludalfs
Woolper-----	Fine, mixed, mesic Typic Argiudolls

Table 20.--Geologic Systems, Formations, and Members

System	Formation	Member	Predominant soils	
Quaternary	---	Alluvium	Allegheny, Boonesboro, Elk, Lawrence, Newark, Nolin, Otwell, Wheeling	
	---	Glacial outwash	Wheeling, Otwell	
	---	Glacial drift	Allegheny, Wheeling, Otwell	
Quaternary and Tertiary	---	High-level fluvial deposits	Allegheny, Monongahela, Elk	
Ordovician	Grant Lake	---	Lowell, Nicholson, Sandview	
	Fairview	---	Fairmount, Faywood, Lowell, Nicholson	
	Kope	---	Eden	
	Clays Ferry, including Point Pleasant Tongue	---	Eden, Faywood, Lowell, Woolper	
	Point Pleasant	---	Cynthiana, Faywood, Woolper, Lowell	
	Lexington Limestone	Tanglewood		Cynthiana, Fairmount, Faywood, Lowell, Woolper
		Grier		Cynthiana, Fairmount, Faywood, Lowell, Woolper

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