



United States  
Department of  
Agriculture

Natural  
Resources  
Conservation  
Service

In cooperation with  
Tennessee Agricultural  
Experiment Station

# Soil Survey of Campbell County, Tennessee





# How to Use This Soil Survey

## General Soil Map

The general soil map, which is a color map, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the 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.

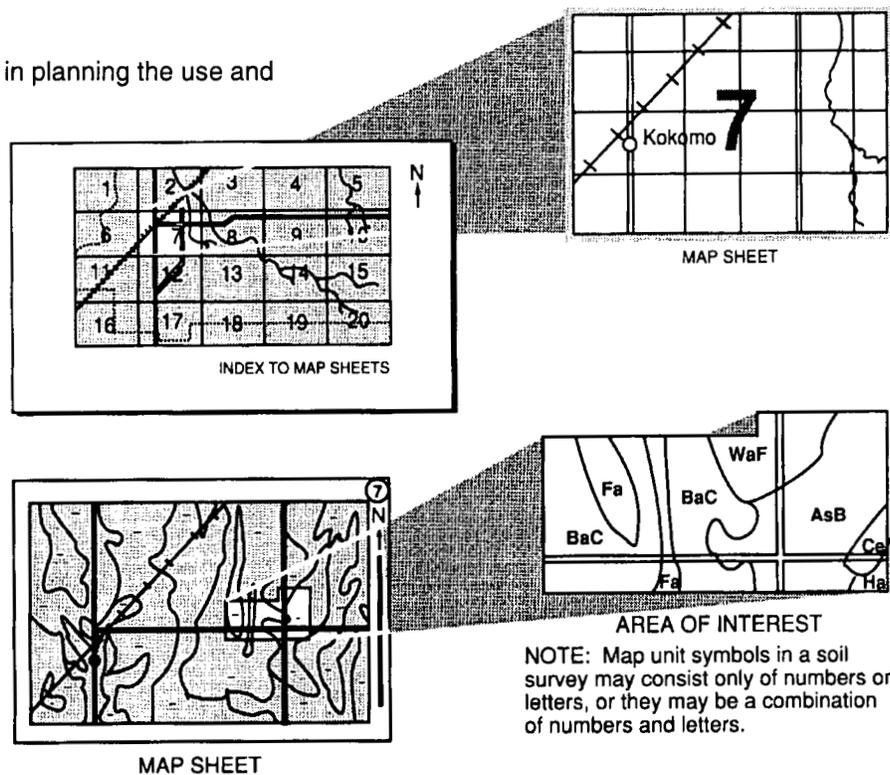
## Detailed Soil Maps

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.



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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) leads the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1990. Soil names and descriptions were approved in 1992. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1990. This survey was made cooperatively by the Natural Resources Conservation Service and the Tennessee Agricultural Experiment Station. The survey is part of the technical assistance furnished to the Campbell County Soil 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: Farmstead on Collegedale soils in Powell Valley. In the background the Ramsey-Rock outcrop complex, 30 to 65 percent slopes, is on the upper part of the Cumberland Mountains and the Jefferson-Grimsley complex, 30 to 60 percent slopes, is on the lower part.**

*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> (click on "Technical Resources").*

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# Foreword

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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, ranchers, 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 map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described. Information on specific uses is given for each soil. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

James W. Ford  
State Conservationist  
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# Soil Survey of Campbell County, Tennessee

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By Clarence T. Conner, Natural Resources Conservation Service

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United States Department of Agriculture, Natural Resources Conservation Service,  
in cooperation with  
Tennessee Agricultural Experiment Station

CAMPBELL COUNTY has an area of 496.1 square miles, or 317,500 acres, including about 11,000 acres of large bodies of water. The county is in the northeastern part of Tennessee (fig. 1). It is bounded on the west by Scott County, on the south by Anderson County, on the southeast by Union County, on the northeast by Claiborne County, and on the north by McCreary and Whitley Counties, Kentucky. According to census data, in 1980 the population of the county was 34,829. LaFollette and Jellico are the largest towns. Jacksboro is about 30 miles northwest of Knoxville. It is the county seat.

Forest covers about 82 percent of the county. Most of the cleared land is used for pasture and hay, or crops, or urban and built-up areas. General farming is predominant, while dairy farming is the leading income-producing farm enterprise.

Many farms are operated part-time. The operators generally commute to larger cities and towns, such as LaFollette, Jellico, Clinton, Oak Ridge, or Knoxville, for primary employment.

The soils of the county formed under trees. They are dominantly light colored, highly leached, and strongly acid. The soils range from shallow to very deep over bedrock. The Ridge and Valley Province is in the southeastern part of the county and makes up about one third of the area. The soils in this area have a clayey or loamy subsoil. The rest of the county is in the Cumberland Mountains. Most soils on the

mountains have a loamy subsoil and few to many rock fragments.

## General Nature of the County

This section gives general information about the county. It describes history and development; natural resources; physiography, geology, relief, and drainage; transportation; and climate.

## History and Development

E. A. Carr, Jr., Campbell County historian, helped prepare this section.

The first inhabitants of what is now Campbell County likely were Candy Creek Indians. They were small in stature, with most being less than 5 feet tall. They lived in rock caves along streams. Their primary food was amphibians from the Powell River and its many tributaries. The period of their habitation ended about 1300 A.D.

The Candy Creek Indians were followed by the Cherokees, who had large settlements near Wells Springs and near Cove Lake. The Cherokees practiced horticulture.

Europeans arrived about 1740 to trade with the Indians. During the next 10 years European explorers also passed through the area.

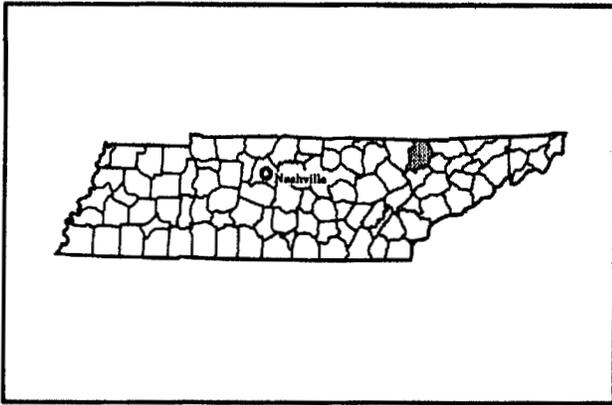


Figure 1.—Location of Campbell County in Tennessee.

In 1783, the North Carolina Assembly granted to Richard Henderson and Company about 200,000 acres of land in what is now east Tennessee, including most of what is now Campbell County. Tracts of land and farms were then sold to many settlers from North Carolina and Virginia. In 1796, Tennessee was admitted to the Union.

By the early 1800's, the growing population of the area required local government. On September 11, 1806, the Tennessee General Assembly created Campbell County, named for Colonel Arthur Campbell. Campbell was a political and military leader in Virginia and frontier Tennessee. The county seat, with a stone courthouse and jail, was laid out in 1809 at Jacksboro.

In the early days, iron was manufactured at four locations in the county. The iron furnaces could produce from 600 to 900 pounds per day. Farms produced corn, wheat, flax, and cotton. Until the Civil War, the main industry was timber cutting. The logs were drifted downriver at flood stage to Chattanooga.

During the Civil War, Campbell County was occupied first by troops from the South, then from the North. The occupying armies changed back and forth many times during the 4 years of war. After the war many people left the county and moved west. Farming remained the main source of livelihood until the Knoxville and Ohio Railroad was extended into the county. About 1870, a commercial coal mine opened near Caryville. In 1873, the total coal production was 368,325 bushels. The mines were abandoned for several years until completion of the railroad. For the next 70 years underground coal mining and lumbering were flourishing industries. Farming was practiced mainly in Powell and Elk Valleys. Burley tobacco and commercial dairy cattle were introduced about 1916. For the next 50 years they were the major source of farm income in Campbell County.

In the 1950's surface coal mining replaced underground coal mining. Surface mines produced most coal for the next 20 years. Currently, both surface and underground coal mines are operational.

## Natural Resources

Forest, coal, and abundant water are major natural resources in Campbell County. Forest covers about 82 percent of the county. In some areas it does not have much commercial value. But, in general, the county has moderately high potential for forest products.

Campbell County is among 11 Tennessee coal-producing counties. Estimates of coal reserves in Tennessee indicate one third of them underlie Campbell County. In most years the county is ranked first or second in the State for coal production. However, coal is second to agriculture in providing jobs in the county.

Water is available from numerous streams, farm ponds, wells, and a large TVA reservoir called Norris Lake. Pennsylvania sandstone formations are a good source of well water. Norris Lake and some of the major streams provide fishing and other recreational activities.

## Physiography, Geology, Relief, and Drainage

The northwestern two-thirds of Campbell County is in the Cumberland Plateau and Mountains Major Land Resource Area. This part of the county has steep, tall mountains that have narrow, uneven tops and narrow, intermountain valleys. The southeastern one-third of the county is in the Southern Appalachian Ridges and Valleys Major Land Resource Area. Its local name is the Great Valley of Tennessee. This part of the county has ridges and valleys. Most of the ridges and valleys are interfingered between tributaries of Norris Lake. Some are in Powell Valley, at the base of Cumberland Mountain.

The geology of the county is complex. Most of the soils of the Cumberland Mountains are underlain by sandstone and shale of Pennsylvanian age. In the Great Valley the soils are underlain by limestone, dolomite, shale, and sandstone that have undergone severe folding and faulting. They range in age from Cambrian to Mississippian.

The Cumberland Mountains are drained by tributaries of the Cumberland River and are part of the Cumberland River System. The Great Valley is drained by the Clinch River and its tributaries, which are part of the Tennessee River system.

The highest elevation in Campbell County, 3,303 feet, is on Hurricane Mountain. The lowest elevation, 900 feet, is in Vasper, where U.S. 25W enters Anderson County.

## Transportation

Two highways run north-south in Campbell County. U.S. 25 was the main north-south route until 1970. It is now an alternate, or scenic, route as well as part of the local road system. In 1970, route I-75 was completed. It is now the major north-south route in the eastern part of Tennessee. State and county highways connect these highways and provide access to all parts of the county. Some mountainous areas, however, are difficult to reach. Two railroads serve the county.

## Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Oneida, Tennessee, in the period 1952 to 1986. 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 34 degrees F and the average daily minimum temperature is 22 degrees. The lowest temperature on record, which occurred at Oneida, on January 21, 1985 is -26 degrees. In summer, the average temperature is 71 degrees and the average daily maximum temperature is 84 degrees. The highest recorded temperature, which occurred at Oneida on July 17, 1980, is 102 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 54 inches. Of this, 27 inches, or 50 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 23 inches. The heaviest 1-day rainfall during the period of record was 4.80 inches on September 3, 1982. Thunderstorms occur on about 47 days each year, and most occur in summer.

The average seasonal snowfall is about 12 inches. The greatest snow depth at any one time during the

period of record was 9 inches. On the average, 2 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 85 percent. The sun shines 60 percent of the time possible in summer and 45 percent in winter. The prevailing wind is from the northeast. Average windspeed is highest, 9 miles per hour, in spring.

## 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 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.

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.

The descriptions, names, and delineations of the soils in this survey area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

# General Soil Map Units

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The general soil map at the back of this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. Each map unit on the general soil map is a unique natural landscape. Typically, 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 map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

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

## Soil Descriptions

### 1. Fullerton-Bodine-Claiborne

*Rolling to very steep, very deep soils that have a clayey or loamy subsoil; on uplands*

This map unit consists of the highly dissected areas of a dendritic drainage system. It has prominent ridges that have narrow, sloping tops and steep or very steep sides.

This unit makes up about 22 percent of the county. It is about 60 percent Fullerton soils, 19 percent Bodine soils, 6 percent Claiborne soils, and 15 percent soils of minor extent.

Fullerton soils are well drained, have a clayey subsoil, and are gravelly throughout. They are sloping to steep. These soils are on ridgetops and hillsides.

Bodine soils are somewhat excessively drained. They are loamy and have a large amount of gravel throughout. They are moderately steep to very steep. They are on hillsides.

Claiborne soils are well drained. They are loamy throughout. They are sloping to steep. In most areas

these soils are on ridges and hillsides that have a northeast aspect.

Of minor extent in this unit are Dewey soils on uplands, Etowah soils on foot slopes and high terraces, Minvale soils on foot slopes, and Hamblen soils on flood plains.

Most areas of this soil are used as woodland. Some areas have been cleared, mostly on ridgetops and in narrow valleys. Most cleared areas are used for hay, pasture, or row crops. Tobacco is the main cash crop grown on these soils.

The slope is a severe limitation for all uses of these soils. In most areas these soils are poorly suited to row crops and moderately suited or poorly suited to hay and pasture. They are also poorly suited to residential or commercial development. They are well suited to woodland use.

### 2. Collegedale-Sequoia-Etowah

*Undulating to steep, very deep and moderately deep soils that have a clayey or loamy subsoil; on uplands, foot slopes, and terraces*

This map unit consists mainly of Powell Valley. It is dominantly rolling, but it includes some hilly and steep foot slopes and ridges along the edge of the valley. The valley is about 300 feet lower than the cherty ridges to the southeast and about 1,200 feet lower than the Cumberland Mountains to the northwest.

This map unit makes up about 6 percent of the county. It is about 50 percent Collegedale soils, 22 percent Sequoia soils, 6 percent Etowah soils, and 22 percent soils of minor extent.

Collegedale soils are very deep and well drained, and have a clayey subsoil. In most areas they are on rolling uplands that are underlain by limestone. These soils have some sinkholes and do not have a distinct drainage pattern.

Sequoia soils are moderately deep and well drained, and have a clayey subsoil. These soils are sloping to steep and are located on shale ridges adjacent to the Cumberland Mountains.

Etowah soils are very deep, well drained, and loamy throughout. They are undulating and rolling. They are on foot slopes and terraces.

Of minor extent in this unit are Allen and Jefferson soils on foot slopes, Gladeville soils on uplands, Whitwell soils on terraces, and Hamblen soils on bottom lands.

In most areas the soils in this map unit are used for hay and pasture. In some areas they are used for row crops and residential and commercial development. Jacksboro and LaFollette have been built on these soils. The major crops are corn, tobacco, and wheat.

These soils are well suited to hay and pasture. They are moderately suited to poorly suited to row crops. They are moderately suited to urban development except in steeper areas, where they are poorly suited.

### 3. Jefferson-Grimsley-Muskingum

*Hilly to very steep, very deep to moderately deep, well drained soils that are loamy throughout; on uplands and foot slopes*

This map unit consists of steep and very steep mountainsides and less steep foot slopes below the Cumberland Mountain escarpment. It is between Powell Valley and the escarpment. The slopes are dissected by some deep drainageways.

This unit makes up about 3 percent of the county. It is about 51 percent Jefferson soils, 24 percent Grimsley soils, 10 percent Muskingum soils, and 15 percent soils of minor extent.

Jefferson soils are very deep and loamy throughout. They are moderately steep and steep. These soils are on the lower part of mountainsides and foot slopes.

Grimsley soils are deep and loamy throughout. They contain a large number of cobbles and stones throughout. They are in coves and in other concave areas on the slopes.

Muskingum soils are moderately deep and loamy throughout. They are on the upper part of mountainsides and on the tops of some ridges.

Of minor extent in this map unit are Sequoia soils on the tops of ridges and on the upper part of slopes and Petros soils on points of ridges.

In most areas the soils in this map unit are used as woodland. A few cleared areas on foot slopes are used for unimproved pasture or are reverting to woodland.

These soils are moderately suited to woodland use. They are poorly suited or not suited to farming and most urban uses. Steep, irregular slopes and gravel and stones in the soils and on the surface are limitations. These limitations are very difficult to overcome.

### 4. Ramsey-Rock Outcrop-Lily

*Rolling to very steep, shallow and moderately deep soils that are loamy throughout, and sandstone outcrops; on sides and tops of mountains*

This map unit consists of very steep, rugged mountainsides, numerous sandstone outcrops and cliffs, and stones and boulders along drainageways and in other low areas. Narrow, rolling and hilly ridges that have numerous rock outcrops are on mountaintops.

This map unit makes up about 4 percent of the county. It is about 55 percent Ramsey soils, 20 percent Rock outcrop, 20 percent Lily soils, and 5 percent soils of minor extent.

Ramsey soils are shallow and somewhat excessively drained. They are on the upper part of mountainsides and near a discontinuous escarpment that forms several sandstone cliffs.

Rock outcrop consists of intermittent sandstone cliffs and other sandstone outcrops.

Lily soils are moderately deep and well drained. In most areas they are on narrow ridges on mountaintops.

Of minor extent in this map unit are Jefferson and Grimsley soils in concave areas such as coves, benches, and foot slopes.

In most areas the soils in this map unit are used as woodland. In a few cleared areas on mountaintops they are used for recreation.

These soils are poorly suited to woodland use. But, woodland is generally the most feasible use. These soils are not suited to farming or urban development because of very steep slopes, depth to bedrock, and rock outcrops. In most areas they are inaccessible except by four-wheel drive vehicles or on foot.

### 5. Ramsey-Rock Outcrop-Grimsley-Jefferson

*Steep and very steep, shallow to very deep soils that are loamy throughout and that have numerous stones and rock outcrops; on mountainsides*

This map unit consists of very steep, rugged mountainsides that have numerous sandstone outcrops and cliffs. In many deeply entrenched drainageways and coves, stones and boulders are on the surface. Narrow, rolling and hilly ridges and numerous rock outcrops are on mountaintops.

This map unit makes up about 8 percent of the county. It is about 55 percent Ramsey soils, 16 percent Rock outcrop, 7 percent Grimsley soils, 6 percent Jefferson soils, and 16 percent soils of minor extent.

Ramsey soils are shallow and somewhat excessively drained. They are on the upper part of mountainsides and are near a discontinuous escarpment that forms several sandstone cliffs.

Rock outcrop consists of intermittent sandstone cliffs and other sandstone outcrops.

Grimsley soils are deep, well drained, and loamy throughout. They have a large number of cobbles and stones both on the surface and in all layers. They are in coves and other concave areas.

Jefferson soils are very deep, gravelly, and loamy throughout. They have stones on the surface. They are moderately steep and steep. They are on the lower part of mountainsides and on foot slopes.

Of minor extent in this map unit are Lily soils on narrow mountaintops and Muskingum and Sequoia soils on slopes below Ramsey soils.

In most areas the soils in this map unit are in woodland use. In a few areas on mountaintops they are used for hiking trails and other recreation uses.

These soils are poorly suited to woodland. But, woodland is generally the most feasible use. These soils are not suited to farming or urban development because of very steep slopes, depth to bedrock, and rock outcrops. Some areas of these soils adjoin I-75, but in most areas they are inaccessible except by four-wheel drive vehicles or on foot.

#### **6. Atkins-Whitwell-Jefferson**

*Nearly level to moderately steep, very deep, poorly drained to well drained soils that are loamy throughout; on bottom lands, stream terraces, and foot slopes*

This map unit is along Elk Creek and its tributaries in Elk Valley and along the New River and its tributaries southwest of Caryville. It consists of nearly level areas on flood plains and sloping to moderately steep areas on foot slopes.

This map unit makes up about 2 percent of the county. It is about 25 percent Atkins soils, 19 percent Whitwell soils, 19 percent Jefferson soils, and 37 percent soils of minor extent.

Atkins soils are nearly level and poorly drained. They are on bottom lands. They are subject to frequent flooding.

Whitwell soils are moderately well drained. They are on low, nearly level stream terraces. They are subject to occasional flooding.

Jefferson soils are sloping to moderately steep. They are well drained. They are on foot slopes adjacent to flood plains.

Of minor extent in this map unit are Ealy and Sewanee soils on flood plains, Sequatchie and Swafford soils on stream terraces, and Sequoia soils on adjacent uplands.

In most areas the soils in this map unit have been cleared and are used for row crops, hay, or pasture. Atkins soils are moderately suited to pasture and woodland. They are poorly suited to other uses. Whitwell and Jefferson soils on bottom lands and terraces are well suited to crops and pasture. All soils in the unit are poorly suited to residential or commercial development because of wetness and flooding.

#### **7. Muskingum-Bethesda-Jefferson-Sequoia**

*Rolling to very steep, well drained, moderately deep to very deep soils that have a loamy or clayey subsoil; on tops and sides of mountains and on foot slopes*

This map unit is in the Cumberland Mountains. It consists mainly of steep and very steep areas highly dissected by drainageways. Deep coves are common on this unit.

This map unit makes up about 55 percent of the county. It is about 30 percent Muskingum soils, 18 percent Bethesda soils, 12 percent Jefferson soils, 12 percent Sequoia soils, and 28 percent soils of minor extent.

Muskingum soils are moderately deep over weathered shale. They have a loamy subsoil. They are on sides of mountains.

Bethesda soils are very deep and loamy throughout, and contain a large amount of rock fragments. They formed during stripmining for coal on mountainsides. These soils are on benches and on outslopes where material has moved downslope from benches.

Jefferson soils are very deep and loamy throughout. They are on the lower part of mountainsides, on foot slopes, and in coves.

Sequoia soils are moderately deep over weathered shale. They have a clayey subsoil. These soils are sloping to moderately steep. They are on mountaintops.

Of minor extent in this map unit are Petros soils on narrow ridgetops and points of ridges, Lily soils on sloping mountaintops, and Grimsley soils in coves.

Most areas of this soil are used for woodland. They are well suited or moderately suited to woodland use. They are poorly suited to farming and residential or commercial development because of very steep,

irregular slopes. In many areas they are inaccessible because of rugged topography and lack of roads.

### **8. Sequoia-Hamblen-Cynthiana**

*Nearly level to steep, very deep to shallow soils that have a loamy or clayey subsoil; on uplands and narrow bottom lands*

This map unit consists of moderately steep and steep hillsides, narrow ridgetops, and narrow bottom lands

This map unit makes up less than 1 percent of the county, but it joins a similar unit in Anderson County. It is about 39 percent Sequoia soils, 29 percent Hamblen soils, 16 percent Cynthiana soils, and 16 percent soils of minor extent.

Sequoia soils are moderately deep and well drained. They have a clayey subsoil. They are on

rolling ridgetops and moderately steep and steep hillsides.

Hamblen soils are very deep and moderately well drained. They are loamy throughout. They are nearly level. These soils are on narrow bottom lands.

Cynthiana soils are shallow and well drained. They have a clayey subsoil. They are on hillsides. They have limestone flagstones throughout and outcrops of limestone bedrock.

Of minor extent in this map unit are Atkins and Swafford soils. These soils are on bottom lands and low terraces.

In most areas these soils are used for woodland or pasture. They are moderately suited to woodland use and pasture. They are poorly suited to row crops and residential or commercial development. Steep slopes, depth to bedrock, and moderately slow permeability are limitations.

## Detailed Soil Map Units

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The map units delineated on the detailed maps at the back of this survey 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.

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, Collegedale silt loam, 5 to 12 percent slopes, is a phase of the Collegedale series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

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. Jefferson-Grimsley complex, 30 to 60 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. There are no associations mapped in Campbell County.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Fullerton and Bodine gravelly silt loams, 10 to 25 percent slopes, is an undifferentiated group in this survey area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Pits, quarry, is an example.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Tables" in "Contents") 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.

## Soil Descriptions

### **AeD2—Allen loam, 10 to 25 percent slopes, eroded**

This is a very deep, well drained soil. It formed in residuum and colluvium derived mainly from sandstone and shale. It is on foot slopes and hillsides. Typically, areas range from 5 to 25 acres in size.

The typical sequence, depth, and composition of the layers of this Allen soil are as follows—

*Surface layer:*  
0 to 8 inches, dark brown loam

*Subsoil:*  
8 to 55 inches, yellowish red clay loam  
55 to 65 inches, yellowish red clay

In most areas erosion has removed part of the original surface layer and tillage has mixed the remaining surface layer and subsoil.

Included with this soil in mapping are a few small areas of soils that are similar to this Allen soil but that have a yellowish subsoil. Also included, in some fields, are a few spots of severely eroded soils that have a surface layer of reddish clay loam.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most of the acreage of this soil is used for pasture, hay, or residential development.

This soil is poorly suited to row crops because of slope and the erosion hazard.

This soil is well suited to pasture and moderately suited to hay. Erosion is a hazard unless a good cover of forage plants is maintained. Good management practices ensure adequate cover and maintain a high level of forage production. These include fertilizing and liming, maintaining an adequate legume-grass mixture, controlling weeds and brush, and preventing overgrazing.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, loblolly pine, and shortleaf pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species. Steepness of slope is a moderate limitation for equipment. Erosion is a hazard on logging roads and skid trails.

Slope is a severe limitation for residential or commercial development. Grading and excavating are generally required. Overcoming slope becomes increasingly difficult and expensive in the steeper areas. Conservation measures help to control erosion on construction sites.

This map unit is in capability subclass IVe.

### **At—Atkins silt loam, frequently flooded**

This is a very deep, poorly drained soil. It formed in alluvium derived from acid shale and sandstone on flood plains. Slopes are 0 to 2 percent. Typically, areas range from 5 to 300 acres in size.

The typical sequence, depth, and composition of the layers of this Atkins soil are as follows—

*Surface layer:*  
0 to 10 inches, light brownish gray silt loam

**Subsoil:**

10 to 32 inches, light brownish gray loam  
 32 to 40 inches, light brownish gray silt loam  
 40 to 46 inches, gray silt loam

**Substratum:**

46 to 61 inches, gray silt loam

Included with this Atkins soil in mapping are small areas of well drained and moderately well drained soils adjacent to streambanks. Also included are a few small areas of Whitwell soils on low stream terraces.

**Important soil properties and features—**

**Permeability:** Moderate to slow

**Available water capacity:** High

**Soil reaction:** Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

**Flood hazard:** Frequently flooded

**Depth to rock:** Very deep

**Depth to a seasonal high water table:** 0 to 1 foot

Most areas of this soil are used for pasture and hay. In several areas it is idle and is reverting to weeds and bushes (fig. 2). It is moderately suited to pasture and hay. Water-tolerant grasses and legumes, such as tall fescue and ladino clover, are suited. In undrained areas this soil is poorly suited to row crops. In drained areas it is moderately suited to such annual summer crops as soybeans.

This soil is moderately suited to woodland use. Trees that are water tolerant grow well on this soil. Trees suitable for planting or feasible to manage for production include sweetgum, American sycamore, pin oak, loblolly pine, eastern white pine, and white spruce. Harvesting operations are generally confined



**Figure 2.—An area of Atkins silt loam, frequently flooded, in the foreground, reverting to invasive brushy vegetation. The Cumberland Mountains are in the background.**

to summer and early fall, when the soil is not completely saturated. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is not suited to residential or commercial development because of frequent flooding and the shallow seasonal high water table.

This map unit is in capability subclass IVw.

### **Be—Bethesda channery silt loam, benches and outsoles**

This unit consists of areas that have been excavated in stripmining coal in the Cumberland Mountains. A notch cut out of the mountainside formed generally contour strips that range from a few hundred yards to several miles in length. The strips consist of a bench that ranges from about 20 to 200 feet in width and an outslope where spoil has moved downhill from the bench about 100 to several hundred feet. A highwall of vertical rock 50 feet or more in height is on the uphill side of the bench. Slopes are dominantly 5 to 15 percent on benches and 30 to 70 percent on outsoles.

A few areas of this unit are also in Elk Valley near Newcomb and Jellico. They have been excavated and mined, but unlike the areas in the mountains, they do not have highwalls and steep outsoles. They have been smoothed and have slopes of 5 percent or less.

The typical sequence, depth, and composition of the layers of this Bethesda soil are as follows—

*Surface layer:*

0 to 6 inches, dark grayish brown channery silt loam

*Substratum:*

6 to 17 inches, variegated strong brown, dark gray, and brown very channery silty clay loam  
17 to 61 inches, variegated yellowish brown and dark gray very channery silty clay loam

Included with this Bethesda soil in mapping are narrow areas of Petros and Ramsey soils. These soils are shallow over shale and sandstone. Also included are a few areas of Muskingum and Sequoia soils. These soils are moderately deep over shale.

#### ***Important soil properties and features—***

*Permeability:* Moderately slow

*Available water capacity:* Low

*Soil reaction:* Strongly acid to extremely acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

This soil is generally not suited to farming or residential and commercial development because of steep slopes, a large amount of rock fragments, and high acidity. These limitations are difficult to overcome.

Except for a few reclaimed areas, this soil is poorly suited to woodland use. Trees native to the area are slow to re-establish after mining. Trees suited for planting include eastern white pine, black locust, Virginia pine, and scotch pine. Seedling mortality is high because of droughtiness. Steep slopes and stoniness are severe limitations for equipment.

This map unit is in capability subclass VIIc.

### **BrF—Bland-Rock outcrop complex, 30 to 50 percent slopes**

This map unit consists of the Bland soil and small areas of Rock outcrop that are so intermingled they could not be separated in mapping. The Bland soil makes up about 65 percent of each mapped area, rock outcrop makes up about 20 percent, and included soils make up the rest. This unit consists mainly of steep, dissected ridges adjacent to the south aspect of Cumberland Mountain. Typically, areas range from 5 to 35 acres in size.

The typical sequence, depth, and composition of the layers of this Bland soil are as follows—

*Surface layer:*

0 to 4 inches, dark reddish brown silty clay loam

*Subsoil:*

4 to 7 inches, dark reddish brown silty clay

7 to 25 inches, dark reddish brown clay

*Substratum:*

25 to 30 inches, dark reddish brown clay

*Bedrock:*

30 inches, hard, dusky red limestone

Rock outcrop consists of limestone bedrock that extends a few inches to about 1 foot above the soil surface. In many areas contour bands of rock outcrop are on side slopes.

Included with this unit in mapping are small areas of soils less than 20 inches deep over bedrock. Also included are small areas of soils that are similar to this Bland soil but that are deeper than 40 inches over bedrock.

#### ***Important soil properties and features—***

*Permeability:* Moderately slow

*Available water capacity:* Low or moderate

*Soil reaction:* Neutral to strongly acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this map unit are used as woodland. In a few cleared areas it is used for pasture. It is not suited to row crops and hay and is poorly suited to pasture because of steep slopes, low or moderate available water capacity, and rock outcrops.

This Bland soil is moderately suited to woodland use. Trees suitable for planting or feasible to manage for production include northern red oak, yellow-poplar, Virginia pine, and eastern white pine. Limited available water capacity, slope, and rock outcrops restrict tree growth and interfere with woodland management. Steepness of slope limits equipment use. Erosion is a hazard on logging roads and skid trails. Seedling mortality is a moderate limitation because of droughtiness.

This unit is not suited to residential or commercial development because of slope, rock outcrops, and depth to bedrock. These limitations are very difficult to overcome.

This map unit is in capability subclass VIIc.

### **CaC—Claiborne silt loam, 5 to 12 percent slopes**

This is a very deep, well drained soil. It formed in residuum derived from limestone on ridgetops. Typically, areas range from 4 to about 30 acres in size, but most areas are less than 20 acres.

The typical sequence, depth, and composition of the layers of this Claiborne soil are as follows—

*Surface layer:*

0 to 1 inch, very dark grayish brown silt loam

1 to 7 inches, dark brown silt loam

*Subsoil:*

7 to 15 inches, reddish brown silt loam

15 to 27 inches, yellowish red and red silty clay loam

27 to 46 inches, dark red silty clay loam

46 to 72 inches, red gravelly silty clay loam

Included with this Claiborne soil in mapping are small areas of similar soils that contain numerous chert fragments in the surface layer.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used as woodland because they are on narrow ridgetops adjacent to steeper, wooded areas.

This soil is moderately suited to row crops and well suited to hay and pasture. However, it is not generally used for these purposes because it is located next to steeper wooded areas.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, black walnut, northern red oak, shortleaf pine, and loblolly pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is well suited as sites for individual houses. However, it is poorly suited to residential or commercial development because it is in narrow areas next to steep slopes.

This map unit is in capability subclass IIIc.

### **CaD—Claiborne silt loam, 12 to 25 percent slopes**

This is a deep, well drained soil. It formed in residuum or colluvium derived from limestone on hillsides. Typically, areas range from 5 to 90 acres in size, but most areas are less than 30 acres.

The typical sequence, depth, and composition of the layers of this Claiborne soil are as follows—

*Surface layer:*

0 to 1 inch, very dark grayish brown silt loam

1 to 7 inches, dark brown silt loam

*Subsoil:*

7 to 15 inches, reddish brown silt loam

15 to 27 inches, yellowish red and red silty clay loam

27 to 46 inches, dark red silty clay loam

46 to 72 inches, red gravelly silty clay loam

Included with this Claiborne soil in mapping are small areas of similar soils that contain numerous chert fragments in the surface layer.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used as woodland. In cleared areas it is moderately suited to hay and well suited to pasture. It is poorly suited to row crops. Slope and the erosion hazard are the main limitations for farming.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, black walnut, northern red oak, shortleaf pine, and loblolly pine. Steepness of slope is a moderate limitation for equipment use. Erosion is a hazard on roads and skid trails. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is poorly suited to residential or commercial development because of moderately steep slopes. It is moderately suited to use as sites for a few individual houses.

This map unit is in capability subclass IVe.

### **CaE—Claiborne silt loam, 25 to 45 percent slopes**

This is a deep, well drained soil. It formed in residuum and colluvium derived from limestone on hillsides and foot slopes. It is underlain by dolomite. Typically, areas range from 5 to 30 acres in size.

The typical sequence, depth, and composition of the layers of this Claiborne soil are as follows—

*Surface layer:*

0 to 1 inch, very dark grayish brown silt loam  
1 to 7 inches, dark brown silt loam

*Subsoil:*

7 to 15 inches, reddish brown silt loam  
15 to 27 inches, yellowish red and red silty clay loam  
27 to 46 inches, dark red silty clay loam  
46 to 72 inches, red gravelly silty clay loam

Included with this soil in mapping are small areas of soils that have a gravelly surface layer and subsoil.

#### **Important soil properties and features—**

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used as woodland. Trees

grow well on this soil, but it is only moderately suited to woodland use because of steep slopes. Use of equipment is limited and erosion is a severe hazard. Slippage can occur when cuts for logging roads or skid trails are made across slopes. Trees suitable for planting or feasible to manage for production include black walnut, northern red oak, yellow-poplar, loblolly pine, and shortleaf pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is not suited to cultivated crops because of the steep slopes. It is poorly suited to pasture, which is difficult to maintain on steep slopes. Farm equipment is hazardous to operate on these slopes.

Steep slopes make this soil poorly suited to residential or commercial development.

This map unit is in capability subclass VIe.

### **CoB—Collegedale silt loam, 2 to 5 percent slopes**

This is a very deep, well drained soil. It formed in residuum derived from limestone on low, gently sloping uplands. Typically, areas range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this Collegedale soil are as follows—

*Surface layer:*

0 to 7 inches, brown silt loam

*Subsoil:*

7 to 42 inches, yellowish red clay  
42 to 61 inches, mottled yellowish red, brownish yellow, light yellowish brown, and light brownish gray clay

Included with this soil in mapping are a few small areas of soils that have a gravelly surface layer. Also included are a few areas of soils that are less than 60 inches deep over bedrock and a few areas of rock outcrop.

#### **Important soil properties and features—**

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for hay and pasture. In some areas it is used for row crops. It is moderately suited to row crops and well suited to hay

and pasture. Moderate available water capacity and the moderate erosion hazard are the main limitations. Just below the plow layer the available water capacity is limited because of the high clay content in the subsoil.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, white oak, shortleaf pine, Virginia pine, and loblolly pine. The clayey subsoil just below the surface causes a moderate limitation to use of equipment when the soil is wet. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is moderately suited to residential or commercial development. Moderately slow permeability, moderate shrink-swell potential, and low strength of the clayey subsoil are significant limitations. A central sewer system is needed because permeability is a severe limitation for septic tank absorption fields.

This map unit is in capability subclass IIIe.

### **CoC—Collegedale silt loam, 5 to 12 percent slopes**

This is a deep, well drained soil. It formed in residuum derived from limestone on low, rolling uplands. Typically, areas range from 5 to 25 acres in size.

The typical sequence, depth, and composition of the layers of this Collegedale soil are as follows—

*Surface layer:*  
0 to 7 inches, brown silt loam

*Subsoil:*  
7 to 42 inches, yellowish red clay  
42 to 61 inches, mottled yellowish red, brownish yellow, light yellowish brown, and light brownish gray clay

Included with this soil in mapping are a few small areas of soils that have a gravelly surface layer. Also included are a few areas of soils that are less than 60 inches deep over bedrock and a few areas of rock outcrop.

#### **Important soil properties and features—**

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for pasture and hay. It is moderately suited to these uses. The soil is poorly suited to row crops because of the severe erosion hazard and the moderate available water capacity. Good management practices on hay and pasture ensure adequate cover and maintain a high level of forage production. They include fertilizing and liming, maintaining an adequate legume-grass mixture, controlling weeds and brush, and preventing overgrazing.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, white oak, shortleaf pine, Virginia pine, and loblolly pine. The clayey subsoil just below the surface causes a moderate limitation to use of equipment when the soil is wet. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

The soil is moderately suited to residential or commercial development. Moderately slow permeability, moderate shrink-swell potential, slope, and low strength of the clayey subsoil are significant limitations. A central sewer system is needed because permeability is a severe limitation for septic tank absorption fields.

This map unit is in capability subclass IVe.

### **CoC2—Collegedale silt loam, 5 to 12 percent slopes, eroded**

This is a deep, well drained soil. It formed in residuum derived from limestone on low, rolling uplands. Typically, areas range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this Collegedale soil are as follows—

*Surface layer:*  
0 to 5 inches, brown silt loam

*Subsoil:*  
5 to 36 inches, yellowish red clay  
36 to 61 inches, mottled yellowish red, brownish yellow, light yellowish brown, and light brownish gray clay

In most areas erosion has removed part of the original surface layer and tillage has mixed the remaining surface layer and subsoil.

Included with this soil in mapping are a few small areas of soils that have a gravelly surface layer. Also included are a few areas of soils that are less than 60

inches deep over bedrock and a few areas of rock outcrop.

**Important soil properties and features—**

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for pasture and hay. It is moderately suited to these uses. The soil is poorly suited to row crops because of the severe erosion hazard and moderate available water capacity. Good management practices on hay and pasture insure adequate cover and maintain a high level of forage production. They include fertilizing and liming, maintaining an adequate legume-grass mixture, controlling weeds and brush, and preventing overgrazing.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, white oak, shortleaf pine, Virginia pine, and loblolly pine. The clayey subsoil just below the surface causes a moderate limitation to use of equipment when the soil is wet. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

The soil is moderately suited to residential or commercial development. Moderately slow permeability, moderate shrink-swell potential, slope, and low strength of the clayey subsoil are significant limitations. A central sewer system is needed because permeability is a severe limitation for septic tank absorption fields.

This map unit is in capability subclass IVe.

**CoD2—Collegedale silt loam, 12 to 25 percent slopes, eroded**

This is a deep, well drained soil. It formed in residuum derived from limestone. This soil is in irregularly shaped areas on low hills. Typically, areas range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this Collegedale soil are as follows—

*Surface layer:*

0 to 5 inches, brown silt loam

*Subsoil:*

5 to 36 inches, yellowish red clay

36 to 61 inches, mottled yellowish red, brownish yellow, light yellowish brown, and light brownish gray clay

In most areas erosion has removed part of the original surface layer, and tillage has mixed the remaining surface layer and subsoil.

Included with this soil in mapping are a few small areas of soils that have a gravelly surface layer. Also included are a few areas of soils that are less than 60 inches deep over bedrock and a few areas of rock outcrop.

**Important soil properties and features—**

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for pasture and hay (fig. 3). It is not suited to row crops and is poorly suited to small grain. This soil is moderately suited to pasture and poorly suited to hay. Good management practices ensure adequate cover and maintain a high level of forage production. They include fertilizing and liming, maintaining an adequate legume-grass mixture, controlling weeds and brush, and preventing overgrazing.

This soil is moderately suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, white oak, shortleaf pine, Virginia pine, and loblolly pine. Erosion is a hazard along roads and skid trails. Steepness of slope and a clayey subsoil just below the surface cause a moderate limitation to use of equipment when the soil is wet. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

The soil is poorly suited to residential or commercial development. Slope, moderately slow permeability, moderate shrink-swell potential, and low strength of the clayey subsoil are significant limitations.

This map unit is in capability subclass VIe.

**CrD2—Collegedale-Rock outcrop complex, 5 to 20 percent slopes, eroded**

This map unit consists of the Collegedale soil and small areas of Rock outcrop so intermingled that they could not be separated in mapping. It is on rolling ridgetops and hillsides. The Collegedale soil makes up



**Figure 3.—**In most areas Collegedale silt loam, 12 to 25 percent slopes, eroded, is used for pasture. It is moderately productive for pasture. In the background are the Cumberland Mountains.

about 65 percent of each mapped area, Rock outcrop makes up about 25 percent, and included soils make up the rest. Typically, areas range from 5 to 25 acres in size.

The typical sequence, depth, and composition of the layers of this Collegedale soil are as follows—

*Surface layer:*

0 to 5 inches, brown silt loam

*Subsoil:*

5 to 36 inches, yellowish red clay

36 to 61 inches, mottled yellowish red, brownish yellow, light yellowish brown, and light brownish gray clay

In most areas erosion has removed part of the original surface layer, and tillage has mixed the remaining surface layer and subsoil.

***Important soil properties and features—***

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Rock outcrop consists of limestone bedrock that extends from a few inches to 3 feet or more above the surface of the soil. In many places contour bands of rock outcrop are on side slopes.

Included with this unit in mapping are small areas of soils that are 40 to 60 inches deep or less than 40 inches deep over bedrock.

Most areas of this map unit are used for woodland or pasture. It is not suited to row crops and is poorly suited to hay and pasture. The large number of rock outcrops and moderate available water capacity limit production and interfere with pasture management.

This map unit is moderately suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, white oak, shortleaf pine, Virginia pine, and loblolly pine. Erosion is a hazard along logging roads and skid trails. Steepness of slope, rock outcrops, and a clayey subsoil just below the surface cause a moderate limitation to use of equipment. Careful management is needed after harvest and for new

plantings to control plant competition and to favor desired species.

This map unit is poorly suited to residential or commercial development. Rock outcrops, slope, moderately slow permeability, moderate shrink-swell potential, and low strength of the clayey subsoil are significant limitations.

This map unit is in capability subclass VIs.

### **CrE2—Collegedale-Rock outcrop complex, 20 to 35 percent slopes, eroded**

This map unit consists of small areas of Collegedale soils and limestone outcrops so intermingled that they could not be separated in mapping. It is on steep hillsides. The Collegedale soil makes up about 65 percent of each mapped area, Rock outcrop makes up about 25 percent, and included soils make up the rest. Typically, areas range from 5 to 40 acres in size.

The typical sequence, depth, and composition of the layers of this Collegedale soil are as follows—

*Surface layer:*

0 to 5 inches, brown silt loam

*Subsoil:*

5 to 36 inches, yellowish red clay

36 to 61 inches, mottled yellowish red, brownish yellow, light yellowish brown, and light brownish gray clay

In most areas erosion has removed part of the original surface layer, and tillage has mixed the remaining surface layer and subsoil.

#### ***Important soil properties and features—***

*Permeability:* Moderately slow

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Rock outcrop consists of limestone bedrock that extends from a few inches to 3 feet or more above the soil surface. In many areas contour bands of rock outcrop are on side slopes.

Included with this unit in mapping are small areas of soils that are 40 to 60 inches deep, or less than 40 inches deep over bedrock.

In most areas this map unit is used for woodland. It is not suited to row crops and hay and is poorly suited to pasture. The large number of rock outcrops, slope,

and moderate available water capacity limit production and interfere with pasture management.

This map unit is moderately suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, white oak, shortleaf pine, Virginia pine, and loblolly pine. Erosion is a hazard on logging roads and skid trails. Steepness of slope, rock outcrops, and a clayey subsoil just below the surface are moderate limitations to equipment use. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This map unit is poorly suited to residential or commercial development. Rock outcrops, steep slopes, moderately slow permeability, moderate shrink-swell potential, and low strength of the clayey subsoil are limitations. These limitations are difficult to overcome.

This map unit is in capability subclass VIIIs.

### **CuF—Cutshin channery silt loam, 35 to 60 percent slopes**

This is a deep, well drained soil that has a thick, dark colored surface layer. It formed in colluvial material derived from sandstone, shale, and siltstone. It is on north and east slopes and in coves mostly above 3,000 feet in elevation. Typically, areas range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this Cutshin soil are as follows—

*Surface layer:*

0 to 9 inches, very dark brown channery silt loam

9 to 19 inches, dark brown channery silt loam

*Subsoil:*

19 to 44 inches, dark yellowish brown and dark brown channery silt loam

44 to 63 inches, yellowish brown channery silt loam

Included with this Cutshin soil in mapping are a few small areas of soils that are less than 40 inches thick over bedrock. Also included are small areas of soils that do not have a dark surface layer. Also included are a few areas of soils that contain many cobbles and boulders.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High or moderate

*Soil reaction:* Moderately acid or strongly acid

*Flood hazard:* None

*Depth to rock:* Deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas are used as woodland. It is well suited to this use. Trees suitable for planting or feasible to manage for production include yellow-poplar, black walnut, sugar maple, white ash, northern red oak, white oak, shortleaf pine, and eastern white pine. The erosion hazard and equipment limitation are severe because of steep slopes. Careful management is needed after harvest and in new plantings to control plant competition and to favor desired species.

This soil is poorly suited to farming and residential or commercial development because of steep slopes. It is in isolated areas in the Cumberland Mountains. Landslides are a hazard on this soil if cuts are made for roads and other structures.

This map unit is in capability subclass VIIe.

### **CyE2—Cynthiana flaggy silty clay loam, 10 to 35 percent slopes, eroded, rocky**

This is a shallow, well drained soil. It formed in residuum derived from interbedded limestone and shale. It is on hillsides and has numerous flagstones on the surface and throughout the soil. Limestone crops out on 5 to 10 percent of the surface. Typically, areas range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this Cynthiana soil are as follows—

*Surface layer:*

0 to 4 inches, dark grayish brown flaggy silty clay loam

*Subsoil:*

4 to 14 inches, yellowish brown flaggy clay

*Bedrock:*

14 inches, limestone interbedded with calcareous shale

In most areas erosion has removed part of the original surface layer, and tillage has mixed the remaining surface layer and subsoil.

Included in mapping are numerous small areas of soils that formed in material derived from shale. In these areas soft shale is generally less than 20 inches below the surface, but hard bedrock is dominantly more than 20 inches below the surface.

#### **Important soil properties and features—**

*Permeability:* Moderately slow

*Available water capacity:* Very low

*Soil reaction:* Slightly acid to slightly alkaline

*Flood hazard:* None

*Depth to rock:* Shallow

*Depth to a seasonal high water table:* More than 6 feet

In most areas this soil is used as woodland. It is

poorly suited to the commercial production of trees, but woodland is generally the most feasible use. Common trees on this soil are eastern redcedar, locust, hickory, hackberry, and Virginia pine. The erosion hazard and equipment limitation are severe because of slope and a clayey subsoil at a very shallow depth. The very low available water capacity and shallow depth to bedrock cause seedling mortality and a windthrow hazard.

This soil is poorly suited to farming and residential or commercial development because of the shallow depth to bedrock, the clayey subsoil, the moderately slow permeability, rock outcrops, and the moderately steep and steep slopes. These limitations are difficult to overcome.

This map unit is in capability subclass VIIc.

### **DeD—Dewey silt loam, 12 to 25 percent slopes**

This is a very deep, well drained soil. It formed in 1 to 2 feet of alluvium and in several feet of residuum derived from limestone. It makes up hilly areas some of which have karst and irregular topography. Typically, areas range from 5 to 25 acres in size.

The typical sequence, depth, and composition of the layers of this Dewey soil are as follows—

*Surface layer:*

0 to 6 inches, dark reddish brown silt loam

*Subsoil:*

6 to 29 inches, dark red clay

29 to 61 inches, red clay

Included with this soil in mapping are small areas of soils that are loamy in the upper part of the subsoil.

#### **Important soil properties and features—**

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most of the acreage of this soil is used for pasture and hay. It is poorly suited to row crops because of the slope and the erosion hazard.

This soil is well suited to pasture and moderately suited to hay. Erosion is a hazard unless a good cover of forage plants is maintained. Good management practices ensure adequate cover and maintain a high level of forage production. They include fertilizing and

liming, maintaining an adequate legume-grass mixture, controlling weeds and brush, and preventing overgrazing.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, black walnut, southern red oak, white oak, loblolly pine, and eastern white pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species. Steepness of slope is a moderate limitation for equipment. Erosion is a hazard on logging roads and skid trails.

This soil is poorly suited to residential or commercial development because of slope. Grading and excavating is generally required. Overcoming slope becomes increasingly difficult and expensive on the steeper parts of this soil. Conservation measures are needed to control erosion on construction sites.

This map unit is in capability subclass IVe.

### **Ea—Ealy loam, occasionally flooded**

This is a very deep, well drained soil. It formed in loamy alluvium on flood plains. Slopes are 0 to 3 percent. Typically, areas range from 5 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this Ealy soil are as follows—

*Surface layer:*  
0 to 7 inches, brown loam

*Subsoil:*  
7 to 18 inches, dark yellowish brown loam

*Substratum:*  
18 to 61 inches, dark yellowish brown loam

Included with this Ealy soil in mapping are some small areas of Sewanee soils and a few small areas of soils that have a subsoil of silty clay loam or clay loam.

#### **Important soil properties and features—**

*Permeability:* Moderately rapid  
*Available water capacity:* High  
*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid  
*Flood hazard:* Occasional  
*Depth to rock:* Very deep  
*Depth to a seasonal high water table:* 5 to 6 feet

This soil is in small, irregularly shaped areas that are dissected by streams and that are commonly adjacent to steep slopes. It is used for pasture, hay, and woodland. It is suitable for most crops because of the small size and irregular shape of areas.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, black walnut, southern red oak, American sycamore, loblolly pine, and eastern white pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is not suited to residential or commercial development because of flooding.

This map unit is in capability subclass IIw.

### **EtB—Etowah silt loam, 2 to 5 percent slopes**

This is a very deep, well drained soil. It formed in alluvium or colluvium on stream terraces and foot slopes. Typically, areas range from 5 to 25 acres in size.

The typical sequence, depth, and composition of the layers of this Etowah soil are as follows—

*Surface layer:*  
0 to 7 inches, dark brown silt loam

*Subsoil:*  
7 to 15 inches, dark brown silt loam  
15 to 45 inches, yellowish red silty clay loam  
45 to 70 inches, strong brown silty clay loam

Included with this soil in mapping are a few areas of soils that have a dark red, clayey subsoil.

#### **Important soil properties and features—**

*Permeability:* Moderate  
*Available water capacity:* High  
*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid  
*Flood hazard:* None  
*Depth to rock:* Very deep  
*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for row crops, pasture, or hay.

This soil is well suited to row crops. Tobacco and all other commonly grown crops are suited to this soil. Erosion is a moderate hazard if row crops are grown. A management system that includes crop rotation, contour farming, stripcropping, grassed waterways, and winter cover crops helps to control erosion. Crop residue management and minimum tillage also help to control erosion and to conserve moisture.

This soil is well suited to hay and pasture. It has no serious limitations to these uses. Liming and fertilizing help to obtain good yields of forages.

This soil is well suited to woodland use. Trees

suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, loblolly pine, and shortleaf pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is well suited to residential or commercial development. It has a few moderate limitations, which are easy to overcome.

This map unit is in capability subclass IIe.

### **EtC—Etowah silt loam, 5 to 12 percent slopes**

This is a very deep, well drained soil. It formed in alluvium or colluvium on stream terraces and foot slopes. Typically, areas range from 5 to 15 acres in size.

The typical sequence, depth, and composition of the layers of this Etowah soil are as follows—

*Surface layer:*

0 to 7 inches, dark brown silt loam

*Subsoil:*

7 to 15 inches, dark brown silt loam

15 to 45 inches, yellowish red silty clay loam

45 to 70 inches, strong brown silty clay loam

Included with this soil in mapping are a few areas of soils that have a dark red, clayey subsoil.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for row crops, pasture, or hay.

This soil is moderately suited to row crops. Tobacco and all other commonly grown crops are suited to this soil. Erosion is a severe hazard if row crops are grown. A management system that includes crop rotation, contour farming, stripcropping, grassed waterways, and winter cover crops reduces the erosion hazard. Other practices that are effective in reducing erosion and conserving moisture are crop residue management and minimum tillage.

This soil is well suited to hay and pasture. It has no serious limitations to these uses. Liming and fertilizing will obtain good yields of forages.

This soil is well suited to woodland use. Trees

suitable for planting or feasible to manage for production include yellow-poplar, southern red oak, loblolly pine, and shortleaf pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is well suited to residential or commercial development. Slope is a moderate limitation. Slope generally can be overcome without great cost.

This map unit is in capability subclass IIIe.

### **FaC—Fullerton gravelly silt loam, 5 to 12 percent slopes**

This is a very deep, well drained soil. It formed in residuum derived from dolomite on rolling ridgetops. Typically, areas range from 4 to 20 acres in size.

The typical sequence, depth, and composition of the layers of this Fullerton soil are as follows—

*Surface layer:*

0 to 1 inch; very dark grayish brown gravelly silt loam

1 to 11 inches, light yellowish brown gravelly silt loam

*Subsoil:*

11 to 18 inches, strong brown gravelly silt loam

18 to 21 inches, yellowish red gravelly silty clay loam

21 to 36 inches, yellowish red gravelly clay

36 to 61 inches, red gravelly clay

Included with this soil in mapping are a few areas of Etowah soils. Also included are a few severely eroded spots of Fullerton soils that have a surface layer of yellowish red gravelly silty clay loam. Also included are a few areas of soils that are sandy loam in the surface layer and clay loam in the upper part of the subsoil.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are cleared and are used for pasture. It is poorly suited to most row crops because it is in small areas on narrow ridgetops adjacent to steeper soils. The slope, moderate available water capacity, and gravel in the surface layer are also limitations. The soil is well suited but only moderately productive for hay and pasture.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for

production include yellow-poplar, southern red oak, loblolly pine, and shortleaf pine. Careful management is needed after harvest and in new plantings to control plant competition and to favor desired species.

This soil is poorly suited to residential or commercial development because it is in small areas adjacent to steeper soils. It is moderately suited as sites for individual dwellings.

This map unit is in capability subclass IIIe.

### **FbD—Fullerton and Bodine gravelly silt loams, 12 to 25 percent slopes**

This map unit consists of very deep, well drained soils on sides and tops of low hills and ridges. Fullerton and Bodine soils are in an irregular pattern on the landscape. Most areas of Fullerton or Bodine soils are large enough to map separately. But, because of present and predicted use, they were mapped as one unit. Most mapped areas contain both soils, but some areas of this map unit contain only one of the soils. Fullerton soils make up about 70 percent of the unit, Bodine soils make up about 20 percent, and included soils make up the rest.

The typical sequence, depth, and composition of the layers of Fullerton soils are as follows—

*Surface layer:*

0 to 1 inch; very dark grayish brown gravelly silt loam  
1 to 11 inches, light yellowish brown gravelly silt loam

*Subsoil:*

11 to 18 inches, strong brown gravelly silt loam  
18 to 21 inches, yellowish red gravelly silty clay loam  
21 to 36 inches, yellowish red gravelly clay  
36 to 61 inches, red gravelly clay

#### ***Important soil properties and features of the Fullerton soil—***

*Permeability:* Moderate

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

The typical sequence, depth, and composition of the layers of Bodine soils are as follows—

*Surface layer:*

0 to 3 inches, dark grayish brown gravelly silt loam  
3 to 10 inches, light yellowish brown gravelly silt loam

*Subsoil:*

10 to 51 inches, strong brown very gravelly loam

51 to 62 inches, yellowish red very gravelly silty clay loam

#### ***Important soil properties and features of the Bodine soil—***

*Permeability:* Moderately rapid

*Available water capacity:* Low

*Soil reaction:* Strongly acid to extremely acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Included with this unit in mapping are small areas of soils that are loamy throughout and that contain fewer fragments of chert than Bodine and Fullerton soils. Also included are soils that have a subsoil of reddish clay and a few fragments of chert.

Fullerton and Bodine soils are used mainly as woodland. They are not suited to row crops because of slope, droughtiness, and a large amount of gravel in the plow layer. These soils are poorly suited to small grain and hay and moderately suited to pasture. Good management practices will obtain moderate yields of pasture. They include fertilizing and liming, timely clipping, and controlled grazing.

These soils are moderately suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, upland oaks, loblolly pine, Virginia pine, and eastern white pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species. Steepness of slope is a moderate limitation for equipment. Erosion is a hazard on logging roads and skid trails.

These soils are poorly suited to residential or commercial development. Slope is the most severe limitation because considerable cuts and fills are required. The least sloping part of this unit is suited to sites for individual dwellings or for other small buildings.

This map unit is in capability subclass VIe.

### **FbF—Fullerton and Bodine gravelly silt loams, 25 to 70 percent slopes**

This map unit consists of very deep, well drained soils on sides of hills and ridges. Fullerton and Bodine soils are in an irregular pattern on the landscape. Most individual areas of Fullerton or Bodine soils are large enough to map separately. But, because of present and predicted use, they were mapped as one unit. Most mapped areas contain both

soils, but some areas contain only one of the soils. Fullerton soils make up about 60 percent of the unit, Bodine soils make up about 30 percent, and included soils make up the rest. Fullerton soils are on slopes up to 45 percent and Bodine soils are mostly on slopes greater than 45 percent.

The typical sequence, depth, and composition of the layers of Fullerton soils are as follows—

*Surface layer:*

0 to 1 inch; very dark grayish brown gravelly silt loam

1 to 11 inches, light yellowish brown gravelly silt loam

*Subsoil:*

11 to 18 inches, strong brown gravelly silt loam

18 to 21 inches, yellowish red gravelly silty clay loam

21 to 36 inches, yellowish red gravelly clay

36 to 61 inches, red gravelly clay

***Important soil properties and features of the Fullerton soil—***

*Permeability:* Moderate

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

The typical sequence, depth, and composition of the layers of Bodine soils are as follows—

*Surface layer:*

0 to 3 inches, dark grayish brown gravelly silt loam

3 to 10 inches, light yellowish brown gravelly silt loam

*Subsoil:*

10 to 51 inches, strong brown very gravelly loam

51 to 62 inches, yellowish red very gravelly silty clay loam

***Important soil properties and features of the Bodine soil—***

*Permeability:* Moderately rapid

*Available water capacity:* Low

*Soil reaction:* Strongly acid to extremely acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Included with the Fullerton and Bodine soils in mapping are small areas of soils that have a brown, silt loam surface layer and a brownish or reddish, loamy subsoil.

Fullerton and Bodine soils are used mainly as woodland. They are not suited to row crops and hay and are poorly suited to pasture because of steep slopes and droughtiness.

These soils are moderately suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, upland oaks, loblolly pine, Virginia pine, and eastern white pine. Steep slopes are a severe limitation for equipment. Erosion is a hazard on logging roads and skid trails.

These soils are not suited to residential or commercial development because of steep slopes. Landslides are a hazard on cuts on steep slopes.

This map unit is in capability subclass VIle.

**GrD—Gladeville-Rock outcrop complex, 5 to 25 percent slopes**

This map unit consists of the shallow, well drained Gladeville soil and areas of Rock outcrop. The Gladeville soil and Rock outcrop are so intermingled they could not be separated in mapping (fig. 4). They are on rolling and hilly uplands that are underlain by limestone. The Gladeville soil makes up 50 to 70 percent of each mapped area, Rock outcrop makes up about 20 to 40 percent, and included soils make up the rest. This Gladeville soil and Rock outcrop are in areas of 5 to 75 acres.

The typical sequence, depth, and composition of the layers of this Gladeville soil are as follows—

*Surface layer:*

0 to 4 inches, very dark grayish brown flaggy silty clay loam

4 to 8 inches, dark brown very flaggy silty clay loam

*Substratum:*

8 to 11 inches, dark yellowish very brown flaggy clay

*Bedrock:*

11 inches, limestone

***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* Very low

*Soil reaction:* Neutral to moderately alkaline

*Flood hazard:* None

*Depth to rock:* Very shallow

*Depth to a seasonal high water table:* More than 6 feet

Rock outcrop consists of limestone bedrock that ranges from level with the soil surface to extending



**Figure 4.**—Native pasture in an area of Gladeville-Rock outcrop complex, 5 to 25 percent slopes. On this map unit the soil and limestone outcrops form an intricate pattern.

1.5 feet above the soil surface. In some areas contour bands of rock outcrop are on side slopes.

Included with this unit in mapping are a few areas of soils that are more than 12 inches deep over limestone bedrock.

This map unit is poorly suited to woodland use, farming, and urban use. Very shallow depth to bedrock and closely spaced limestone outcrops are very severe limitations. These limitations are difficult to overcome for most uses.

This map unit is in capability subclass VIIc.

### **Ha—Hamblen silt loam, occasionally flooded**

This is a very deep, moderately well drained soil. It formed in alluvium on flood plains. Slopes range from 0 to 3 percent. Typically, areas range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this Hamblen soil are as follows—

#### *Surface layer:*

0 to 4 inches, brown silt loam

4 to 9 inches, dark yellowish brown silt loam

#### *Subsoil:*

9 to 17 inches, yellowish brown silt loam

17 to 31 inches, brown silt loam

#### *Substratum:*

31 to 48 inches, brown loam

48 to 61 inches, brown gravelly loam

Included with this soil in mapping are a few small areas of moderately well drained Whitwell soils on low stream terraces. Also included are a few small areas of well drained soils.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Neutral to strongly acid

*Flood hazard:* Occasional

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* 2 to 3 feet

Most areas of this soil are used for pasture and hay (fig. 5). In some of the larger areas it is used for row crops. It is well suited to these uses. Corn, soybeans, and most pasture and hay plants produce good yields on this soil. Occasional flooding and the seasonal high water table in late winter and early spring are the main limitations.

This soil is well suited to woodland use. In most areas it has been cleared, but in some isolated areas it is in native forest. Trees suitable for planting or feasible to manage for production include yellow-poplar, northern red oak, and loblolly pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species. This soil has no significant limitations to woodland use and management.

This soil is not suited to residential or commercial development because of flooding. Wetness is also a limitation for many urban uses.

This map unit is in capability subclass IIw.

### **JeC—Jefferson gravelly loam, 5 to 15 percent slopes**

This is a very deep, well drained soil. It formed in colluvium derived from shale and sandstone. It is on benches on the sides of mountains and on foot slopes. Typically, areas range from 5 to 100 acres in size.

The typical sequence, depth, and composition of

the layers of this soil are as follows—

*Surface layer:*

0 to 3 inches, dark grayish brown silt loam  
3 to 10 inches, yellowish brown gravelly loam

*Subsoil:*

10 to 34 inches, strong brown loam  
34 to 54 inches, strong brown gravelly sandy loam

*Substratum:*

54 to 61 inches, mottled strong brown, yellowish red, and pale brown gravelly sandy loam

Included with this soil in mapping are a few areas of Muskingum soils that are less than 40 inches deep to shale bedrock. Also included are some areas of Grimsley soils, which contain more than 35 percent rock fragments throughout.

### ***Important soil properties and features—***

*Permeability:* Moderately rapid

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

This soil is used mainly for pasture and hay. It is poorly suited to row crops and is well suited to hay and pasture. In places gravel in the surface layer can



**Figure 5.—Pasture in an area of Hamblen silt loam, occasionally flooded. This soil is in small areas on narrow flood plains. In most areas it is used for pasture.**

interfere with tillage. Erosion is a severe hazard if row crops are grown. A management system that includes crop rotation, contour farming, stripcropping, grassed waterways, and winter cover will help to control erosion. Crop residue management and minimum tillage also help to control erosion and to conserve moisture.

This soil is well suited to hay and pasture. It has no serious limitations to these uses. Liming and fertilizing help to obtain good yields of forages.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, northern red oak, shortleaf pine, and eastern white pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is well suited to most residential or commercial development. Slope is a limitation for most uses. It is generally not difficult or costly to overcome.

This map unit is in capability subclass IIIe.

### **JeD—Jefferson gravelly loam, 15 to 25 percent slopes**

This is a very deep, well drained soil. It formed in colluvium derived from shale and sandstone. It is on benches on the sides of mountains and on foot slopes. Typically, areas range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this Jefferson soil are as follows—

*Surface layer:*

0 to 3 inches, dark grayish brown silt loam  
3 to 10 inches, yellowish brown gravelly loam

*Subsoil:*

10 to 34 inches, strong brown loam  
34 to 54 inches, strong brown gravelly sandy loam

*Substratum:*

54 to 61 inches, mottled strong brown, yellowish red, and pale brown gravelly sandy loam

Included with this soil in mapping are a few areas of Muskingum soils that are less than 40 inches deep to shale. Also included are some areas of Grimsley soils that contain more than 35 percent rock fragments throughout.

#### **Important soil properties and features—**

*Permeability:* Moderately rapid

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

This soil is used mainly for pasture and hay. It is poorly suited to row crops because of slope and the erosion hazard. In places gravel in the surface layer also interferes with tillage.

This soil is well suited to pasture and is moderately suited to hay. Erosion is a hazard unless a good cover of forage plants is maintained. Good management practices ensure adequate cover and maintain a high level of forage production. They include fertilizing and liming, maintaining an adequate legume-grass mixture, controlling weeds and brush, and preventing overgrazing.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, northern red oak, shortleaf pine, and eastern white pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species. Steepness of slope is a moderate limitation to equipment use. Erosion is a hazard on logging roads and skid trails.

This soil is poorly suited to residential or commercial development because of slope. Grading and excavating are generally required. Overcoming slope becomes increasingly difficult and expensive on the steeper part of this soil. Conservation measures are needed to control erosion on construction sites.

This map unit is in capability subclass VIe.

### **JgF—Jefferson-Grimsley complex, 30 to 60 percent slopes**

This map unit consists of the Jefferson and Grimsley soils in areas so small and so intermingled they could not be separated at the scale selected for mapping. The Jefferson soil is very deep and the Grimsley soil is deep. These soils are well drained. They formed in colluvium derived from sandstone and shale on mountainsides and in coves. The Jefferson soil makes up about 50 percent of this map unit, the Grimsley soil makes up about 40 percent, and included soils make up the rest.

The typical sequence, depth, and composition of the layers of this Jefferson soil are as follows—

*Surface layer:*

0 to 3 inches, dark grayish brown silt loam

3 to 10 inches, yellowish brown gravelly loam

*Subsoil:*

10 to 34 inches, strong brown loam

34 to 54 inches, strong brown gravelly sandy loam

*Substratum:*

54 to 61 inches, mottled strong brown, yellowish red,  
and pale brown gravelly sandy loam

***Important soil properties and features of the  
Jefferson soil—***

*Permeability:* Moderately rapid

*Available water capacity:* Moderate

*Soil reaction:* Strongly acid or very strongly acid, but in  
limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

The typical sequence, depth, and composition of  
the layers of this Grimsley soil are as follows—

*Surface layer:*

0 to 3 inches, very dark grayish brown stony loam

3 to 8 inches, light yellowish brown stony loam

*Subsoil:*

8 to 28 inches, yellowish brown and strong brown very  
stony loam

28 to 47 inches, strong brown extremely stony loam

*Substratum:*

47 to 54 inches, yellowish brown extremely stony  
loam

*Bedrock:*

54 inches, sandstone

***Important soil properties and features of the  
Grimsley soil—***

*Permeability:* Moderately rapid

*Available water capacity:* Low

*Soil reaction:* Strongly acid or very strongly acid

*Flood hazard:* None

*Depth to rock:* Deep

*Depth to a seasonal high water table:* More than 6 feet

Included with this unit in mapping, on foot slopes,  
are long narrow areas of soils that have very few rock  
fragments. Also included, on north slopes, are a few  
areas of soils that have a thick, dark colored surface  
layer. Also included, near drainageways, are a few  
areas of moderately well drained soils.

Most areas of these soils are used as woodland.  
They are moderately suited to this use. Trees suitable  
for planting or feasible to manage for production  
include yellow-poplar, northern red oak, shortleaf pine,

and eastern white pine. Careful management is  
needed after harvest and for new plantings to control  
plant competition and to favor desired species. Steep  
slopes are a severe limitation to use of equipment.  
Erosion is a moderate hazard on logging roads and  
skid trails.

These soils are poorly suited to farming. Stones  
and steep slopes are the major limitations.

These soils are not suited to residential or  
commercial development because of steep slopes.  
Stones and cobbles are also a limitation for most uses.  
Landslides are a hazard on cuts made on the lower  
part of slopes.

The map unit is in capability subclass VIIe.

**LyC—Lily fine sandy loam, 5 to 15 percent  
slopes**

This is a moderately deep, well drained soil. It  
formed in residuum derived from sandstone on the  
rolling tops of the Cumberland Mountains. Typically,  
areas range from 5 to 200 acres in size.

The typical sequence, depth, and composition of  
the layers of this Lily soil are as follows—

*Surface layer:*

0 to 3 inches, brown fine sandy loam

3 to 10 inches, yellowish brown fine sandy loam

*Subsoil:*

10 to 18 inches, strong brown loam

18 to 25 inches, strong brown clay loam

25 to 32 inches, strong brown sandy clay loam

*Bedrock:*

32 inches, hard sandstone

Included with this soil in mapping are small areas  
of Sequoia soils that formed in shale and that have a  
clayey subsoil.

***Important soil properties and features—***

*Permeability:* Moderately rapid

*Available water capacity:* Moderate or low

*Soil reaction:* Strongly acid to extremely acid, but in  
limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6  
feet

Most areas of this soil are used as woodland. It is  
on the tops of the Cumberland Mountains, and thus in  
many areas is isolated.

This soil is moderately suited to row crops and well

suited to small grains, hay, and pasture. Good rainfall distribution partly offsets moderate or low available water capacity. Slope and moderate soil depth are also limitations.

This soil is moderately suited to woodland use. Trees suitable for planting or feasible to manage for production include upland oaks, Virginia pine, and shortleaf pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

In many areas this soil is poorly suited to residential or commercial development because it is on isolated mountaintops. Depth to bedrock is a severe limitation for most urban uses.

This map unit is in capability subclass IIIe.

### **MaD—Minvale gravelly loam, 15 to 25 percent slopes**

This is a very deep, well drained soil. It formed in colluvium and residuum derived from cherty limestone on benches, foot slopes, and fans. Typically, areas range from 5 to 50 acres, but most areas are less than 10 acres in size.

The typical sequence, depth, and composition of the layers of this Minvale soil are as follows—

*Surface layer:*

0 to 7 inches, dark grayish brown gravelly loam

*Subsoil:*

7 to 20 inches, brown and strong brown gravelly loam

20 to 33 inches, yellowish brown gravelly loam

33 to 61 inches, red gravelly silty clay loam

Included with this Minvale soil in mapping are a few small areas of Fullerton soils and small areas of soils that have more gravel in the surface layer than the Minvale soil.

#### ***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid.

*Flood hazard:* None

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used as woodland. It is poorly suited to row crops, hay, and small grain. Moderately steep slopes make machinery very difficult to use. Erosion is a severe hazard. This soil is moderately suited to pasture. Slope limits seedbed preparation and pasture management.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, white oak, black walnut, northern red oak, shortleaf pine, and loblolly pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species. Moderately steep slopes are a moderate limitation to use of equipment. Erosion is a hazard on logging roads and skid trails.

This soil is poorly suited to residential or commercial development because of slope. In most areas it can be used if the developments are designed to fit the landscape. Such designs will generally increase the cost of development.

This map unit is in capability subclass VIe.

### **MkF—Muskingum-Sequoia-Petros complex, 30 to 60 percent slopes**

This map unit consists of areas of Muskingum, Sequoia, and Petros soils that are so intermingled they could not be separated at the scale selected for mapping. They are on mountainsides and on narrow crests below an elevation of about 2,400 feet (fig. 6). The Muskingum soil makes up about 50 percent of this unit, the Sequoia soil about 20 percent, the Petros soil about 15 percent, and included soils make up the rest. Typically, areas range from 10 to 2,000 acres, and most areas are large.



**Figure 6.—Inclusion of sandstone rock outcrop in an area of Muskingum-Sequoia-Petros complex, 30 to 60 percent slopes. The bedrock is tilted vertically 90 degrees from the original horizontal orientation. Layers of shale bedrock between the sandstone have weathered more rapidly and are not exposed.**

The typical sequence, depth, and composition of the layers of the Muskingum soil are as follows—

*Surface layer:*

0 to 2 inches, very dark grayish brown silt loam  
2 to 6 inches, yellowish brown silt loam

*Subsoil:*

6 to 21 inches, yellowish brown silt loam  
21 to 24 inches, yellowish brown channery silt loam

*Substratum:*

24 to 30 inches, yellowish brown very channery silt loam  
30 to 45 inches, rippable shale

***Important soil properties and features of the Muskingum soil—***

*Permeability:* Moderate

*Available water capacity:* Moderate or low

*Soil reaction:* Strongly acid or very strongly acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

The typical sequence, depth, and composition of the layers of the Sequoia soil are as follows—

*Surface layer:*

0 to 4 inches, brown silt loam

*Subsoil:*

4 to 20 inches, strong brown channery silty clay

*Substratum:*

20 to 30 inches, strong brown channery silty clay  
30 to 40 inches, weakly consolidated shale  
interlayered with thin seams of fine earth

***Important soil properties and features of the Sequoia soil—***

*Permeability:* Moderately slow

*Available water capacity:* Moderate or low

*Soil reaction:* Strongly acid or very strongly acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

The typical sequence, depth, and composition of the layers of the Petros soil are as follows—

*Surface layer:*

0 to 1 inch, very dark grayish brown channery silt loam  
1 to 5 inches, brown channery silt loam

*Subsoil:*

5 to 16 inches, yellowish brown very channery silt loam

*Substratum:*

16 to 26 inches, thin, layered shale removable with hand tools

*Bedrock:*

26 inches, moderately hard shale

***Important soil properties and features of the Petros soil—***

*Permeability:* Moderate or moderately rapid

*Available water capacity:* Very low

*Soil reaction:* Strongly acid or very strongly acid

*Flood hazard:* None

*Depth to rock:* Shallow

*Depth to a seasonal high water table:* More than 6 feet

Included with this unit in mapping, on benches and foot slopes, are areas of loamy soils more than 40 inches deep to bedrock. Also included are some areas of soils where stones are on the surface and areas of soils that have narrow bands of sandstone outcrop. Also included, on mountain crests, are some small areas of soils that have slope of less than 30 percent. Also included, on mountainsides, are some areas of soils that have slope of more than 60 percent.

The Muskingum, Sequoia, and Petros soils are used as woodland. They are moderately suited to this use. Trees suitable for planting or feasible to manage for production are upland oaks, Virginia pine, shortleaf pine, and eastern white pine. Steep and very steep slopes require specialized equipment. Erosion is a hazard on logging roads and skid trails. On the Petros soil seedling mortality is a problem.

This map unit is not suited to farming or residential or commercial development because of steep slopes and depth to bedrock. These limitations are difficult to overcome.

This map unit is in capability subclass VIIe.

**MpF—Muskingum-Petros complex, 30 to 60 percent slopes**

This map unit consists of areas of Muskingum and Petros soils that are so intermingled they could not be separated at the scale selected for mapping. They are on mountainsides and on narrow crests below an elevation of about 2,400 feet. The Muskingum soil is mostly on mountainsides. It is moderately deep and well drained. The Petros soil is mainly on points of ridges and narrow mountaintops. It is shallow and excessively drained. The Muskingum soil makes up about 60 percent of this unit, the Petros soil makes up about 25 percent, and included soils make up the rest. Typically, areas range from 10 to 500 acres in size.

The typical sequence, depth, and composition of the layers of this Muskingum soil are as follows—

*Surface layer:*

0 to 2 inches, very dark grayish brown silt loam  
2 to 6 inches, yellowish brown silt loam

*Subsoil:*

6 to 21 inches, yellowish brown silt loam  
21 to 24 inches, yellowish brown channery silt loam

*Substratum:*

24 to 30 inches, yellowish brown very channery silt loam  
30 to 45 inches, rippable shale

***Important soil properties and features of the Muskingum soil—***

*Permeability:* Moderate

*Available water capacity:* Moderate or low

*Soil reaction:* Strongly acid or very strongly acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

The typical sequence, depth, and composition of the layers of this Petros soil are as follows—

*Surface layer:*

0 to 1 inch; very dark grayish brown channery silt loam  
1 to 5 inches, brown channery silt loam

*Subsoil:*

5 to 16 inches, yellowish brown very channery silt loam

*Substratum:*

16 to 26 inches, thin layered shale removable with hand tools

*Bedrock:*

26 inches, moderately hard shale

***Important soil properties and features of the Petros soil—***

*Permeability:* Moderate or moderately rapid

*Available water capacity:* Very low

*Soil reaction:* Strongly acid or very strongly acid

*Flood hazard:* None

*Depth to rock:* Shallow

*Depth to a seasonal high water table:* More than 6 feet

Included with this unit in mapping are small areas of Sequoia and Ramsey soils and narrow bands of sandstone outcrops. Also included, in coves and on benches, are some areas of soils that have stones on

the surface. Also included are areas of soils that are more than 40 inches deep to bedrock.

The Muskingum and Petros soils are used as woodland. They are moderately suited to this use. Trees suitable for planting or feasible to manage for production are upland oaks, Virginia pine, shortleaf pine, and eastern white pine. The steep and very steep slopes require specialized equipment. Erosion is a hazard on logging roads and skid trails. On the Petros soil seedling mortality is a problem.

This map unit is not suited to farming and residential or commercial development because of steep slopes and depth to bedrock. These limitations are difficult to overcome.

This map unit is in capability subclass VIIe.

**Pt—Pits, quarries**

Pits are excavations made in limestone and dolomite bedrock. Most of these units consist of a pit and a stockpile of crushed stone and overburden. In some abandoned quarries the pits are full of water. The quarried rock is used in road construction, in commercial development, and as agricultural lime. The quarries are commonly adjacent to Gladeville and Fullerton soils. Typically, areas of Pits, quarries, range from 5 to 125 acres in size.

This map unit has not been assigned a capability subclass.

**RaF—Ramsey-Rock outcrop complex, 30 to 65 percent slopes**

This map unit consists of areas of the Ramsey soil and Rock outcrop that are so intermingled they could not be separated at the scale selected for mapping. Most areas of this unit are on Walden Ridge, Fork Mountain, Chestnut Ridge, and Pine Mountain. A few areas are in other parts of the Cumberland Mountains. The Ramsey soil is shallow and somewhat excessively drained. It makes up about 65 percent of the map unit. Rock outcrop makes up about 25 percent. Included soils make up the rest. Typically, areas range from 10 to more than 1,000 acres in size.

The typical sequence, depth, and composition of the layers of the Ramsey soil are as follows—

*Surface layer:*

0 to 2 inches, very dark grayish brown sandy loam  
2 to 7 inches, brown sandy loam

*Subsoil:*

7 to 18 inches, yellowish brown sandy loam

*Bedrock:*  
18 inches, sandstone

***Important soil properties and features—***

*Permeability:* Rapid  
*Available water capacity:* Very low  
*Soil reaction:* Strongly acid or very strongly acid  
*Flood hazard:* None  
*Depth to rock:* Shallow  
*Depth to a seasonal high water table:* More than 6 feet

Rock outcrop consists of sandstone outcrops on about 25 percent of the surface and many areas of bluffs. Most outcrops extend about 2 to 10 feet above the soil surface.

Included in mapping are small areas of Lily, Petros, and Muskingum soils.

Most areas are used as woodland. It is poorly suited to woodland use. But, in most areas woodland is the most feasible use. The most common trees on this unit are upland oaks, Virginia pine, and shortleaf pine. Windthrow hazard and seedling mortality are problems because of the shallow depth to bedrock and very low available water capacity. Slope is a severe limitation for standard equipment.

This map unit is not suited to either farming or urban developments because of steep slopes, shallow soils, and numerous rock outcrops.

This map unit is in capability subclass VII<sub>s</sub>.

**SaB—Sequatchie loam, 1 to 5 percent slopes, occasionally flooded**

This is a very deep, well drained soil. It formed in loamy alluvium on low stream terraces. Typically, areas range from 5 to 30 acres in size.

The typical sequence, depth, and composition of the layers of this Sequatchie soil are as follows—

*Surface layer:*  
0 to 9 inches, dark brown loam

*Subsoil:*  
9 to 16 inches, brown loam  
16 to 34 inches, strong brown loam  
34 to 41 inches, strong brown sandy loam

*Substratum:*  
41 to 62 inches, strong brown loam

Included with this soil in mapping are a few small areas of Whitwell soils and some small areas of Sequatchie soils, rarely flooded. Also included are areas of soils that are less productive than the

Sequatchie soil, that have a lighter surface layer, and that are higher in sand content.

***Important soil properties and features—***

*Permeability:* Moderate  
*Available water capacity:* High  
*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid  
*Flood hazard:* Occasional  
*Depth to rock:* Very deep  
*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for row crops, small grain, hay, or pasture. It is well suited to these uses. All the commonly grown crops are suited to this soil. However, this soil is in small, irregularly shaped areas.

This soil is well suited to woodland use. Trees suited for planting or feasible to manage for production include black walnut, yellow-poplar, and loblolly pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is not suited to residential or commercial development because of the flood hazard. Onsite determinations are needed for other urban uses.

This map unit is in capability subclass II<sub>e</sub>.

**SeC2—Sequoia silt loam, 5 to 12 percent slopes, eroded**

This is a moderately deep, well drained soil. It formed in clayey residuum of acid shale on rolling mountaintops. Typically, areas range from 5 to 200 acres in size.

The typical sequence, depth, and composition of the layers of this Sequoia soil are as follows—

*Surface layer:*  
0 to 6 inches, brown silt loam

*Subsoil:*  
6 to 20 inches, strong brown channery silty clay

*Substratum:*  
20 to 30 inches, strong brown channery silty clay  
30 to 40 inches, weakly consolidated shale  
interlayered with thin seams of fine earth

In most areas erosion has removed part of the original surface, and tillage has mixed the remaining surface layer and subsoil.

***Important soil properties and features—***

*Permeability:* Moderately slow  
*Available water capacity:* Moderate or low

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

Included with this Sequatchie soil in mapping are a few small areas of soils that are less than 20 inches deep over bedrock and that contain more than 35 percent shale fragments.

Most areas of this soil are used for woodland, partly because it is surrounded by steeper slopes on mountaintops.

This soil is poorly suited to row crops and moderately suited to hay and pasture. Slope, moderate depth to bedrock, and low or moderate available water capacity are limitations.

This soil is well suited to woodland use. Trees suited for planting or feasible to manage for production include northern red oak, shortleaf pine, Virginia pine, and loblolly pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is poorly suited to residential or commercial development. Depth to bedrock, moderately slow permeability, clayey subsoil that has low strength, and its isolated location on mountains are limitations.

This map unit is in capability subclass IVe.

### **SeC3—Sequoia silty clay loam, 5 to 15 percent slopes, severely eroded**

This is a moderately deep and well drained soil. It formed in clayey residuum derived from acid shale. It is on ridgetops and hillsides of uplands. Typically, areas range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this Sequoia soil are as follows—

*Surface layer:*

0 to 4 inches, brown silty clay loam

*Subsoil:*

4 to 20 inches, strong brown channery silty clay

*Substratum:*

20 to 30 inches, strong brown channery silty clay

30 to 40 inches, weakly consolidated shale interlayered with thin seams of fine earth

Erosion has removed most of the original surface, and the remaining surface layer consists mainly of subsoil material.

Included with this soil in mapping are areas of the Petros soil on narrow, convex ridgetops and areas of the Jefferson soil on concave slopes.

### **Important soil properties and features—**

*Permeability:* Moderately slow

*Available water capacity:* Low

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

In most areas this Sequoia soil is used for pasture and hay. It is moderately suited to this use. Cool-season grasses, such as tall fescue, are well suited. It is poorly suited to cultivated crops because of slope, droughtiness, and past erosion.

This soil is moderately suited to woodland use. Trees suited to planting or feasible to manage for production include northern red oak, shortleaf pine, Virginia pine, and loblolly pine. Use of standard equipment makes ruts in the soil because of its low strength when wet. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is poorly suited to residential or commercial development. Depth to bedrock, moderately slow permeability, clayey subsoil that has low strength, and slope are limitations.

This map unit is in capability subclass VIe.

### **SeD2—Sequoia silt loam, 12 to 25 percent slopes, eroded**

This is a moderately deep, well drained soil. It formed in clayey residuum derived from acid shale. It occurs on the sides and tops of dissected ridges. Typically, areas range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this Sequoia soil are as follows—

*Surface layer:*

0 to 6 inches, brown silt loam

*Subsoil:*

6 to 20 inches, strong brown channery silty clay

*Substratum:*

20 to 30 inches, strong brown channery silty clay

30 to 40 inches, interlayered weakly consolidated shale and thin seams of fine earth

In most areas erosion has removed part of the

original surface layer, and tillage has mixed the remaining surface layer and subsoil.

***Important soil properties and features—***

*Permeability:* Moderately slow

*Available water capacity:* Moderate or low

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used as pasture and hay. It is moderately suited to this use. Yields are low unless fertilized. This soil is not suited to row crops because of moderately steep slopes, very severe erosion hazard, and low or moderate available water capacity.

This soil is moderately suited to woodland use. Trees suited to planting or feasible to manage for production include northern red oak, shortleaf pine, Virginia pine, and loblolly pine. Slope is a moderate limitation to the use of standard equipment. Erosion is a hazard on logging roads and skid trails. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is poorly suited to residential or commercial development. Depth to bedrock, moderately slow permeability, clayey subsoil that has low strength, and slope are limitations.

This map unit is in capability subclass VIe.

**SeD3—Sequoia silty clay loam, 15 to 25 percent slopes, severely eroded**

This is a moderately deep, well drained soil. It formed in clayey residuum derived from acid shale. It is on hillsides on uplands. Typically, areas range from 5 to 75 acres in size.

The typical sequence, depth, and composition of the layers of this Sequoia soil are as follows—

*Surface layer:*

0 to 4 inches, brown silty clay loam

*Subsoil:*

4 to 20 inches, strong brown channery silty clay

*Substratum:*

20 to 30 inches, strong brown channery silty clay

30 to 40 inches, interlayered weakly consolidated shale and thin seams of fine earth

Included with this soil in mapping are areas of

Petros soils on narrow, convex ridgetops and areas of Jefferson soils on concave slopes.

Erosion has removed most of the original surface layer, and the present surface layer consists mainly of subsoil.

***Important soil properties and features—***

*Permeability:* Moderately slow

*Available water capacity:* Low

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

Most areas of this soil are used for pasture. It is poorly suited to pasture because maintaining a good stand of grass is difficult and because yields are low. Cool-season grasses, such as tall fescue, are best suited. This soil is not suited to row crops.

This soil is moderately suited to woodland use. Shortleaf pine, loblolly pine, and Virginia pine are suitable for planting. Seedling mortality and the equipment limitation are moderate problems because of the high clay content in the surface layer and in the upper part of the subsoil. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is poorly suited to residential or commercial development. Depth to bedrock, moderately slow permeability, clayey subsoil that has low strength, and slope are limitations.

This map unit is in capability subclass VIIe.

**SeE2—Sequoia silt loam, 25 to 45 percent slopes, eroded**

This is a moderately deep, well drained soil. It formed in clayey residuum derived from acid shale. It is on the sides of dissected ridges. Typically, areas range from 5 to 75 acres in size.

The typical sequence, depth, and composition of the layers of this Sequoia soil are as follows—

*Surface layer:*

0 to 6 inches, brown silt loam

*Subsoil:*

6 to 20 inches, strong brown channery silty clay

*Substratum:*

20 to 30 inches, strong brown channery silty clay

30 to 40 inches, interlayered weakly consolidated shale and thin seams of fine earth

In most areas erosion has removed part of the original surface layer, and tillage has mixed the remaining surface layer and subsoil.

Included with this soil in mapping are a few small areas of soils that are less than 20 inches deep over bedrock and that have more than 35 percent shale fragments.

#### **Important soil properties and features—**

*Permeability:* Moderately slow

*Available water capacity:* Moderate or low

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* None

*Depth to rock:* Moderately deep

*Depth to a seasonal high water table:* More than 6 feet

In most areas this Sequoia soil is used for pasture. It is poorly suited to pasture and is not suited to hay and row crops because of steep slopes. Pasture management is hazardous when using farm equipment on steep slopes.

This soil is poorly suited to woodland use because of steep slopes. Trees suitable for planting are shortleaf pine, loblolly pine, and Virginia pine. The erosion hazard and the equipment limitation are severe because of slope.

In most areas this soil is not suited to residential or commercial development because of slope. Other limitations are depth to bedrock, moderately slow permeability, and clayey subsoil that has low strength.

This map unit is in capability subclass VIIe.

### **Sn—Sewanee silt loam, occasionally flooded**

This is a deep, moderately well drained soil. It formed in alluvium on flood plains. Slopes are 0 to 3 percent. Typically, areas range from 5 to 100 acres in size.

The typical sequence, depth, and composition of the layers of this Sewanee soil are as follows—

*Surface layer:*

0 to 8 inches, brown silt loam

*Subsoil:*

8 to 24 inches, brown loam

24 to 31 inches, yellowish brown loam

*Substratum:*

31 to 59 inches, light brownish gray loam

*Bedrock:*

59 inches, moderately hard shale

Included with this soil in mapping are small areas of well drained soils and a few, small isolated areas of poorly drained soils. Also included are areas of soils that have a higher clay content in the subsoil and soils that are very deep to bedrock.

#### **Important soil properties and features—**

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* Occasional

*Depth to rock:* Deep

*Depth to a seasonal high water table:* 1 to 2 feet

This soil is used mostly for pasture, hay, or woodland. In many areas streams dissect this soil into small, irregular shapes or into isolated areas.

In most areas this soil has been cleared and is used for row crops, pasture and hay. It is well suited to these uses. It will produce high yields with good management. Equipment use may be limited due to irregular shape and small size of some areas. Flooding is a hazard to crops. The flood hazard is greatest in spring. Row crops can be grown without excessive soil erosion, except in those included areas with short, steep slopes of 5 percent or more.

This soil is well suited to woodland use. Trees suitable for planting or feasible to manage for production include yellow-poplar, northern red oak, eastern cottonwood, eastern white pine, and loblolly pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is not suited to residential or commercial development because of the flood hazard.

This map unit is in capability subclass IIw.

### **Sw—Swafford loam, occasionally flooded**

This is a very deep, moderately well drained soil. It has a brittle, slightly compact layer in the subsoil at a depth of about 30 inches. It formed in old loamy alluvium on terraces along the larger streams. Slopes are 0 to 3 percent. Typically, areas range from 5 to 25 acres in size.

Included with this soil in mapping, in slightly lower positions, are areas of Whitwell soils.

The typical sequence, depth, and composition of the layers of this Swafford soil are as follows—

*Surface layer:*

0 to 7 inches, brown loam

*Subsoil:*

7 to 30 inches, yellowish brown loam  
 30 to 59 inches, brittle, yellowish brown loam  
 59 to 65 inches, yellowish brown clay loam

**Important soil properties and features—***Permeability:* Moderately slow*Available water capacity:* High*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid*Flood hazard:* Occasional*Depth to rock:* Very deep*Depth to a seasonal high water table:* 2 to 3 feet

This soil is used for row crops, hay, and pasture. It is well suited to these uses. In some years the seasonal high water table and rare flooding in early spring delay planting.

This soil is well suited to woodland use. Trees suited to planting or feasible to manage for production include yellow-poplar, sweetgum, loblolly pine, and northern red oak. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is not suited to residential or commercial development because of the flood hazard. Onsite determinations are needed for other urban uses.

This map unit is in capability subclass IIw.

**TaF—Talbot-Rock outcrop complex, 30 to 50 percent slopes**

This map unit consists of the Talbott soil and areas of Rock outcrop that are so intermingled they could not be separated at the scale selected for mapping. The Talbott soil formed in a layer of cherty colluvium and in the underlying clayey residuum derived from limestone. It is moderately deep and well drained. This unit is on sides and points of steep ridges. The Talbott soil makes up about 65 percent of this unit, Rock outcrop makes up about 20 percent, and included soils make up the rest. Typically, areas range from 5 to 20 acres in size.

The typical sequence, depth, and composition of the layers of this Talbott soil are as follows—

*Surface layer:*

0 to 1 inch, dark grayish brown gravelly loam  
 1 to 15 inches, pale brown gravelly loam

*Subsoil:*

15 to 20 inches, yellowish red silty clay  
 20 to 36 inches, red clay

*Bedrock:*

36 inches, limestone

**Important soil properties and features—***Permeability:* Moderately slow*Available water capacity:* Low or moderate*Soil reaction:* Moderately acid or strongly acid, but the layer just above bedrock ranges to moderately alkaline*Flood hazard:* None*Depth to rock:* Moderately deep*Depth to a seasonal high water table:* More than 6 feet

Limestone outcrops make up about 20 percent of each mapped area. They commonly occur as bands generally parallel to the slope. Most outcrops protrude a few inches to about 5 feet above the surface.

Included with this unit in mapping, generally near rock outcrops, are small areas of soils less than 20 inches thick over bedrock.

Almost all areas of this map unit are used as woodland. It is moderately suited to this use. Trees suited to planting or feasible to manage for production include loblolly pine, shortleaf pine, Virginia pine, eastern redcedar, and northern red oak. Steep slopes and numerous rock outcrops limit the kind of equipment that can be used to plant and harvest trees. Care should be used in locating skid trails and haul roads because of the erosion hazard. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This map unit is poorly suited to farming and to residential or commercial development because of steep slopes, moderately deep depth to bedrock, and rock outcrops. These limitations are very difficult to overcome for most uses.

This map unit is in capability subclass VIIc.

**Wh—Whitwell loam, occasionally flooded**

This is a very deep, moderately well drained soil. It formed in old alluvium on low terraces along the larger streams. Slopes are 0 to 3 percent. Typically, areas range from 5 to 50 acres in size.

The typical sequence, depth, and composition of the layers of this Whitwell soil are as follows—

*Surface layer:*

0 to 6 inches, dark brown loam

*Subsoil:*

6 to 12 inches, dark yellowish brown loam

12 to 30 inches, yellowish brown loam  
 30 to 50 inches, yellowish brown silt loam

*Substratum:*

50 to 61 inches, yellowish brown loam

Included with this Whitwell soil in mapping are a few small areas of poorly drained soils in slight depressions and small areas of Swafford soils in slightly higher positions.

***Important soil properties and features—***

*Permeability:* Moderate

*Available water capacity:* High

*Soil reaction:* Strongly acid or very strongly acid, but in limed areas the surface layer is less acid

*Flood hazard:* Occasional

*Depth to rock:* Very deep

*Depth to a seasonal high water table:* 2 to 3 feet

This soil is used for row crops, hay, and pasture. It is well suited to these uses. Most commonly grown crops are suited. In wet years in low spots the seasonal high water table damages burley tobacco.

This soil is well suited to woodland use. Trees suited to planting or feasible to manage for production include yellow-poplar, sweetgum, northern red oak, loblolly pine, and eastern white pine. Careful management is needed after harvest and for new plantings to control plant competition and to favor desired species.

This soil is not suited to residential or commercial development because of the flood hazard. Onsite determinations are needed for other urban uses.

This map unit is in capability subclass IIw.

# Prime Farmland

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Prime farmland is important in meeting the Nation's short- and long-range needs for food and fiber. The supply of high-quality farmland is limited. Hence, 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.

The U.S. Department of Agriculture has defined prime farmland as one of several kinds of important farmland. Prime farmland 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 5,039 acres, or 1.6 percent of the soils in Campbell County, meet the requirements for prime farmland. Almost all the acreage of these soils is on bottom lands and low stream terraces.

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. 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.

The map units in the survey area that are considered prime farmland are listed in table 5. 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."



# Use and Management of the Soils

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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.

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, and the system of land capability classification used by the Natural Resources Conservation Service is explained.

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.

About 20,000 acres, or about 6 percent of Campbell County, was used for crops and pasture in 1987, according to the U.S. Census of Agriculture. About 11,000 acres was used only for pasture. The rest was used as rotational cropland, including hay, pasture, small grain, and row crops. In 1987, about 1,000 acres of row crops, mainly corn and tobacco, was harvested. Most cleared land and consequently most cropland and pasture are in Powell Valley, Elk Valley, and along the New River and its tributaries southwest of Careyville.

Erosion on cropland is not a major concern in Campbell County. Most crops are grown on bottom lands. Management of pasture and hay is the main concern.

Good pasture management includes fertilizing according to soil tests, clipping for weed control, and using proper stocking rates to prevent overgrazing. These practices help to maintain a good stand of mixed grasses and legumes. Cool-season grasses are dominant in this area. They include tall fescue, orchardgrass, and Kentucky bluegrass. Legumes include ladino clover, Korean lespedeza, alfalfa, and red clover. They tend to thin out in a few years and may need to be added to the mixture occasionally.

## Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The 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 6 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the 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. 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. They have not been identified in Campbell County.

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. They have not been identified in Campbell County.

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, pasture, or tree production. They have not been identified in Campbell County.

*Capability subclasses* are soil groups within one class. They are designated by adding a small letter, *e*, *w*, or *s*, 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); and *s* shows that the soil is limited mainly because it is shallow, droughty, stony, or rocky.

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

The acreage of soils in each capability class and subclass is shown in table 4. The capability classification of the map units in this survey area is given in the section "Detailed Soil Map Units" and in table 6, "Land Capability Classes and Yields per Acre of Crops and Pasture."

### Woodland Management and Productivity

Campbell County was originally completely forested. Now, forests cover about 82 percent of the county.

Oak-hickory is the dominant forest type. It makes up about 78 percent of forests. Its most common trees

are oak and hickory. The loblolly pine-shortleaf pine and oak-pine forest types are important associates. They comprise about 10 and 12 percent, respectively, of forests.

The part of the county in the Cumberland Plateau and Mountains supports mostly oaks and hickories. It also supports some areas of mixed shortleaf pine, oak, and hickories. Eastern hemlock is prevalent in the deep gorges and moist coves on mountainsides. The Southern Appalachian Ridge and Valley area supports oak, hickory, Virginia pine, and loblolly pine. Yellow-poplar, maple, ash, sycamore, and sweetgum are scattered throughout the county.

Wood products contribute value to the county's economy, but production is well below potential. Campbell County's forests also provide recreation, wildlife habitat, natural beauty, erosion control, and watershed protection.

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.

*Windthrow hazard* is the likelihood that trees will be uprooted by the wind because the soil is not deep enough for adequate root anchorage. The main restrictions that affect rooting are a seasonal high water table and the depth to bedrock, a fragipan, or other limiting layers. A rating of *slight* indicates that under normal conditions no trees are blown down by the wind. Strong winds may damage trees, but they do not uproot them. A rating of *moderate* indicates that some trees can be blown down during periods when the soil is wet and winds are moderate or strong. A rating of *severe* indicates that many trees can be blown down during these periods.

*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. 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. It indicates the amount of fiber produced in a fully stocked, even-aged, unmanaged stand. Volume is expressed as cubic feet per acre per year. It can be converted to board feet by multiplying by a factor of about 5. For example, a productivity class of 114 means the soil can be expected to produce 114 cubic feet per acre per year at the point where mean annual increment culminated, or about 570 board feet per acre per year.

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.

*Trees to plant* are those that are suitable for commercial wood production.

## Recreation

Many recreational facilities are in Campbell County, and most are publicly owned. They are dominantly along water. Norris Lake is an impoundment built by the Tennessee Valley Authority on the Clinch River. It has public picnic areas and boat launches.

Three state parks and numerous recreation areas are also open to the public. The state parks have extensive recreation areas, including campgrounds.

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

Michael E. Zeman, state biologist, Natural Resources Conservation Service, helped to prepare this section.

Wildlife is an important natural resource of the county. It provides a source of revenue through sport hunting and such recreational activities as photography and birdwatching. Popular game species include bobwhite quail, cottontail rabbit, whitetailed deer, ruffed grouse, eastern wild turkey, and gray and fox squirrels.

Whitetailed deer is the most popular game animal in the county. Deer populations are low, but substantial herd growth has occurred over the past few years. Harvest records indicate an eight-fold increase in the deer population during the 1980's. Eastern wild turkey declined to a zero population in Campbell County in 1950. The Tennessee Wildlife Resources Agency has established foundation flocks of eastern wild turkey in the county.

Bobwhite quail populations are low in the county because the habitat is of low quality in forested and mountainous regions. However, the habitat is of high quality for ruffed grouse. Ruffed grouse populations are moderate or high throughout the county. Cottontail rabbit populations are low because of the overall poor quality of the mostly forested habitat. The county has three species of squirrel: southern flying squirrel, fox squirrel, and gray squirrel. Gray squirrel is the most common species; its populations are moderate or high throughout the hardwood forests.

Waterfowl populations are low in the county. The highest numbers are found on Norris Lake, where the open expanse of water provides resting and feeding habitat. Several species of furbearers inhabit the county. Wetland furbearers include mink, muskrat, and beaver. They live in low or moderate numbers along streams, small lakes, farm ponds, and Norris Lake. Upland furbearers are abundant throughout the county. They include bobcat, opossum, raccoon, gray fox, striped skunk, and coyote.

Many nongame species occur throughout the county. Various species of songbirds are associated with different plant communities. Woodland birds include the Carolina chickadee, tufted titmouse, pileated woodpecker, and wood thrush. Openland birds include robin, meadowlark, and various sparrows. Common birds of prey include red-tailed hawk, sparrow hawk, barred owl, and screech owl.

Common reptiles and amphibians include eastern box turtle, skinks, eastern hognose snake, copperhead snake, bullfrogs, and dusky salamander. Common mammals include hispid cotton rat, moles, and other small rodents. The relative abundance of nongame species depends upon the type and quality of habitat available to the species.

State and federally listed threatened or endangered wildlife species that may occur in the county include Indiana bat, gray bat, red-cockaded woodpecker, blackside dace, river otter, eastern cougar, and three species of freshwater mussel. Species that may migrate through the county include bald eagle, peregrine falcon, osprey, sharp-shinned hawk, Cooper's hawk, and grasshopper sparrow.

The county has only a few soil types suitable for impounding water, but it has several ponds. Many of the ponds are stocked for recreational fishing with such species as largemouth bass, bluegill sunfish, and channel catfish. Most ponds have acidic water, which limits fish production. The largest lake in the county is Norris Lake, a 34,200-acre reservoir. It provides sportfishing for largemouth bass, white crappie, channel catfish, bluegill sunfish, white bass, and striped bass.

Campbell County has a total of 251 miles of warmwater streams that provide about 421 acres of aquatic habitat. Common fish species that occur in streams include largemouth bass, rock bass, bluegill sunfish, green sunfish, channel catfish, bullhead catfish, and several species of darters and minnows. Most streams in the county are only moderately productive and have fair populations of warmwater fishes. Acid drainage from abandoned coal mines has rendered some streams nonproductive and essentially sterile.

Neither warmwater nor coldwater aquaculture is practiced in the county. Overall, the terrain is steep, and most soils are generally unsuitable for extensive pond construction.

Very few wetlands are in Campbell County, excluding such artificial wetlands as upland ponds. The wetlands are mainly wooded bottom lands on Atkins soils. Bottom land hardwoods provide some of the most productive wildlife habitat in the county. Bottom land hardwoods improve water quality of streams by removing nutrients and trapping sediment from upland runoff. Thus, they lower water temperatures by shading streams and they drop leaf litter that provides food for aquatic insects.

Conservation practices can improve or provide quality wildlife habitat. On cropland, planned crop rotations and crop residue management provide food and needed winter cover for many species of wildlife.

Deferred grazing of livestock and fencing can protect food plots, nesting cover, and even fish habitat by providing stream protection. Field borders and filter strips along streams can protect water quality and provide food, cover, and travel lanes for many species of wildlife.

On woodland, selective thinning of the forest can protect den trees and quality mast-producing trees. Other practices to improve wildlife habitat include wildlife upland habitat management, wildlife wetland habitat management, fishpond management, pasture and hayland management, livestock exclusion, and woodland improvement.

Some practices are harmful to wildlife. The most common ones include indiscriminate burning, use of chemicals, heavy grazing, complete clean mowing early in the growing (nesting) season, clean fall plowing, extensive clear cutting of timber, draining of wetlands, and removal of den and all mast-producing trees.

Technical assistance in planning or applying wildlife conservation practices can be obtained from the Natural Resources Conservation Service, the University of Tennessee Agricultural Extension Service, the Tennessee Wildlife Resources Agency, and the Tennessee Division of Forestry.

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. 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.

### Elements of Wildlife Habitat

*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, millet, and soybean.

*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, lovegrass, orchardgrass, clover, annual lespedeza, 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 crabgrass, goldenrod, beggarweed, ragweed, and partridge pea.

*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, ash, sweetgum, walnut, dogwood, hickory, blackberry, honeysuckle, and wild grape. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are shrub lespedeza, 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 pine and 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, arrowhead, 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, lake margins, and ponds.

### **Habitat for Various Kinds of Wildlife**

*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, mourning dove, 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 coyote.

*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 without basements, dwellings with basements, 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, and shrink-swell potential 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, and the available water capacity in the upper 40 inches 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, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

The table also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

*Septic tank absorption fields* are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock, 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 areas* 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, and large stones.

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. Slope and bedrock can cause construction problems, and large stones can hinder compaction of the lagoon floor.

*Trench sanitary landfill* and *area sanitary landfill* 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, 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, and bedrock.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or 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 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, irrigation, terraces and diversions, and grassed waterways.

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of

the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

*Embankments, dikes, and levees* are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

*Drainage* is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope,

and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, and sulfur. Availability of drainage outlets is not considered in the ratings.

*Irrigation* is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

*Terraces and diversions* are embankments or a combination of channels and ridges constructed across a slope to 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 or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts and sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.



# Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help 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.

*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.

If a soil is assigned to two hydrologic groups in the table, the first letter is for drained areas and the second is for undrained areas.

*Flooding*, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. 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).

*Common* is used when the occasional and frequent classes are grouped for certain purposes. 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, apparent, or

artesian; 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. An *artesian* water table is under hydrostatic head, generally below an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

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.

# Classification of the Soils

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The system of soil classification used by the National Cooperative Soil Survey has six categories (USDA 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 17 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 Entisol.

**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 Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

**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 Fluvaquents (*Fluv*, meaning flood plain, plus *aquent*, the suborder of the Entisols that has a aquatic 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 Fluvaquents.

**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-loamy, mixed, acid, mesic Typic Fluvaquents.

**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. An example is the Atkins series.

## 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" (USDA 1993). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (USDA 1975) and in "Keys to Soil Taxonomy" (USDA 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."

### Allen Series

The Allen series consists of very deep, well drained soils on foot slopes and hillsides. Permeability is moderate.

These soils formed in colluvium and residuum derived mainly from sandstone and shale. Most areas

of these soils are in Powell Valley. Slopes range from 10 to 25 percent.

Allen soils are near Collegedale soils, which have a clayey subsoil and are more than 60 inches deep over limestone.

Typical pedon of Allen loam, 10 to 25 percent slopes, eroded, 1,500 feet northeast of Rogers Cemetery and 625 feet southeast of Woodlawn Cemetery; (Jacksboro Quadrangle):

Ap—0 to 8 inches; dark brown (7.5YR 4/4) loam; weak fine granular structure; friable; many fine and medium roots; strongly acid; abrupt smooth boundary.

Bt1—8 to 20 inches; yellowish red (5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; many fine and medium roots; few faint clay films on faces of peds; few fine brown and black iron and manganese concretions; very strongly acid; gradual smooth boundary.

Bt2—20 to 26 inches; yellowish red (5YR 4/6) clay loam; few fine faint reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; friable; many fine and medium roots; few distinct clay films on faces of peds; 2 percent chert and quartz pebbles; few fine brown and black manganese and iron concretions; very strongly acid; gradual smooth boundary.

Bt3—27 to 37 inches; yellowish red (5YR 4/6) clay loam; common medium distinct reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; few distinct clay films on faces of peds; 5 percent chert and quartz pebbles; few fine brown and black iron and manganese concretions; very strongly acid; gradual smooth boundary.

Bt4—37 to 55 inches; yellowish red (5YR 4/6) clay loam; many medium distinct reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; friable; few fine roots; few distinct clay films on faces of peds; 5 percent chert and quartz pebbles; few fine brown and black iron and manganese concretions; very strongly acid; gradual smooth boundary.

Bt5—55 to 65 inches; yellowish red (5YR 4/6) clay; many medium distinct reddish yellow (7.5YR 6/8) and dark red (10R 3/6) mottles; moderate medium subangular blocky structure; firm; many prominent clay films on faces of peds; few fine brown and black iron and manganese concretions; very strongly acid.

The solum is more than 60 inches in thickness. Depth to bedrock is more than 72 inches. The soils are

strongly acid or very strongly acid, but where limed the surface layer is less acid. Rock fragments range from 0 to 15 percent throughout.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or fine sandy loam.

The Bt horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8. In some pedons it ranges to dark red (2.5YR 3/6) below a depth of 36 inches. It has mottles in shades of brown, yellow, and red. It is loam, clay loam, or sandy clay loam. In some pedons it ranges to clay below a depth of about 3 feet.

### Atkins Series

The Atkins series consists of very deep, poorly drained soils on flood plains. These soils formed in alluvium derived from acid shale and sandstone. Permeability is moderate or slow. A water table is within 1 foot of the surface for significant periods. Slopes range from 0 to 2 percent.

Atkins soils are near Whitwell soils. Whitwell soils are on low stream terraces, are moderately well drained, and have an argillic horizon.

Typical pedon of Atkins silt loam, frequently flooded, about 5,500 feet southwest of Stanfield Church and 350 feet east of intersection of Coontail Branch and paved road; (Pioneer Quadrangle); in a field:

Ap—0 to 10 inches; light brownish gray (10YR 6/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak fine granular structure; friable; common fine and medium roots; very strongly acid; clear wavy boundary.

Bg1—10 to 32 inches; light brownish gray (2.5YR 6/2) loam; many fine prominent strong brown (7.5YR 5/6) mottles; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine and medium roots; many brown and black iron and manganese concretions; very strongly acid; gradual smooth boundary.

Bg2—32 to 40 inches; light brownish gray (2.5Y 6/2) silt loam; common medium prominent strong brown (7.5YR 5/6) mottles; weak subangular blocky structure; friable; few fine roots; many brown and black iron and manganese concretions; very strongly acid; clear smooth boundary.

Bg3—40 to 46 inches; gray (10YR 6/1) silt loam, many fine prominent strong brown (7.5YR 5/8) mottles; weak fine prismatic structure parting to weak medium subangular blocky; friable; few fine roots; many brown and black iron and manganese concretions; very strongly acid; clear smooth boundary.

Cg—46 to 60 inches; gray (N 6/) silt loam; few medium distinct strong brown (7.5YR 5/8) mottles; massive, friable; common brown and black iron and manganese concretions; very strongly acid.

The solum is 30 to 50 inches in thickness. The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid. Gravel ranges from none to about 10 percent in all horizons.

The A horizon has hue of 10YR, value of 4 to 6, and chroma of 1 or 2. It is loam, silt loam, or fine sandy loam.

The Bg horizon has hue of 10YR to 2.5Y or it is neutral, value of 5 or 6, and chroma of 0 to 2. It is mottled in shades of brown and red. It is silt loam, loam, or silty clay loam.

The Cg horizon has hue of 10YR to 5Y or it is neutral, value of 5 or 6, and chroma of 1 to 2. It is mottled in shades of brown and red. It is silt loam, loam, or silty clay loam.

### Bethesda Series

The Bethesda series consists of very deep, well drained, very strongly acid and extremely acid soils that contain a large amount of rock fragments. These soils formed in spoil from surface mining of coal. In most areas they are in strips on the upper part of mountainsides in the Cumberland Mountains. In most areas permeability is moderately slow. In some areas on outcrops that have large amounts of sandstone fragments, the soils are more permeable.

Bethesda soils are near Muskingum, Sequoia, and Petros soils. These soils are in positions similar to those of Bethesda soils and are alongside each other. Muskingum soils formed in residuum derived from shale, siltstone, and sandstone. They have a loamy subsoil and do not have an argillic horizon. Sequoia soils formed in residuum derived from clay shale and siltstone. They are on more stable slopes and have a clayey argillic horizon. Petros soils are shallow and loamy-skeletal.

Typical pedon of Bethesda channery silt loam, benches and outcrops, 4,500 feet southwest of Pioneer Post Office and 4,250 feet northwest of Benchmark 1758; (Pioneer Quadrangle):

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) channery silt loam; weak coarse granular structure; friable; many fine roots; 25 percent fragments of shale; very strongly acid; clear smooth boundary.

C1—6 to 17 inches; variegated strong brown (7.5YR 5/6), dark gray (10YR 4/1), and brown (10YR 4/3) very channery silty clay loam; massive; firm; few

fine roots; 40 percent fragments of shale and 25 percent fragments of sandstone, siltstone, and coal; very strongly acid; gradual smooth boundary.  
C2—17 to 60 inches; variegated yellowish brown (10YR 5/4) and dark gray (10YR 4/1) very channery silty clay loam; massive; friable; few fine roots; 45 percent fragments of shale and 25 percent fragments of sandstone, siltstone, and coal; very strongly acid.

Depth to bedrock is more than 5 feet. The soils are strongly acid to extremely acid, but in limed areas the surface layer is less acid. They contain fragments of shale, sandstone, siltstone, and coal that, in most pedons, are less than 10 inches in diameter, but that, in some pedons, include some stones and boulders. The fragments range from 15 to 45 percent in the A horizon and from 35 to 80 percent in the C horizon.

The A horizon has hue of 7.5YR to 2.5Y, value of 4 to 6, and chroma of 2 to 6. In the fine earth fraction it is silty clay loam, clay loam, silt loam, or loam.

The C horizon has hue of 7.5YR to 5Y, value of 4 to 6, and chroma of 1 to 6. It is commonly variegated with two or more colors and reflects the color of parent rocks. In the fine earth fraction it is silty clay loam, clay loam, silt loam, or loam.

### Bland Series

The Bland series consists of moderately deep, well drained soils on uplands. These soils formed in materials derived from dusky red to purplish limestone. Permeability is moderately slow. In most areas they are adjacent to the lower part of mountainsides in the Cumberland Mountains. Slopes range from 30 to 50 percent.

Bland soils are near Muskingum and Sequoia soils. These soils are on adjacent slopes on the lower part of mountainsides. Muskingum soils formed in residuum derived from shale, siltstone, and sandstone. They have a loamy subsoil and do not have an argillic horizon. Sequoia soils formed in residuum derived from clay shale and siltstone. They have a higher value and chroma in the argillic horizon.

Typical pedon of Bland silty clay loam, in an area of Bland-Rock outcrop complex, 30 to 50 percent slopes, 2,175 feet northwest of Midway Baptist Church and 3,000 feet southwest of Rodgers Cemetery; (Jacksboro Quadrangle):

A—0 to 4 inches; dark reddish brown (5YR 3/2) silty clay loam; moderate fine granular structure; friable; common fine and medium roots; moderately acid; abrupt smooth boundary.

Bt1—4 to 7 inches; dark reddish brown (5YR 3/3) silty

clay; moderate fine and medium subangular blocky structure; firm; common fine roots; common fine tubular pores; few faint clay films on faces of peds; moderately acid; clear smooth boundary.

Bt2—7 to 14 inches; dark reddish brown (5YR 3/3) clay; moderate fine and medium subangular blocky structure; firm; common fine roots; common fine and medium tubular pores; few faint clay films on faces of peds; 5 percent limestone fragments measuring up to 5 inches across; neutral; gradual smooth boundary.

Bt3—14 to 25 inches; dark reddish brown (5YR 3/3) clay; moderate medium subangular blocky structure; firm; few fine roots; common fine and medium tubular pores; common distinct clay films on faces of peds; 5 percent limestone fragments measuring up to 5 inches across; neutral; gradual smooth boundary.

C—25 to 30 inches; dark reddish brown (2.5YR 3/4) clay; few fine roots; many distinct clay films on faces of peds; 10 percent limestone fragments that break apart under applied pressure; neutral; abrupt smooth boundary.

R—30 inches; hard dusky red limestone.

Thickness of the solum and depth to bedrock range from 20 to 40 inches. The soils range from strongly acid to neutral, and generally become less acid with depth. Rock fragments range, by volume, from 0 to 15 percent in the solum and to as much as 50 percent in the C horizon.

The A horizon has hue of 5YR, value of 3, and chroma of 2 or 3. It is silt loam or silty clay loam.

The Bt horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 2 or 3. It is silty clay or clay.

The C horizon has hue of 5YR or 2.5YR, value of 3 or 4, and chroma of 2 to 4. In the fine earth fraction it is silty clay loam, silty clay, or clay.

## Bodine Series

The Bodine series consists of very deep, somewhat excessively drained, gravelly soils. Permeability is moderately rapid. These soils formed in residuum derived from cherty limestone. In most areas they are on the sides of steep, wooded ridges and hills. In a few areas they are on ridgetops. Slopes range from 12 to 60 percent.

Bodine soils are near and in similar positions as Fullerton and Claiborne soils. Fullerton soils have a gravelly, clay subsoil and are less than 35 percent fragments of chert. Claiborne soils are redder in the subsoil than Bodine soils and are less than 25 percent chert.

Typical pedon of Bodine gravelly silt loam, in an area of Fullerton and Bodine gravelly silt loams, 25 to 70 percent slopes; about 1.8 miles (274 degrees) west of Demory School and about 1,850 feet west of Whitman Hollow Church; (Demory Quadrangle); in a wooded area:

Oi—0.5 inch to 0; fresh and slightly decomposed pine needles.

A—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly silt loam; weak fine granular structure; friable; many fine, medium, and coarse roots; few fine pores; 25 percent fragments of chert; strongly acid; abrupt smooth boundary.

E—3 to 10 inches; light yellowish brown (10YR 6/4) gravelly silt loam; weak fine granular structure; friable; many fine, medium, and coarse roots; few fine pores; 30 percent fragments of chert; strongly acid; clear wavy boundary.

Bt1—10 to 28 inches; strong brown (7.5YR 5/6) very gravelly loam; weak medium subangular blocky structure; friable; common fine and medium roots; few fine pores; few faint clay films on faces of peds; 50 percent fragments of chert; strongly acid; clear smooth boundary.

Bt2—28 to 51 inches; strong brown (7.5YR 5/8) very gravelly loam; weak medium subangular blocky structure; friable; few fine and medium roots; few fine pores; few faint clay films on faces of peds; 60 percent fragments of chert; very strongly acid; abrupt wavy boundary.

Bt3—51 to 62 inches; yellowish red (5YR 4/8) very gravelly silty clay loam; common fine prominent very pale brown (10YR 7/3) and yellow (10YR 7/6) variegations; moderate medium angular blocky structure; friable; few fine roots; many faint clay films on faces of peds; 60 percent fragments of chert; very strongly acid.

Thickness of the solum and depth to bedrock are more than 60 inches. Fragments of chert range from 20 to 60 percent in the A horizon and from 35 to 75 percent in the B horizon. The soils are strongly acid to extremely acid, but in limed areas the surface layer is less acid.

The A horizon has hue of 10YR and 2.5Y, value of 3 to 5, and chroma of 2 or 3. In the fine earth fraction it is silt loam or loam.

The E horizon or Ap horizon, where it occurs, has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 to 4. In the fine earth fraction it is silt loam or loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. In the lower part the Bt horizon also has hue of 5YR, value of 4 or 5, and

chroma of 6 or 8. In the fine earth fraction it is silt loam, loam, silty clay loam, and clay loam.

### Claiborne Series

The Claiborne series consists of very deep, well drained soils that formed in residuum derived from limestone or dolomite. These soils are on ridgetops and hillsides and at the base of slopes. Slopes range from 5 to 45 percent.

Claiborne soils are near Fullerton and Bodine soils. These soils are in positions similar to those of Claiborne soils and lie alongside each other. Fullerton soils have a gravelly, clay subsoil. Bodine soils have a very gravelly, loamy subsoil in shades of brown.

Typical pedon of Claiborne silt loam, 12 to 25 percent slopes, about 2,750 feet (224 degrees) southwest of Macedonia Church; (Norris Quadrangle); in a wooded area:

- A1—0 to 1 inch; very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; friable; many fine, medium, and coarse roots; 5 percent fragments of chert less than 3 inches in diameter; neutral; abrupt smooth boundary.
- A2—1 to 7 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; friable; many fine, medium, and coarse roots; 5 percent of fragments of chert less than 3 inches in diameter; moderately acid; abrupt smooth boundary.
- BA—7 to 15 inches; reddish brown (5YR 4/4) silt loam; weak medium granular and weak medium subangular blocky structure; friable; common fine roots; 5 percent fragments of chert less than 3 inches in diameter; strongly acid; clear smooth boundary.
- Bt1—15 to 20 inches; yellowish red (5YR 4/8) silty clay loam; weak medium subangular blocky structure; friable; common fine roots; few faint clay films on faces of peds; 5 percent fragments of chert less than 3 inches in diameter; strongly acid; clear smooth boundary.
- Bt2—20 to 27 inches; red (2.5YR 4/8) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; 5 percent fragments of chert less than 3 inches in diameter; very strongly acid; gradual smooth boundary.
- Bt3—27 to 46 inches; dark red (2.5YR 3/6) silty clay loam; moderate medium subangular blocky structure; firm; few fine roots; common faint clay films on faces of peds; 12 percent fragments of chert less than 3 inches in diameter; very strongly acid; diffuse smooth boundary.

Bt4—46 to 72 inches; red (2.5YR 4/6) gravelly silty clay loam; moderate medium and coarse subangular blocky structure; firm; common faint clay films on faces of peds; 20 percent fragments of chert less than 3 inches in diameter; very strongly acid; diffuse smooth boundary.

The solum is more than 60 inches thick. Depth to bedrock is more than 72 inches. The soils are strongly acid or very strongly acid throughout, but where limed the surface layer is less acid. Fragments of chert range, by volume, from 5 to 25 percent. In most areas they increase in size and abundance with depth.

The A or Ap horizon has hue of 10YR and 7.5YR, value of 3, and chroma of 2 or 3. It is silt loam or gravelly silt loam.

The BA horizon has hue of 7.5YR and 5YR, value of 4 and 5, and chroma of 4 or 6. It is silt loam or gravelly silt loam.

The Bt horizon has hue of 5YR or 2.5YR, value of 4 to 5, and chroma of 6 or 8. In some pedons in the lower part it is also dark red (2.5YR 3/6). In the fine earth fraction it is silty clay loam or clay loam, and in the lower part it ranges to clay.

### Collegedale Series

The Collegedale series consists of very deep, well drained soils that have a clayey subsoil. These soils formed in residuum of limestone on uplands. Permeability is moderately slow. Slopes range from 2 to 25 percent.

Collegedale soils are near Gladeville soils. Gladeville soils are less than 12 inches deep over bedrock and in many places have limestone outcrops.

Typical pedon of Collegedale silt loam, 12 to 25 percent slopes, eroded, 1,625 feet northeast of Midway Baptist Church and 300 feet southwest of Rodgers Cemetery; (Jacksboro Quadrangle):

- Ap—0 to 5 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many fine and medium roots; few fine tubular pores; slightly acid; abrupt smooth boundary.
- Bt1—5 to 13 inches; yellowish red (5YR 4/6) clay; moderate medium subangular blocky structure; very firm; common fine and medium roots; few fine tubular pores; common distinct clay films on faces of peds; few fine brown and black iron and manganese concretions; strongly acid; abrupt smooth boundary.
- Bt2—13 to 23 inches; yellowish red (5YR 4/6) clay; few fine prominent light yellowish brown (10YR 6/4) mottles; weak fine prismatic structure parting to

moderate fine subangular blocky; very firm; common fine and medium roots; common fine tubular pores; many distinct clay films on faces of peds; common fine brown and black iron and manganese concretions; strongly acid; clear smooth boundary.

Bt3—23 to 36 inches; yellowish red (5YR 4/6) clay; common medium prominent light yellowish brown (10YR 6/4) mottles; weak medium prismatic structure parting to moderate fine angular blocky; very firm, sticky and plastic; few fine and medium roots; common fine tubular pores; many distinct clay films on faces of peds; few fine brown and black iron and manganese concretions; strongly acid; gradual smooth boundary.

Bt4—36 to 61 inches; mottled yellowish red (5YR 4/6), brownish yellow (10YR 6/6), light yellowish brown (10YR 6/4), and light brownish gray (10YR 6/2) clay; moderate medium and fine angular blocky structure; very firm; common fine tubular pores; many prominent clay films on faces of peds; few fine brown and black iron and manganese concretions; strongly acid.

Thickness of the solum and depth to bedrock exceed 60 inches. The soils are strongly acid or very strongly acid throughout, but where limed the surface layer is less acid. Fragments of chert range from 0 to 10 percent in each horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. It is silt loam.

The Bt horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8. It is silty clay or clay, but in some pedons the upper few inches are silty clay loam. In many pedons the lower part is mottled in shades of red, yellow, brown, and gray. In most pedons the mottles increase in size and number with depth. In some pedons the lower part of the horizon is mottled without a dominant color.

## Cutshin Series

The Cutshin series consists of deep, well drained, moderately permeable, loamy soils on high mountains. These soils formed in colluvial material derived from shale, sandstone, and siltstone on north- and east-facing slopes. They are commonly on concave landscapes above an elevation of 3,000 feet. Slopes range from 35 to 60 percent.

Cutshin soils are near Muskingum and Petros soils. On both soils the surface layer either has value of 4 or higher or is of lower value and less than 6 inches thick. Muskingum soils are 20 to 40 inches deep over bedrock. Petros soils are less than 20 inches deep

over shale and contain more than 35 percent shale fragments in the subsoil.

Typical pedon of Cutshin channery silt loam, 35 to 60 percent slopes, 4,680 feet southwest of radio tower on Cross Mountain and 2,500 feet north of Marker VABM 3216 on Hatmaker Knob; (Block Quadrangle):

A1—0 to 9 inches; very dark brown (10YR 2/2) channery silt loam; moderate fine granular structure; very friable; many fine, medium, and coarse roots; common fine pores; 16 percent thin flat fragments of sandstone, siltstone, and shale fragments 3.5 to 6.5 inches in diameter; moderately acid; abrupt smooth boundary.

A2—9 to 19 inches; dark brown (7.5YR 3/2) channery silt loam; moderate medium and coarse granular structure; very friable; many fine, medium, and coarse roots; common fine pores; 16 percent thin, flat fragments of sandstone, shale, and siltstone 1 to 2.5 inches in diameter; moderately acid; clear smooth boundary.

Bw1—19 to 27 inches; dark yellowish brown (10YR 4/4) channery silt loam; moderate fine and medium subangular blocky structure; friable; few fine, medium, and coarse roots; common fine pores; 20 percent thin flat fragments of sandstone, shale, and siltstone less than 2.5 inches in diameter; strongly acid; clear smooth boundary.

Bw2—27 to 44 inches; dark brown (7.5YR 4/4) channery silt loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common fine pores; 20 percent thin, flat fragments of sandstone, shale, and siltstone less than 2.5 inches in diameter; strongly acid; clear smooth boundary.

Bw3—44 to 63 inches; yellowish brown (10YR 5/4) channery silt loam; few fine prominent yellowish red (5YR 4/8) and faint pale brown (10YR 6/3) mottles; weak fine subangular blocky structure; common fine pores; 25 percent thin, flat fragments of sandstone, shale, and siltstone 1 to 2 inches in diameter; strongly acid.

Thickness of the solum and depth to bedrock range from 40 to more than 80 inches. The soils are moderately acid or strongly acid throughout. Fragments of sandstone, shale, and siltstone range from 10 to 30 percent in each horizon.

The A horizon has hue of 10YR, value and chroma of 2 or 3. In the fine earth fraction it is silt loam or loam.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 and 5, and chroma of 4 or 6. In the fine earth fraction it is loam, silt loam, or clay loam.

The C horizon, where it occurs, has hue of 7.5YR

or 10YR, value of 5 or 6, and chroma of 4 or 6. In the fine earth fraction it is loam, silt loam, or clay loam.

### Cynthiana Series

The Cynthiana series consists of shallow, well drained soils on uplands. These soils formed in residuum derived from interbedded limestone and shale. They have a clayey subsoil. Permeability is moderately slow. Slope ranges from 10 to 35 percent.

Cynthiana soils are adjacent to Sequoia soils. Sequoia soils are moderately deep to shale and have a redder hue than that of Cynthiana soils.

Typical pedon of Cynthiana flaggy silty clay loam, 10 to 35 percent slopes, eroded, rocky, 625 feet northwest of Cherry Bottom Baptist Church and 625 feet northeast of U.S. Highway 25W; (Jacksboro Quadrangle):

A—0 to 4 inches; dark grayish brown (10YR 4/2) flaggy silty clay loam; moderate fine and medium granular structure; friable; few fine medium and coarse roots; 16 percent fragments of shale and limestone; few fine brown and black iron and manganese concretions; slightly acid; clear smooth boundary.

Bt—4 to 14 inches; yellowish brown (10YR 5/6) flaggy clay; common fine distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; few fine medium and coarse roots; few faint clay films on faces of peds; 20 percent fragments of shale and limestone; few fine brown and black iron and manganese concretions; slightly acid; abrupt smooth boundary.

R—14 inches; limestone interbedded with calcareous shale.

Thickness of the solum and depth to consolidated weathered shale and interbedded limestone bedrock range from 10 to 20 inches. The soils are slightly acid to slightly alkaline. Fragments of shale and limestone range from 0 to 30 percent in the A horizon and from 10 to 35 percent in the Bt horizon.

The A horizon has hue of 10YR to 2.5Y, value of 4, and chroma of 2 to 4. In the fine earth fraction it is silt loam or silty clay loam.

The Bt horizon has hue of 10YR or 2.5Y, value of 4 or 5, and chroma of 4 to 6. In the fine earth fraction it is silty clay or clay.

### Dewey Series

The Dewey series consists of very deep, well drained, moderately permeable soils on uplands.

These soils formed in residuum derived from limestone. Some soils have 1 to 2 feet of alluvium overlying the residuum. Slopes range from 12 to 25 percent.

Dewey soils are near Fullerton soils. Fullerton soils are in positions similar to those of Dewey soils but have 15 to 35 percent fragments of chert throughout.

Typical pedon of Dewey silt loam, 12 to 25 percent slopes, 1,000 feet southwest of BM 1029 and 2,750 feet northeast of BM 1028 on Fork Bend; (Demory Quadrangle):

Ap—0 to 6 inches; dark reddish brown (5YR 3/4) silt loam; weak fine granular structure; friable; many fine and medium roots; 2 percent fragments of chert; very strongly acid; clear smooth boundary.

Bt1—6 to 14 inches; dark red (2.5YR 3/6) clay; moderate medium and fine subangular blocky structure; firm; common fine and medium roots; few faint clay films on faces of peds; 5 percent fragments of chert; very strongly acid; gradual smooth boundary.

Bt2—14 to 29 inches; dark red (2.5YR 3/6) clay; moderate medium subangular blocky structure; firm; common fine and medium roots; common faint clay films on faces of peds; 5 percent fragments of chert; common fine black concretions and stains; very strongly acid; gradual smooth boundary.

Bt3—29 to 50 inches; red (2.5YR 4/6) clay; common fine prominent strong brown (7.5YR 5/8) mottles; moderate fine and medium angular blocky structure; firm; few fine roots; common faint clay films on faces of peds; 5 percent fragments of chert; common fine black concretions and stains; very strongly acid; gradual smooth boundary.

Bt4—50 to 61 inches; red (2.5YR 4/6) clay; many fine distinct strong brown (7.5YR 5/8) mottles; moderate fine and medium angular blocky structure; very firm; many distinct clay films on faces of peds; 10 percent fragments of chert; common fine black concretions and stains; very strongly acid.

Thickness of the solum and depth to limestone are more than 60 inches. Fragments of chert range to 15 percent. The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid.

The Ap horizon has hue of 5YR or 7.5YR, value and chroma of 3 or 4. It is silt loam except for a few severely eroded areas that are silty clay loam.

The Bt horizon has hue of 2.5YR or 5YR, value of 3 to 5, and chroma of 6 or 8. It is clay or silty clay except

for some pedons where the upper few inches are silty clay loam.

### Ealy Series

The Ealy series consists of very deep, well drained soils on bottom lands. These soils formed in alluvium washed from soils underlain by shale, siltstone, and sandstone. Permeability is moderately rapid. Slopes range from 0 to 3 percent, but in most areas are less than 2 percent.

Ealy soils are near Sewanee and Whitwell soils. Sewanee soils are in positions similar to those of Ealy soils and are moderately well drained. Whitwell soils are on low terraces, are moderately well drained, and have an argillic horizon.

Typical pedon of Ealy loam, occasionally flooded, 1,500 feet south of Nicks Creek Baptist Church, 200 feet east of New River, and 100 feet west of Southern Railway tracks; (Block Quadrangle); in an idle field:

- Ap—0 to 7 inches; brown (10YR 4/3) loam; weak fine granular structure; very friable; many fine, medium, and coarse roots; many fine tubular pores; slightly acid; clear wavy boundary.
- Bw—7 to 18 inches; dark yellowish brown (10YR 4/4) loam; weak fine and medium subangular blocky structure; very friable; many fine and medium roots; common fine tubular pores; strongly acid; abrupt smooth boundary.
- C1—18 to 24 inches; dark yellowish brown (10YR 4/4) loam; common coarse distinct yellowish brown (10YR 5/8) mottles; massive; friable; few fine and medium roots; common fine tubular pores; few fine coal particles; strongly acid; clear wavy boundary.
- C2—24 to 35 inches; dark yellowish brown (10YR 4/4) loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few fine and medium roots; common fine tubular pores; few fine coal particles; strongly acid; clear smooth boundary.
- C3—35 to 61 inches; dark yellowish brown (10YR 4/4) loam; common fine distinct yellowish brown (10YR 5/6) mottles; massive; friable; few fine and medium roots; few fine tubular pores; few fine coal particles; 2 percent fragments of sandstone ranging to 2.5 inches in diameter; strongly acid.

Depth to bedrock is more than 60 inches.

Fragments of sandstone range from 0 to 15 percent in each horizon. In most pedons they are less than 2.5 inches in diameter. The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid.

The A horizon has hue of 10YR, value of 4 or 5,

and chroma of 3 or 4. It is loam or fine sandy loam.

The Bw and C horizons have hue of 10YR, value of 4 or 5, and chroma of 3 or 4. They are loam or fine sandy loam. In some pedons the C horizon is mottled in shades of brown. In some pedons gray mottles are below a depth of 25 inches. In some pedons a buried A horizon is below a depth of 25 inches.

### Etowah Series

The Etowah series consists of very deep, well drained, moderately permeable soils on high stream terraces and foot slopes. These soils formed in alluvium or colluvium. Most areas of this soil are in Powell Valley. Slopes range from 2 to 12 percent.

Etowah soils are near Collegedale soils, which have a light-colored surface layer and a clayey subsoil.

Typical pedon of Etowah silt loam, 2 to 5 percent slopes, 1,500 feet northeast of State Vocational Technical School and 2,250 feet southwest of Lake View Church; (Jacksboro Quadrangle):

- Ap—0 to 7 inches; dark brown (10YR 3/3) silt loam; weak fine granular structure; friable; many fine and medium roots; very strongly acid; abrupt smooth boundary.
- BA—7 to 15 inches; dark brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; common fine and medium roots; few brown and black iron and manganese concretions; very strongly acid; clear smooth boundary.
- Bt1—15 to 30 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; common fine and medium roots; common faint clay films on faces of peds; common brown and black iron and manganese concretions; very strongly acid; clear smooth boundary.
- Bt2—30 to 45 inches; yellowish red (5YR 5/8) silty clay loam; few fine distinct strong brown (7.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; few fine and medium roots; common faint clay films on faces of peds; common brown and black iron and manganese concretions; very strongly acid; clear smooth boundary.
- Bt3—45 to 70 inches; strong brown (7.5YR 5/8) silty clay loam; few fine faint reddish yellow (7.5YR 6/8) mottles; moderate medium subangular blocky structure; friable; common faint clay films on faces of peds; 5 percent fragments of chert; common brown and black iron and manganese concretions; very strongly acid.

The solum is more than 60 inches in thickness.

Depth to bedrock is more than 72 inches. The soil is strongly acid or very strongly acid, but where limed the surface layer is less acid. Coarse fragments, mainly chert, range to 15 percent in each horizon.

The A horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 to 4. It is loam or silt loam.

The BA horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. It is silt loam or loam.

The Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 6 or 8. In some pedons in the lower part it has mottles in shades of brown, yellow, or red. It is silty clay loam or clay loam.

### Fullerton Series

The Fullerton series consists of very deep, well drained, moderately permeable soils that formed in residuum derived from dolomite. The soils are on ridges and hills that have wide, rolling tops and steep hillsides. Slopes range from 5 to 45 percent.

Fullerton soils are near Bodine and Claiborne soils. Bodine and Claiborne soils are in positions similar to those of Fullerton soils and are near Fullerton soils. Bodine soils are loamy-skeletal. Claiborne soils are darker in the surface layer than Fullerton soils and are fine-loamy.

Typical pedon of Fullerton gravelly silt loam, in an area of Fullerton and Bodine gravelly silt loams, 25 to 70 percent slopes, 1,600 feet northeast of Norris Dam State Park Headquarters building and 700 feet (10 degrees) northeast of storage building; (Norris Quadrangle); in a wooded area:

A—0 to 1 inch; very dark grayish brown (10YR 3/2) gravelly silt loam; weak fine granular structure; friable; many fine and medium roots; 20 percent fragments of chert; strongly acid; abrupt smooth boundary.

E—1 to 11 inches; light yellowish brown (10YR 6/4) gravelly silt loam; weak fine granular structure; friable; many fine medium and coarse roots; 20 percent fragments of chert ranging to 1.5 inches in diameter; strongly acid; clear smooth boundary.

BE—11 to 18 inches; strong brown (7.5YR 5/6) gravelly silt loam; weak fine subangular blocky structure; friable; common fine medium and coarse roots; 20 percent fragments of chert ranging to 4 inches in diameter; very strongly acid; clear wavy boundary.

Bt1—18 to 21 inches; yellowish red (5YR 5/8) gravelly silty clay loam; moderate medium subangular blocky structure; firm; few fine and medium roots; few faint clay films on faces of pedis; 20 percent

fragments of chert mostly less than 3 inches in diameter but ranging to 6 inches; very strongly acid; clear smooth boundary.

Bt2—21 to 36 inches; yellowish red (5YR 5/8) gravelly clay; moderate medium angular and subangular blocky structure; very firm; few fine and medium roots; common clay films on faces of pedis; 20 percent fragments of chert mostly less than 3 inches in diameter but ranging to 6 inches; very strongly acid; gradual smooth boundary.

Bt3—36 to 61 inches; red (2.5YR 5/8) gravelly clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate fine and medium angular blocky structure; very firm; few fine and medium roots; many prominent clay films on faces of pedis; 25 percent fragments of chert mostly less than 3 inches in diameter but ranging to 6 inches; very strongly acid.

Thickness of the solum and depth to bedrock are more than 60 inches. The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid. Content of chert fragments in each horizon ranges from 15 to 35 percent.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is gravelly silt loam or gravelly loam.

The E horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. It is gravelly silt loam or gravelly loam.

The BE horizon has hue of 7.5YR, value of 5, and chroma of 4 or 6. It is gravelly silt loam or gravelly loam.

The Bt horizon has hue of 5YR and 2.5YR, value of 4 or 5, and chroma of 6 or 8. In some pedons it has mottles in shades of brown, yellow, and red. It is gravelly silty clay or gravelly clay, but in some pedons in the upper few inches it is gravelly silty clay loam.

### Gladeville Series

The Gladeville series consists of very shallow, well drained, moderately permeable soils on uplands. These dark colored soils formed in residuum derived from thin-bedded, flaggy limestone. Slopes range from 5 to 25 percent.

Gladeville soils are near Collegedale soils, which are more than 60 inches deep over bedrock.

Typical pedon of Gladeville flaggy silty clay loam, in an area of Gladeville-Rock outcrop complex, 5 to 25 percent slopes, 750 feet northeast of Midway Baptist Church and 2,625 feet southwest of Rogers Cemetery; (Jacksboro Quadrangle):

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) flaggy silty clay loam; moderate fine and medium granular structure; friable; many fine, medium, and coarse roots; common fine tubular pores; 30 percent thin flat fragments of limestone up to 8 inches in diameter; moderately alkaline; abrupt wavy boundary.

A2—4 to 8 inches; dark brown (10YR 3/3) very flaggy silty clay loam; moderate medium and fine subangular blocky structure; firm; common fine, medium, and coarse roots; common fine tubular pores; common pressure faces on surface of peds; 40 percent thin flat fragments of limestone up to 10 inches in diameter; moderately alkaline; abrupt wavy boundary.

C—8 to 11 inches; dark yellowish brown (10YR 4/4) very flaggy clay that has common very dark grayish brown (10YR 3/2) stains; massive; firm; common fine roots; few fine tubular pores; 45 percent thin, flat fragments of limestone up to 10 inches in diameter.

R—11 inches; limestone.

Depth to bedrock ranges from 3 to 12 inches. The soils are neutral to moderately alkaline. Fragments of limestone range from 35 to 65 percent.

The A horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2 or 3. In the fine earth fraction it is silty clay loam, silty clay, or clay.

The C horizon has hue of 10YR or 7.5YR, value of 4, and chroma of 3 or 4. In the fine earth fraction it is silty clay loam, silty clay, or clay.

## Grimsley Series

The Grimsley series consists of deep, well drained soils. Permeability is moderately rapid. These soils formed in colluvium in coves and on the lower slopes of steep mountains. They are underlain by sandstone and shale. Slopes range from 30 to about 60 percent.

Grimsley soils are near Jefferson soils. Jefferson soils are in positions similar to those of Grimsley soils and have less than 35 percent rock fragments throughout.

Typical pedon of Grimsley stony loam, in an area of Jefferson-Grimsley complex, 30 to 60 percent slopes, 0.9 mile southeast of Stony Fork Church and 0.25 mile west of VABM 2154; (Duncan Flats Quadrangle):

A—0 to 3 inches; very dark grayish brown (10YR 3/2) stony loam; weak fine granular structure; friable; many fine, medium, and coarse roots; 30 percent

fragments of sandstone 2 to 20 inches in diameter; very strongly acid; clear smooth boundary.

E—3 to 8 inches; light yellowish brown (10YR 6/4) very stony loam; common small pockets of very dark grayish brown (10YR 3/2) loam that moved down from the A horizon; weak fine granular structure; friable; many fine, medium, and coarse roots; 40 percent fragments of sandstone 2 to 20 inches in diameter; very strongly acid; gradual smooth boundary.

Bt1—8 to 21 inches; yellowish brown (10YR 5/4) very stony loam; weak fine and medium subangular blocky structure; friable; common fine, medium, and coarse roots; common fine pores; few faint clay films in pores; 60 percent fragments of sandstone 2 to 20 inches in diameter; very strongly acid; clear smooth boundary.

Bt2—21 to 28 inches; strong brown (7.5YR 5/6) very stony loam; weak medium subangular blocky structure; friable; common fine, medium, and coarse roots; common fine pores; few faint clay films in pores and on faces of peds; 60 percent, by volume, fragments of sandstone 2 to 20 inches in diameter; very strongly acid; clear smooth boundary.

Bt3—28 to 47 inches; strong brown (7.5YR 5/6) extremely stony loam; weak medium subangular blocky structure; friable; common fine, medium, and coarse roots; few faint clay films in pores and on faces of peds; 65 percent fragments of sandstone 2 to 24 inches in diameter; very strongly acid; gradual smooth boundary.

C—47 to 54 inches; yellowish brown (10YR 5/4) extremely stony loam; few fine prominent strong brown (7.5YR 5/6) and yellowish red (5YR 5/8) mottles; massive; friable; common fine and medium roots; 65 percent fragments of sandstone 2 to 24 inches in diameter; few dark brown concretions; very strongly acid; abrupt smooth boundary.

R—54 inches; sandstone.

Thickness of the solum and depth to bedrock range from 40 to 60 inches. Fragments of sandstone range from 20 to 45 percent in the A horizon and from 35 to 65 percent in the B and C horizons. Rock fragments range from about 2 to 24 inches or more in diameter. These soils are strongly acid or very strongly acid in all horizons.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 3 or 4. In the fine

earth fraction the A and E horizons are loam or sandy loam.

The Bt horizon has hue of 10YR and 7.5YR, value of 5, and chroma of 4 to 8. In the fine earth fraction it is loam or clay loam.

The C horizon and the BC horizon, where it occurs, have colors and textures like those of the Bt horizon.

## Hamblen Series

The Hamblen series consists of very deep, moderately well drained, moderately permeable soils on flood plains. Slopes range from 0 to 3 percent.

Hamblen soils are near Whitwell soils. Whitwell soils are in areas slightly higher than those of Hamblen soils and have an argillic horizon.

Typical pedon of Hamblen silt loam, occasionally flooded, 1,250 feet west of the Campbell and Claiborne County line on Highway 63 and 250 feet north in bottom along stream channel; (Well Spring Quadrangle):

Ap1—0 to 4 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many fine and medium roots; common fine pores; slightly acid; abrupt smooth boundary.

Ap2—4 to 9 inches; dark yellowish brown (10YR 4/4) silt loam; moderate fine and medium granular structure; friable; many fine and medium roots; common fine pores; 2 percent gravel; few brown and black iron and manganese concretions; slightly acid; clear smooth boundary.

Bw1—9 to 17 inches; yellow brown (10YR 5/4) silt loam; common fine distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; common fine and medium roots; common fine pores; 5 percent gravel; common brown and black iron and manganese concretions; slightly acid; clear smooth boundary.

Bw2—17 to 31 inches; brown (10YR 4/3) silt loam; common fine distinct light brownish gray (10YR 6/2) and few fine prominent strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine and medium roots; 2 percent gravel; few brown and black iron and manganese concretions; neutral; abrupt smooth boundary.

C1—31 to 48 inches; brown (10YR 4/3) loam; many fine distinct light brownish gray (10YR 6/2) and few fine prominent yellowish brown (10YR 5/8) mottles; massive; friable; few fine and medium roots; 10 percent gravel; common brown and black iron and manganese concretions; neutral.

C2—48 to 60 inches; brown (10YR 4/3) gravelly loam; many fine distinct light brownish gray (10YR 6/2) and few fine prominent yellowish brown (10YR 5/8) mottles; massive; friable; few fine and medium roots; 20 percent gravel; common brown and black iron and manganese concretions; neutral.

The solum ranges from 20 to 55 inches in thickness. Depth to bedrock is more than 60 inches. The soils are strongly acid to neutral, but where limed the surface layer is less acid. Coarse fragments range from 0 to 10 percent in the A and B horizons and from 5 to 35 percent in the C horizon.

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

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 to 6. It is mottled in shades of gray and brown. It is silt loam or loam.

The C horizon has hue of 7.5YR to 2.5YR, value of 4 to 6, and chroma of 1 to 6. It has mottles in shades of brown, gray, or red. It is silt loam or loam.

## Jefferson Series

The Jefferson series consists of very deep, well drained soils on foot slopes and mountainsides, especially on benches and in coves. These soils formed in colluvium derived from sandstone and shale. Permeability is moderately rapid. Slopes range from 5 to 60 percent.

Jefferson soils are near Grimsley soils. Grimsley soils are in positions similar to those of Jefferson soils but have more than 35 percent rock fragments in the subsoil.

Typical pedon of Jefferson gravelly loam, in an area of Jefferson-Grimsley complex, 30 to 60 percent slopes, about 1.2 miles northwest of Ridgewood School and 0.65 mile southwest of BM 1179 near Vasper; (Jacksboro Quadrangle):

Oi—0.5 inch to 0; slightly decomposed leaves from hardwood.

A—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly loam; moderate fine granular structure; very friable; many fine, medium, and coarse roots; 20 percent fragments of sandstone less than 3 inches in diameter; strongly acid; clear smooth boundary.

E—3 to 10 inches; yellowish brown (10YR 5/4) gravelly loam; weak fine granular structure; very friable; many fine, medium, and coarse roots; 16 percent fragments of sandstone less than 3 inches in diameter; strongly acid; clear smooth boundary.

- Bt1**—10 to 24 inches; strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure; friable; few fine and medium roots; few fine pores; few faint clay films in pores and on faces of peds; 10 percent fragments of sandstone mostly less than 3 inches in diameter; strongly acid; gradual smooth boundary.
- Bt2**—24 to 34 inches; strong brown (7.5YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine roots; few fine pores; few faint clay films in pores and on faces of peds; 10 percent fragments of sandstone mostly less than 3 inches in diameter; strongly acid; gradual smooth boundary.
- BC**—34 to 54 inches; strong brown (7.5YR 5/6) gravelly sandy loam; weak medium subangular blocky structure; very friable; few fine roots; root channel about 2 inches in diameter and filled with material similar to that in the A horizon begins at a depth of 34 inches and extends downward more than 60 inches below the surface; 20 percent fragments of sandstone mostly less than 3 inches in diameter; very strongly acid; gradual smooth boundary.
- C**—54 to 60 inches; mottled strong brown (7.5YR 5/6), yellowish red (5YR 5/8), and pale brown (10YR 6/3) gravelly sandy loam; massive; very friable; few fine roots; 30 percent fragments of sandstone mostly less than 3 inches in diameter; very strongly acid.

The solum ranges from 40 to more than 60 inches in thickness. Depth to bedrock is more than 60 inches. Rocky fragments range from 10 to 20 percent in the A horizon, 10 to 30 percent in the upper part of the B horizon, and 20 to 50 percent in the lower part of the B horizon and in the C horizon. The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid.

The A or Ap horizon has hue of 10YR, value of 3 to 5, and chroma of 2 to 4. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The A and E horizons are loam or gravelly loam.

The Bt horizon has hue of 10YR and 7.5YR, value of 5, and chroma of 4 to 8. In some pedons in the lower part it has mottles in shades of brown, yellow, and red. It is loam, clay loam, gravelly loam, or gravelly clay loam.

The BC and C horizons have hue of 10YR or 7.5YR, value of 5, and chroma of 4 to 8. They have mottles in shades of brown, yellow, or red, and in some pedons they are mottled without a dominant color. They are gravelly sandy loam, gravelly loam, or gravelly clay loam.

## Lily Series

The Lily series consists of moderately deep, well drained soils on mountaintops. These soils formed in residuum derived from sandstone. Permeability is moderately rapid. Slopes range from 5 to 15 percent.

Lily soils are near Muskingum, Sequoia, and Ramsey soils. Muskingum soils formed in residuum derived from shale and siltstone. Muskingum soils are on steep mountainsides and have a cambic horizon. Sequoia soils formed in residuum derived from clay shale and have a clayey subsoil. Ramsey soils are on steep slopes, have a cambic horizon, and are less than 20 inches deep to bedrock.

Typical pedon of Lily fine sandy loam, 5 to 15 percent slopes, 5,000 feet southeast of Emanuel Church on Highway 63 and 5,360 feet from benchmark 1525 on Chestnut Ridge; (Pioneer Quadrangle):

- A**—0 to 3 inches; brown (10YR 4/3) fine sandy loam; weak fine granular structure; very friable; many fine, medium, and coarse roots; very strongly acid; abrupt smooth boundary.
- E**—3 to 10 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium granular structure; very friable; many fine, medium, and coarse roots; very strongly acid; clear smooth boundary.
- BE**—10 to 13 inches; yellowish brown (10YR 5/6) loam; common fine faint light yellowish brown (10YR 6/4) mottles; weak fine and medium subangular blocky structure; very friable; common fine, medium, and coarse roots; common fine pores; extremely acid; clear smooth boundary.
- Bt1**—13 to 18 inches; strong brown (7.5YR 5/8) loam; weak medium subangular blocky structure; friable; few fine and medium roots; common fine pores; few faint clay films in pores and on faces of peds; extremely acid; clear smooth boundary.
- Bt2**—18 to 25 inches; strong brown (7.5YR 5/6) clay loam; moderate medium subangular blocky structure; friable; few fine and medium roots; common fine pores; few faint clay films in pores and on faces of peds; extremely acid; abrupt smooth boundary.
- BC**—25 to 32 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium distinct brownish yellow (10YR 6/8) mottles; weak medium subangular blocky structure; friable; 10 percent fragments of sandstone; extremely acid.
- R**—32 inches; hard sandstone.

Thickness of the solum and depth to bedrock range

from 20 to 40 inches. Rock fragments, mainly sandstone, range to 10 percent in the A and E horizons and to 25 percent in the B and C horizons. The soils are very strongly acid or extremely acid, but in limed areas the surface layer is less acid.

The A or Ap horizon has hue of 10YR, value of 3 and 5, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. The A and E horizons are fine sandy loam, loam, or sandy loam.

The BE horizon has hue of 10YR, value of 4 or 5, and chroma of 4 or 6. In the fine earth fraction it is sandy loam or loam. The Bt horizon has hue of 5YR to 10YR, value of 4 to 6, and chroma of 6 or 8. In the fine earth fraction it is loam, clay loam, or sandy clay loam.

The BC horizon and the C horizon, where present, have hue of 7.5YR and 10YR, value of 5 or 6, and chroma of 6 or 8. In some pedons they have mottles in shades of brown and yellow. In the fine earth fraction they are sandy clay loam, loam, or sandy loam.

### Minvale Series

The Minvale series consists of very deep, well drained soils. Permeability is moderate. These soils formed in colluvium and residuum derived from cherty limestone on benches, foot slopes, and fans. Slopes range from 15 to 25 percent.

Minvale soils are near Fullerton and Bodine soils. Fullerton and Bodine soils are on uplands above Minvale soils. Fullerton soils have a clayey subsoil and Bodine soils have more than 35 percent fragments of chert in the subsoil.

Typical pedon of Minvale gravelly loam, 15 to 25 percent slopes, 1 mile southeast of Pine Crest School and 600 feet north of Pine Crest Road; (Demory Quadrangle):

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) gravelly loam; moderate medium granular structure; friable; many fine and medium roots; 15 percent fragments of chert; very strongly acid; abrupt smooth boundary.

BE—7 to 12 inches; brown (7.5YR 5/4) gravelly loam; weak fine and medium subangular blocky structure; friable; many fine and medium roots; 15 percent fragments of chert; very strongly acid; clear smooth boundary.

Bt1—12 to 20 inches; strong brown (7.5YR 5/6) gravelly loam; moderate medium subangular blocky structure; friable; common fine and medium roots; few faint clay films on fragments and faces of peds; 20 percent fragments of chert; very strongly acid; clear smooth boundary.

Bt2—20 to 33 inches; yellowish brown (10YR 5/6) gravelly loam; few fine distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; few fine and medium roots; few faint clay films on faces of peds; 20 percent fragments of chert; very strongly acid; clear smooth boundary.

Bt3—33 to 60 inches; red (2.5YR 4/6) gravelly silty clay loam; common medium distinct yellowish red (5YR 5/6) and common fine prominent pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; few fine and medium roots; many distinct clay films on faces of peds; 20 percent fragments of chert; very strongly acid.

Thickness of the solum and depth to bedrock are more than 60 inches. The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid. Fragments of chert range from 10 to 20 percent in the A horizon and from 15 to 35 percent in the B horizon. The lower part of the B horizon has few to common mottles in shades of brown, yellow, red, and gray.

The A horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. In the fine earth fraction it is silt loam or loam.

The BE horizon and the upper part of the Bt horizon have hue of 10YR to 5YR, value of 4 or 5, and chroma of 4 to 8. In the fine earth fraction it is silt loam, loam, or silty clay loam.

The lower part of the Bt horizon has hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 to 8. It has few to common mottles in shades of brown, red, yellow, and gray. In the fine earth fraction it is dominantly silty clay loam, but the range includes silt loam, silty clay, or clay.

### Muskingum Series

The Muskingum series consists of moderately deep, well drained soils that are mostly on steep mountainsides. Permeability is moderate. These soils formed in material derived from interbedded shale, sandstone, and siltstone. Slopes range from 30 to 60 percent.

Muskingum soils are near Sequoia and Petros soils. Sequoia soils have a clayey argillic horizon. Petros soils are loamy-skeletal and less than 20 inches deep to soft shale.

Typical pedon of Muskingum silt loam, in an area of Muskingum-Sequoia-Petros complex, 30 to 60 percent slopes, 1.7 miles west of VABM 2838 at Caryville and 0.25 mile north of VABM 3216 on Hatmaker Knob; (Block Quadrangle):

- A—0 to 2 inches; very dark grayish brown (10YR 3/2) silt loam; moderate fine granular structure; friable; many fine, medium, and coarse roots; 10 percent fragments of shale; very strongly acid; abrupt smooth boundary.
- E—2 to 6 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; friable; many fine, medium, and coarse roots; 10 percent fragments of shale; very strongly acid; clear smooth boundary.
- Bw1—6 to 10 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; many fine, medium, and coarse roots; 10 percent fragments of shale; strongly acid; clear smooth boundary.
- Bw2—10 to 21 inches; yellowish brown (10YR 5/6) silt loam; weak medium subangular blocky structure; friable; many fine, medium, and coarse roots; few fine pores; 10 percent fragments of shale; very strongly acid; clear smooth boundary.
- Bw3—21 to 24 inches; yellowish brown (10YR 5/6) channery silt loam; weak medium subangular blocky structure; friable; few fine and medium roots; 30 percent fragments of shale; very strongly acid; abrupt wavy boundary.
- C—24 to 30 inches; yellowish brown (10YR 5/4) very channery silt loam; massive; friable; few fine roots; 60 percent fragments of shale; very strongly acid; abrupt smooth boundary.
- Cr—30 to 45 inches; rippable shale.

Thickness of the solum and depth to bedrock range from 20 to 40 inches. These soils are strongly acid or very strongly acid. Fragments of shale, siltstone, and sandstone make up 5 to 30 percent of the solum and 35 to 70 percent of the C horizon.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. In the fine earth fraction the A and E horizons are silt loam.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 6. In the fine earth fraction it is silt loam or loam.

The C horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 3 or 4. In the fine earth fraction it is silt loam or loam.

### Petros Series

The Petros series consists of shallow, excessively drained soils on mountains. These soils are mainly on points of ridges, narrow ridgetops, and upper side slopes. They formed in residuum derived from shale and siltstone. Slopes range from 30 to 60 percent.

Petros soils are near Muskingum and Sequoia soils. Muskingum and Sequoia soils are 20 to 40 inches to bedrock and have less than 35 percent rock fragments in the subsoil. Sequoia soils also have a clayey argillic horizon.

Typical pedon of Petros channery silt loam, in an area of Muskingum-Sequoia-Petros complex, 30 to 60 percent slopes, on the point of a narrow ridge about 2,300 feet northeast of confluence of New River and Beech Fork Creek and about 2.0 miles northwest of Stony Fork School; (Duncan Flats Quadrangle):

- A—0 to 1 inch; very dark grayish brown (10YR 3/2) channery silt loam; moderate fine granular structure; friable; many fine and medium roots; 20 percent fragments of shale; very strongly acid; abrupt smooth boundary.
- E—1 inch to 5 inches; brown (10YR 5/3) channery silt loam; weak fine granular structure; friable; many fine, medium, and coarse roots; 20 percent fragments of shale; very strongly acid; clear smooth boundary.
- Bw—5 to 16 inches; yellowish brown (10YR 5/4) very channery silt loam; weak medium subangular blocky structure; friable; common fine, medium, and coarse roots; 50 percent fragments of shale; very strongly acid; clear smooth boundary.
- Cr—16 to 26 inches; thin layered shale removable with hand tools.
- R—26 inches; moderately hard shale.

Thickness of the solum and depth to soft bedrock range from 10 to 20 inches. Depth to hard bedrock ranges from 20 to 40 inches. The soils are strongly acid or very strongly acid in each horizon. Coarse fragments, mainly shale, range from 15 to 35 percent in the A and E horizons and from 35 to 75 percent in the Bw horizon.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. It is channery silt loam or channery loam. The E horizon has hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It is channery silt loam or channery loam.

The Bw horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 or 6. It is very channery silt loam.

### Ramsey Series

The Ramsey series consists of shallow, somewhat excessively drained, rapidly permeable soils on the upper part of mountainsides. These soils formed in residuum derived from sandstone. Slopes range from 30 to 65 percent.

Ramsey soils are near Lily and Muskingum soils. Muskingum soils are on mountainsides, formed in material derived from siltstone and shale, and are 20 to 40 inches deep to bedrock. Lily soils are on mountaintops, have fewer rock fragments than Ramsey soils, and are 20 to 40 inches deep to bedrock.

Typical pedon of Ramsey sandy loam, in an area of Ramsey-Rock outcrop complex, 30 to 65 percent slopes, about 2,200 feet southwest of Vasper on Walden Ridge and 1,525 feet south of private road; (Jacksboro Quadrangle):

- A—0 to 2 inches; very dark grayish brown (10YR 3/2) sandy loam; weak fine and medium granular structure; very friable; many fine, medium, and coarse roots; 2 percent fragments of sandstone; very strongly acid; abrupt smooth boundary.
- E—2 to 7 inches; brown (10YR 5/3) sandy loam; weak medium granular structure; very friable; many fine, medium, and coarse roots; 5 percent fragments of sandstone; very strongly acid; clear smooth boundary.
- Bw1—7 to 15 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; common fine, medium, and coarse roots; 15 percent fragments of sandstone; very strongly acid; clear smooth boundary.
- Bw2—15 to 18 inches; yellowish brown (10YR 5/6) sandy loam; weak medium subangular blocky structure; very friable; few fine and medium roots; 10 percent fragments of sandstone; very strongly acid; abrupt smooth boundary.
- R—18 inches; sandstone.

Thickness of the solum and depth to sandstone bedrock range from 7 to 20 inches. The soils are strongly acid or very strongly acid. Fragments of sandstone in each horizon range from 5 to 35 percent, but are mostly less than 15 percent.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. In the fine earth fraction it is loam, sandy loam, or fine sandy loam.

The E horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. In the fine earth fraction it is loam, sandy loam, or fine sandy loam.

The Bw horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 3 to 6. In the fine earth fraction it is loam or sandy loam.

The C horizon, where it occurs, has the same colors as the Bw horizon. In the fine earth fraction it is sandy loam or loamy sand.

## Sequatchie Series

The Sequatchie series consists of very deep, well drained soils. Permeability is moderate. These soils formed in loamy alluvium on low stream terraces. Slopes range from 1 to 5 percent.

Sequatchie soils are near Whitwell and Ealy soils. Whitwell soils are on low stream terraces and are moderately well drained. Ealy soils are on nearly level bottom lands and do not have an argillic horizon.

Typical pedon of Sequatchie loam, 1 to 5 percent slopes, occasionally flooded, 3,750 feet east of Meredith Cemetery on paved road and 750 feet south along Stinking Creek; (Pioneer Quadrangle); in a cleared field:

- Ap—0 to 9 inches; dark brown (10YR 3/3) loam; weak fine granular structure; very friable; many fine and medium roots; 2 percent gravel less than 2 inches in diameter; strongly acid; abrupt smooth boundary.
- BA—9 to 16 inches; brown (7.5YR 4/4) loam; weak fine and medium subangular blocky structure; friable; many fine and medium roots; very strongly acid; clear smooth boundary.
- Bt1—16 to 26 inches; strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; 2 percent gravel less than 2 inches in diameter; very strongly acid; clear smooth boundary.
- Bt2—26 to 34 inches; strong brown (7.5YR 5/8) loam; moderate fine and medium subangular blocky structure; friable, nonsticky and nonplastic; few fine roots; few faint clay films on faces of peds; 2 percent gravel less than 2 inches in diameter; very strongly acid; clear smooth boundary.
- BC—34 to 41 inches; strong brown (7.5YR 5/8) sandy loam; weak medium and fine subangular blocky structure; friable, nonsticky and nonplastic; few fine roots; 2 percent gravel less than 2 inches in diameter; very strongly acid; gradual smooth boundary.
- C—41 to 62 inches; strong brown (7.5YR 5/6) loam; many fine distinct pale brown (10YR 6/3) mottles; massive; friable; 5 percent gravel less than 2 inches in diameter; very strongly acid.

The solum ranges from 32 to 55 inches in thickness. Depth to bedrock is more than 60 inches. The soils are strongly acid or very strongly acid. Gravel ranges from 0 to 15 percent in the A and B horizons and from 5 to 30 percent in the C horizon.

The Ap horizon has hue of 10YR or 7.5YR, value of

3, and chroma of 2 or 3. It is loam, silt loam, or fine sandy loam.

The BA horizon has hue of 10YR, value of 4, and chroma of 3 or 4 or hue of 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is loam, silt loam, or fine sandy loam.

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

The BC horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It is loam, fine sandy loam, or sandy loam.

The C horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4 or 6. It has mottles in shades of brown or gray. In the fine earth fraction it is loam, sandy loam, or fine sandy loam.

### Sequoia Series

The Sequoia series consists of moderately deep, well drained soils. Permeability is moderately slow. These soils formed in clayey residuum derived from acid shale. They are on ridgetops and hillsides. Slopes range from 5 to 45 percent.

Sequoia soils are near Bland, Muskingum, and Petros soils. Bland soils formed in dusky red to purplish limestone. Muskingum soils have a fine-loamy control section and a cambic horizon. Petros soils are loamy-skeletal and are less than 20 inches deep over soft bedrock.

Typical pedon of Sequoia silt loam, 25 to 45 percent slopes, eroded, 1,625 feet northwest of Midway Baptist Church and 3,500 feet northeast of Rogers Cemetery; (Jacksboro Quadrangle):

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; weak medium granular structure; friable; many fine and medium roots; 10 percent fragments of shale; very strongly acid; abrupt smooth boundary.

Bt1—6 to 13 inches; strong brown (7.5YR 5/6) channery silty clay; many fine distinct yellowish brown (10YR 5/8) and few fine prominent pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; common fine, medium, and coarse roots; few faint clay films on faces of pedis; 25 percent fragments of shale; very strongly acid; clear smooth boundary.

Bt2—13 to 20 inches; strong brown (7.5YR 5/6) channery silty clay; many fine distinct yellowish brown (10YR 5/8) and common fine distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; firm; common fine and medium roots; few faint clay films on faces of

pedis; 25 percent fragments of shale; very strongly acid; clear smooth boundary.

C—20 to 30 inches; strong brown (7.5YR 5/6) channery silty clay; few fine distinct yellowish brown (10YR 5/8), common fine distinct yellowish red (5YR 5/6), and common fine prominent light brownish gray (10YR 6/2) mottles; massive; very firm; few fine roots; 35 percent fragments of shale; very strongly acid.

Cr—30 to 40 inches; weakly consolidated shale with thin seams of fine earth between layers.

Thickness of the solum and depth to soft shale bedrock range from 20 to 40 inches. This soil is strongly acid or very strongly acid. Fragments of shale range from 0 to 10 percent in the A horizon and from 0 to 25 percent in the B and C horizons.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. In severely eroded areas it also includes chroma of 6. It is silt loam or silty clay loam.

The Bt horizon has hue of 7.5YR or 5YR, value of 5, and chroma of 6 or 8. In most pedons it has mottles in shades of brown or red. In the fine earth fraction it is silty clay or clay. The BC and C horizons have the same colors as the Bt horizon. It is mottled in shades of red, brown, or gray. In the fine earth fraction it is silty clay loam, silty clay, or clay.

### Sewanee Series

The Sewanee series consists of deep, moderately well drained soils on bottom lands. Permeability is moderate. These soils formed in alluvium derived from sandstone, siltstone, and shale. Slopes range from 0 to 3 percent.

Sewanee soils are near Ealy soils in positions similar to those of Sewanee soils. Ealy soils are well drained.

Typical pedon of Sewanee silt loam, occasionally flooded, about 8 miles north on Nicks Creek Road from confluence of Stony Fork Creek and New River, 30 feet east of railroad tracks on the flood plain of New River; (Duncan Flats Quadrangle):

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate fine granular structure; friable, nonsticky; many fine and medium roots; few fine tubular pores; slightly acid; abrupt wavy boundary.

Bw1—8 to 17 inches; brown (10YR 4/3) loam; common faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; common fine and medium roots; few very fine tubular pores; few fine particles of coal; 3 percent

fragments of sandstone, siltstone, and shale less than 2.5 inches in diameter; strongly acid; abrupt smooth boundary.

- Bw2—17 to 24 inches; brown (10YR 4/3) loam; common prominent yellowish red (5YR 5/8) and common distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few fine and medium roots; few very fine and fine tubular pores; few fine coal particles; 3 percent fragments of sandstone, siltstone, and shale less than 2.5 inches in diameter; strongly acid; clear smooth boundary.
- Bw3—24 to 31 inches; yellowish brown (10YR 5/4) loam; common prominent yellowish red (5YR 5/8) and common faint grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; few fine and medium roots; few fine tubular pores; few fine particles of coal; 5 percent fragments of sandstone, siltstone, and shale less than 2.5 inches in diameter; strongly acid; clear smooth boundary.
- C1—31 to 39 inches; light brownish gray (2.5Y 6/2) loam; common prominent yellowish red (5YR 5/8) and few faint grayish brown (10YR 5/2) mottles; massive; friable; few fine, medium, and coarse roots; few very fine tubular pores; 5 percent fragments of sandstone, siltstone, and shale 1 to 4 inches in diameter; strongly acid; gradual smooth boundary.
- C2—39 to 60 inches; light brownish gray (2.5Y 6/2) loam; many prominent strong brown (10YR 5/6) mottles; massive; friable; few fine roots; few very fine tubular pores; very strongly acid.

The solum ranges from 25 to 40 inches in thickness. Depth to bedrock ranges from 40 to 60 inches or more. Fragments range, by volume, from 0 to 15 percent in each horizon. The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid.

The A horizon has a hue of 10YR, value of 4 or 5, and chroma of 2 or 3. It is loam or silt loam.

The Bw horizon has a hue of 10YR, value of 4 or 5, and chroma of 3 or 4. It has mottles with chroma of 2 or less within 24 inches of the surface. It is loam or silt loam.

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 or 3. It is fine sandy loam, loam, or silt loam.

## Swafford Series

The Swafford series consist of very deep, moderately well drained soils. Permeability is

moderately slow. These soils formed in old, loamy alluvium on low stream terraces along larger streams. A compact, brittle layer is at a depth of about 30 inches. Slopes range from 0 to 3 percent.

Swafford soils are near Whitwell soils. Whitwell soils are in positions slightly lower than those of Swafford soils and do not have a brittle layer.

Typical pedon of Swafford loam, occasionally flooded, about 4,000 feet southeast of Elk Fork Church and 1,125 feet west of railroad tract in Elk Valley; (Pioneer Quadrangle); in a field:

- Ap—0 to 7 inches; brown (10YR 4/3) loam; weak fine granular structure; friable; many fine and medium roots; common fine tubular pores; strongly acid; abrupt smooth boundary.
- BA—7 to 12 inches; yellowish brown (10YR 5/4) loam; moderate fine granular and weak fine subangular blocky structure; friable; common fine and medium roots; common fine tubular pores; 2 percent gravel; very strongly acid; clear smooth boundary.
- Bt1—12 to 23 inches; yellowish brown (10YR 5/6) loam; few distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; friable; few fine and medium roots; common fine tubular pores; few faint clay films on faces of peds; 2 percent gravel by volume; very strongly acid; clear smooth boundary.
- Bt2—23 to 30 inches; yellowish brown (10YR 5/6) loam; few distinct light brownish gray (10YR 6/2) mottles; weak fine prismatic structure parting to moderate medium subangular blocky; friable; few fine roots; few faint clay films on faces of peds; 2 percent gravel; very strongly acid; gradual smooth boundary.
- Btx1—30 to 59 inches; yellowish brown (10YR 5/6) loam; many fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; firm and brittle in about 50 percent of the volume, friable when crushed; few fine tubular pores; few faint clay films on faces of peds; 5 percent gravel; very strongly acid; gradual smooth boundary.
- Btx2—59 to 65 inches; yellowish brown (10YR 5/6) clay loam; many fine distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to moderate medium subangular blocky; friable; few faint clay films on faces of peds; 30 percent brittle, by volume; 10 percent gravel; very strongly acid.

Thickness of the solum and depth to bedrock are more than 60 inches. Depth to the brittle layer ranges from 20 to 36 inches. Content of gravel ranges from 0 to 10 percent throughout. The soils are strongly acid or

very strongly acid, but where limed the surface layer is less acid.

The Ap horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 3 or 4. It is loam or silt loam.

The BA horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is loam or silt loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 to 8. It has mottles with chroma of 2 or less within 30 inches of the surface. It is loam or clay loam.

The Btx horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 4 to 8. It has mottles in shades of gray and brown. It is loam or clay loam.

### Talbott Series

The Talbott series consists of moderately deep, well drained soils. Permeability is moderately slow. These soils formed in 8 to 20 inches of gravelly colluvium and in the underlying clayey residuum derived from limestone. They are on side slopes and points of steep ridges. Slopes range from about 30 to 50 percent.

Talbott soils are near Bodine, Claiborne, and Fullerton soils. These soils are in positions similar to those of Talbott soils but are more than 60 inches deep over bedrock. Bodine soils are loamy-skeletal and Claiborne soils are fine-loamy.

Typical pedon of Talbott gravelly loam, in an area of Talbott-Rock outcrop complex, 30 to 50 percent slopes, about 900 feet north of Cedar Creek bridge and about 150 feet east of gravel road; (Demory Quadrangle); in woodland:

A—0 to 1 inch; dark grayish brown (10YR 4/2) gravelly loam; moderate fine granular structure; friable; common fine, medium, and coarse roots; few fine pores; 30 percent fragments of chert less than 2 inches in diameter; strongly acid; clear smooth boundary.

E—1 to 15 inches; pale brown (10YR 6/3) gravelly loam; weak fine granular structure; friable; common fine, medium, and coarse roots; few very fine pores; 30 percent fragments of chert less than 2 inches in diameter; strongly acid; clear wavy boundary.

2Bt1—15 to 20 inches; yellowish red (5YR 5/8) silty clay loam; common medium distinct reddish yellow (7.5YR 6/6) mottles; moderate medium subangular blocky structure; friable; common fine and medium roots; 10 percent fragments of chert less than 1 inch in diameter; moderately acid; clear smooth boundary.

2Bt2—20 to 24 inches; red (2.5YR 4/6) clay; common medium distinct reddish yellow (5YR 6/6) mottles;

moderate medium angular blocky structure; very firm; common fine roots; common distinct clay films on faces of peds; 10 percent fragments of chert less than 1 inch in diameter; moderately acid; gradual smooth boundary.

2Bt3—24 to 35 inches; red (2.5YR 4/6) clay; moderate medium angular blocky structure; very firm; common fine roots; common distinct clay films on faces of peds; 3 percent small fragments of chert; moderately acid; clear smooth boundary.

2BC—35 to 36 inches; red (2.5YR 4/6) clay; weak medium angular blocky structure; very firm; few fine roots; 3 percent small fragments of chert; slightly alkaline.

R—36 inches; limestone.

Thickness of the solum and depth to dolomite bedrock range from 20 to 40 inches. Fragments of chert range from 15 to 30 percent in the A and E horizons and from 0 to 10 percent in the 2Bt and 2BC horizons. The A and E horizons are strongly acid or very strongly acid. The 2Bt horizon is moderately acid or strongly acid. The 2BC horizon is neutral or slightly alkaline.

The A horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The E horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. The A and E horizons are gravelly loam or gravelly silt loam.

The 2Bt and 2BC horizons have hue of 7.5YR to 2.5YR, value of 4 or 5, and chroma of 4 or 8. They are clay or silty clay except in some pedons, where in the upper few inches the 2Bt horizon is silty clay loam.

### Whitwell Series

The Whitwell series consists of very deep, moderately well drained soils. Permeability is moderate. These soils formed in loamy alluvium on low stream terraces along the larger streams. Slopes range from 0 to 3 percent.

Whitwell soils are near Atkins, Sequatchie, and Swafford soils. Atkins soils are poorly drained and have a cambic B horizon. Sequatchie soils are well drained. Swafford soils have a brittle layer in the subsoil.

Typical pedon of Whitwell loam, occasionally flooded, about 1,500 feet southeast of Stanfill Cemetery and 625 feet southwest of road in Elk Valley; (Pioneer Quadrangle); in a field:

Ap—0 to 6 inches; dark brown (10YR 3/3) loam; weak fine granular structure; friable; many fine and medium roots; neutral; abrupt smooth boundary.

BA—6 to 12 inches; dark yellowish brown (10YR 4/4)

loam; weak fine and medium subangular blocky structure; friable; many fine and medium roots; very strongly acid; clear smooth boundary.

Bt1—12 to 18 inches; yellowish brown (10YR 5/6) loam; moderate medium subangular blocky structure; friable; few fine and medium roots; few faint clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—18 to 30 inches; yellowish brown (10YR 5/6) loam; few prominent light brownish gray (2.5Y 6/2) mottles; moderate medium subangular blocky structure; friable; few fine roots; few faint clay films on faces of peds; very strongly acid; gradual smooth boundary.

BC—30 to 50 inches; yellowish brown (10YR 5/8) silt loam; few prominent light brownish gray (10YR 6/2) and yellowish red (5YR 5/8) mottles; weak medium subangular blocky structure; friable; few fine roots; very strongly acid; gradual smooth boundary.

C—50 to 60 inches; yellowish brown (10YR 5/8) loam; many prominent light brownish gray (10YR 6/2) and yellowish red (5YR 5/8) mottles; massive; friable; few fine roots; few black and brown concretions; very strongly acid.

The soils are strongly acid or very strongly acid, but where limed the surface layer is less acid. The solum ranges from 40 to 60 inches in thickness. Depth to bedrock is more than 60 inches. Small pebbles range from 0 to 5 percent in the solum and from 0 to 10 percent in the C horizon.

The Ap horizon has hue of 10YR, value of 3 or 4, and chroma of 2 to 4. Where it has value of 3, it is 6 inches thick or less. It is loam or silt loam.

The BA horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. It is loam or silt loam.

The Bt horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 4 or 6. In the lower part it has mottles in shades of brown and gray. Mottles with chroma of 2 or less are within a depth of 30 inches. The horizon is loam, silt loam, clay loam, or silty clay loam.

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

The C horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 2 to 8. It is loam or silt loam.

The BC and C horizons have mottles with chroma of 2 or less.



# Formation of the Soils

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D.A. Lietzke, Associate Professor of Soils, University of Tennessee, helped to prepare this section.

The origin and formation of the soils in Campbell County are discussed in this section. The five factors of soil formation and their influence on the development of different soils are described. The process of horizon development is related to the basic pedogenic processes of additions, losses, translocations, and transformations. It is also related to the soil-forming processes that result in the A, B, C horizon sequence.

## Factors of Soil Formation

The soils of Campbell County resulted from the actions and interactions of the five factors of soil formation: climate, living organisms, topography, parent material, and time. Each factor acts and interacts with and alters the effects of the other factors. The interaction of soils has resulted in a diverse variety and distribution of soils in Campbell County. Climate and biotic factors supply energy for soil development. Topography influences whether water enters the soil or runs off the surface. Parent material is acted on by factors that supply energy. Only time is neutral. Time does not directly affect any other factor, but time must pass for the soil-forming process to produce such visible results as differences in color, texture, and structure.

### Climate

The climate of Campbell County is relatively uniform. Its effects on the soil are uniform, except at the highest elevations in the Cumberland Mountains. Campbell County has warm summers, cool winters, and excessive precipitation in the form of rain. The rain that enters the soil is returned to the atmosphere by evaporation or transpiration by plants. Rain also percolates downward, carrying soluble material with it. Hence, most soils in Campbell County are acid and highly leached, even though the soils in the Powell Valley, for example, formed in carbonate rock. Water percolates through and weathers rock, softens it, and transforms it into parent material. The soils at higher

elevations have cooler temperatures and thus generally interact with biotic factors. Consequently, they have more organic matter in the A horizon.

### Living Organisms

Living organisms include all vegetation, the animals that live above and below the surface, bacteria, fungi, and all manner of grubs, larva, ants, and termites. The kind and amount of vegetation are generally responsible for the amount of organic matter in the O and A horizons of soils. The organic matter content of the horizon is also related to its color. As color darkens, organic matter increases. Typically, soils formed under trees have a thin, dark colored A horizon and a thicker, very light-colored E horizon.

A few soils in Campbell County formed under grass or weed vegetation in parent materials that have high amounts of nutrients. These soils have a thick, dark colored A horizon and do not have an underlying E horizon. Earthworms, ants, termites, and other burrowing critters make tunnels and thus help keep the soil open and porous. They also mix the organic matter from the O horizon into the mineral soil and carry mineral soil to the surface. Bacteria and fungi play a very important role in decomposing all organic matter and releasing nutrients for reuse by growing plants. Man, by clearing forests and plowing the land, has greatly altered many soils in Campbell County.

### Topography

Topography has two affects on soil formation. First, topography provides the pathways for fallen rainfall on the soil surface. If the land is nearly level, most water from precipitation will enter and percolate downward. If the subsoil is permeable, water will continue moving down and not saturate the soil. But, if the subsoil is not permeable, the water cannot move downward fast enough and the soil becomes saturated. Also, in some areas water even ponds on the surface.

On steep topography, most water runs off. Not much water enters the soil and moves downward. Soils on steep slopes tend to be less weathered and have less soil development because very little water enters and percolates downward.

Second, topography affects the stability of the parent material. Soils are most stable on nearly level and gently sloping landforms. They become less stable as slope increases. However, the kind of parent material and its properties greatly determine the stability of soil on a slope. Unstable soils on steep slopes tend to be young because the soils are stripped off. Unstable soils on steep slopes that are farmed are subject to very severe erosion.

Because of the interaction of topography and parent material, soils are generally deeper on nearly level landforms and shallower on steep landforms. Very shallow soils are in shale areas of the Cumberland Mountains. They are the result of steep topography, where most rainfall runs off, carrying particles of soil.

### Parent Material

The three major kinds of parent materials in Campbell County are: residuum, colluvium, and alluvium. Residuum is soil parent material that weathered in place from the underlying bedrock.

On the Cumberland Plateau, Pine Mountain, and Cumberland Escarpment, residuum derived from sandstone, siltstone, and shale of the Crab Orchard and Grizzard Groups. Lily and Ramsey soils formed in sandstone. Petros, Sequoia, and Muskingum soils formed in siltstone and shale. The parent material of these soils contained very little calcium carbonate and other plant nutrients. These kinds of parent materials and rainfall over a long period of time have resulted in highly leached, very acid soils.

In the Cumberland Mountains, residuum derived from sandstone, siltstone, shale, and coal of the Redoak Mountain Formation and shale of the Slatestone Formation. Petros, Muskingum, Sequoia, and Cutshin soils are dominant in the Cumberland Mountains. Bethesda soils formed on stripmined benches and outcrops.

The rest of the county, except for the Powell Valley, is underlain by carbonate rocks of the Knox Formation. This formation consists of dolomite containing small to large quantities of chert. As the rock weathers and soluble calcium and magnesium compounds leach out, chert and clay remain as residue. Most soils that form in residuum of carbonate rocks are very clayey. Fullerton and Talbott soils, for example, formed in the Knox Formation. Fullerton soils are clayey and have a high chert content. Talbott soils are also clayey, but have much less chert.

In the Powell Valley both the geology and the soil patterns are complicated. One part of the valley is underlain by Chickamauga Limestone. Collegedale, Bland, and Gladeville soils formed in residuum derived

from limestone. Another part of Powell Valley overlies interbedded, calcareous shale and limestone. Cynthiana soils formed in residuum derived from calcareous shale and limestone.

Colluvium is earthy material washed down steeper slopes to lower lying areas in coves and the lower parts of hillsides. Jefferson soils formed in colluvial parent material derived from sandstone and shale. Minvale soils formed in colluvium derived from cherty carbonate rocks.

Alluvium is earthy material washed into streams, transported downstream, and then deposited either on flood plains or low terraces of streams at flood stage. Atkins and Sewanee are examples of flood plain soils that formed from alluvium. Atkins soils are poorly drained and are subject to frequent flooding. Sewanee soils are moderately well drained and are subject to occasional flooding. Soils that formed in older alluvium on terraces have a more highly developed subsoil. Sequatchie and Whitwell are examples of terrace soils that have a well developed subsoil. Sequatchie soils are well drained, while Whitwell soils are slightly lower on the landscape and are moderately well drained.

The alluvium is much older in those areas underlain by carbonate rocks. Because of its age, the alluvium is generally dark red or red and has many small, round, black concretions. Etowah soils formed in old alluvium. Dewey soils formed both in old, dark red alluvium and in the underlying clayey residuum derived from the Knox Formation.

### Time

Time does not have a direct effect on the soil. But time must pass for the basic pedogenic processes of addition, losses, translocation, and transformation to affect and develop a soil profile. Very young soils are weakly developed and inherit most properties from parent material. Their horizons are indistinct. Commonly, stratification, or the geologic rock structure, is evident in very young soils. As time passes, a particular soil-forming process exerts a stronger influence. As soils become older, colors are generated and minerals weather to form clay. Soil horizons also become more distinct.

### Processes of Horizon Development

The effects of soil-forming processes can be observed in the different horizons or layers in the soil profile. The soil profile starts at the surface and extends to hard rock or to parent materials little altered by soil-forming processes. The O, A, E, B, and C horizons are the five master soil horizons.

Each master horizon can be subdivided as needed by use of such letter and number subscripts as Ap, Bt, or Bt1.

Soils that formed under trees always have an O (for organic) horizon at the surface. The A horizon, the uppermost mineral horizon, must have an accumulation of incorporated organic matter. When plowed, it becomes an Ap (for plowed) horizon (fig. 7). The E horizon has very little organic matter because clay has been translocated downward. The E horizon is lighter in color than either the A or B horizon. It is characterized by net losses of clay, iron, aluminum, organic matter, and other compounds. It is commonly the most acid of all horizons in a natural forest soil.

The B horizon underlies the A and E horizons and is commonly called the subsoil. It has accumulated iron and aluminum compounds and clay translocated from the A and E horizons. In Campbell County, the B horizon of most soils is higher in clay content than the horizons above or the C horizon below. The B horizon commonly has blocky structure, which is larger than granular structure in the A and E horizons.

The C horizon consists of earthy material little altered by soil-forming processes. It retains many characteristics of the underlying weathered rock or of colluvium or alluvium and has little or no soil structure.

The major soil-forming process in Campbell County is the formation of soils with a clay-enriched Bt ("t" for clay accumulation) horizon. This process takes thousands of years. In young soils a Bw ("w" for

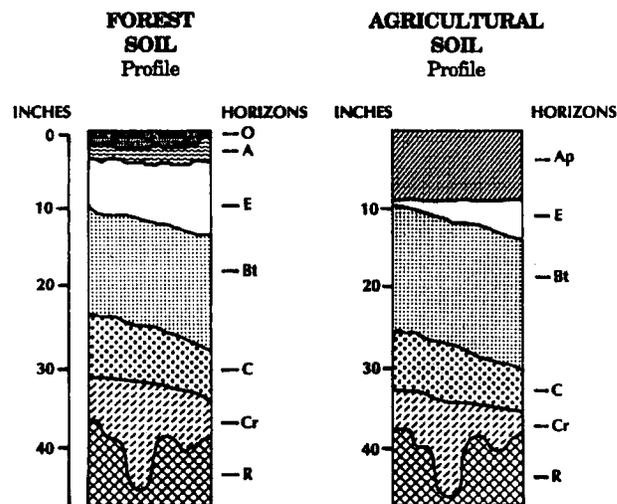


Figure 7.—These soil profiles show the difference between a forest soil with O and A horizons and an agricultural soil with an Ap horizon.

formation of soil structure) horizon is common because insufficient clay has accumulated for it to be a Bt horizon. Muskingum, Petros, and Ramsey soils have a Bw horizon. Lily, Jefferson, and some other soils have a Bt horizon. Inceptisols have a Bw horizon. Alfisols or Ultisols have a Bt horizon.

Another soil-forming process takes place in wet soils. Wet soils have a Bg ("g" for gray color in the B horizon) or Btg horizon. The gray color results from intense iron reduction under constant or fluctuating water tables. Atkins soils, for example, formed in wet conditions while the water table was high.



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# Glossary

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**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.

**Alluvium.** Material, such as sand, silt, or clay, deposited on land by streams.

**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.

**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 40-inch profile or to a limiting layer is expressed as:

Very low .....	0 to 2
Low .....	2 to 4
Moderate .....	4 to 6
High .....	more than 6

**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.

**Bisequum.** Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

**Bottom land.** The normal flood plain of a stream, subject to flooding.

**Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.

**Canopy.** The leafy crown of trees or shrubs. (See Crown.)

**Catena.** A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but have different characteristics as a result of differences in relief and drainage.

**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.

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

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

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

**Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

**Cobbly soil material.** Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25

centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

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

**Complex, soil.** A map unit of two or more kinds of soil 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.

**Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.

**Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

**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.
- 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 (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.
- Escarpment.** A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Synonym: scarp.
- 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.
- Fast intake** (in tables). The rapid movement of water into the soil.
- 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.
- Flood plain.** A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.
- Foot slope.** The inclined surface at the base of a hill.
- Fragipan.** A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.
- 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.
- 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 more than 15 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.
- Ground water.** Water filling all the unblocked pores of the material below the water table.
- 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.

**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.

**Igneous rock.** Rock formed by solidification from a molten or partially molten state. Major varieties include plutonic and volcanic rock. Examples are andesite, basalt, and granite.

**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.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

**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.

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are:

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Corrugation.*—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

*Drip (or trickle).*—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

*Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

*Wild flooding.*—Water, released at high points, is allowed to flow onto an area without controlled distribution.

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

**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.

**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.

**Low strength.** The soil is not strong enough to support loads.

**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.

**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).

**Mountain.** A natural elevation of the land surface, rising more than 1,000 feet above surrounding lowlands, commonly of restricted summit area (relative to a plateau) and generally having steep sides. A mountain can occur as a single, isolated mass or in a group forming a chain or range.

**Mudstone.** Sedimentary rock formed by induration of silt and clay in approximately equal amounts.

**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.)

**Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Low .....	less than 2.0 percent
Moderate .....	2.0 to 4.0 percent
High .....	more than 4.0 percent

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedon.** The smallest volume that can be called “a soil.” A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10

square meters), depending on the variability of the soil.

**Percolation.** The downward movement of water through the soil.

**Percs slowly** (in tables). The slow movement of water through the soil adversely affects the specified use.

**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:

Very slow .....	less than 0.06 inch
Slow .....	0.06 to 0.2 inch
Moderately slow .....	0.2 to 0.6 inch
Moderate .....	0.6 inch to 2.0 inches
Moderately rapid .....	2.0 to 6.0 inches
Rapid .....	more than 6.0 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.)

**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.

**Plateau.** An extensive upland mass with relatively flat summit area that is considerably elevated (more than 100 meters) above adjacent lowlands and separated from them on one or more sides by escarpments.

**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.

**Poorly graded.** Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Poor outlets** (in tables). Refers to areas where surface or subsurface drainage outlets are difficult or expensive to install.

**Productivity, soil.** The capability of a soil for producing a specified plant or sequence of plants under specific management.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Reaction, soil.** A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The 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.

**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.

**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.

**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.

**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.

**Slippage** (in tables). Soil mass susceptible to movement downslope when loaded, excavated, or wet.

**Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance. In this survey, classes for simple slopes are as follows:

Level .....	0 to 3 percent
Gently sloping .....	2 to 5 percent
Sloping .....	5 to 12 percent
Moderately steep .....	12 to 25 percent
Steep .....	20 to 50 percent
Very steep .....	50 percent and higher

Classes for complex slopes are as follows:

Nearly level .....	0 to 3 percent
Undulating .....	2 to 5 percent
Rolling .....	5 to 12 percent
Hilly .....	12 to 25 percent
Steep .....	20 to 50 percent
Very steep .....	50 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.

**Slow intake** (in tables). The slow movement of water into the soil.

**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.

**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).

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

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Surface soil.** The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

**Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

**Terrace** (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic

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

**Thin layer** (in tables). Otherwise suitable soil material 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.

**Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Upland.** Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

**Weathering.** All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

**Well graded.** Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

**Windthrow.** The uprooting and tipping over of trees by the wind.

# Tables

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Table 1.--Temperature and Precipitation  
(Recorded in the period 1952-86 at Oneida, Tennessee)

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have--		Average number of growing degree days*	2 years in 10 will have--			Average number of days with snowfall 0.10 inch or more	
				Maximum temperature higher than--	Minimum temperature lower than--		Less than--	More than--	In		
°F	°F	°F	°F	°F	Units	In	In	In	In		
January----	42.8	19.7	31.3	68	1	16	4.48	2.62	6.19	9	5.1
February----	47.4	22.5	35.0	74	1	20	4.37	2.45	5.73	9	4.0
March-----	57.9	31.3	44.6	80	8	49	5.48	3.31	7.44	10	.5
April-----	68.5	39.3	53.9	87	21	154	4.58	2.90	6.09	9	.1
May-----	75.2	47.5	61.4	88	29	361	4.90	3.16	6.62	9	.0
June-----	82.0	56.5	69.3	92	39	579	4.52	2.45	6.44	8	.0
July-----	85.0	61.0	73.0	94	48	713	5.11	2.66	7.21	9	.0
August-----	84.2	59.8	72.0	94	45	682	3.90	1.99	5.62	7	.0
September---	78.8	53.4	66.1	91	33	483	3.72	1.99	5.29	6	.0
October-----	69.4	40.6	55.0	86	22	199	3.66	1.58	5.43	7	.0
November----	58.5	32.3	45.4	78	11	46	4.41	2.67	6.09	8	.7
December----	48.5	24.3	36.1	70	11	19	4.44	2.35	6.21	9	1.7
Yearly:											
Average----	66.5	40.7	53.6	---	---	---	---	---	---	---	---
Extreme----	---	---	---	96	11	---	---	---	---	---	---
Total-----	---	---	---	---	---	3,321	53.57	47.00	60.90	100	12.1

\* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

Table 2.--Freeze Dates in Spring and Fall  
(Recorded in the period 1952-86 at Oneida, Tennessee)

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. 20	May 5	May 19
2 years in 10 later than--	Apr. 14	Apr. 28	May 13
5 years in 10 later than--	Apr. 3	Apr. 16	May 2
First freezing temperature in fall:			
1 year in 10 earlier than--	Oct. 17	Oct. 9	Sept. 28
2 years in 10 earlier than--	Oct. 24	Oct. 14	Oct. 3
5 years in 10 earlier than--	Nov. 5	Oct. 23	Oct. 12

Table 3.--Growing Season

(Recorded in the period 1952-86 at Oneida, Tennessee)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	<u>Days</u>	<u>Days</u>	<u>Days</u>
9 years in 10	189	169	139
8 years in 10	198	176	147
5 years in 10	215	190	163
2 years in 10	232	203	179
1 year in 10	241	210	187

Table 4.--Acreage and Proportionate Extent of the Soils

Map symbol	Soil name	Acres	Percent
AeD2	Allen loam, 10 to 25 percent slopes, eroded-----	294	0.1
At	Atkins silt loam, frequently flooded-----	1,250	0.4
Be	Bethesda channery silt loam, benches and out-slopes-----	30,408	9.6
BrF	Bland-Rock outcrop complex, 30 to 50 percent slopes-----	407	0.1
CaC	Claiborne silt loam, 5 to 12 percent slopes-----	452	0.1
CaD	Claiborne silt loam, 12 to 25 percent slopes-----	1,694	0.5
CaE	Claiborne silt loam, 25 to 45 percent slopes-----	2,532	0.8
CoB	Collegedale silt loam, 2 to 5 percent slopes-----	379	0.1
CoC	Collegedale silt loam, 5 to 12 percent slopes-----	1,501	0.5
CoC2	Collegedale silt loam, 5 to 12 percent slopes, eroded-----	3,621	1.1
CoD2	Collegedale silt loam, 12 to 25 percent slopes, eroded-----	440	0.1
CrD2	Collegedale-Rock outcrop complex, 5 to 20 percent slopes, eroded-----	3,756	1.2
CrE2	Collegedale-Rock outcrop complex, 20 to 35 percent slopes, eroded-----	392	0.1
CuF	Cutshin channery silt loam, 35 to 60 percent slopes-----	560	0.2
CyE2	Cynthiana flaggy silty clay loam, 10 to 35 percent slopes, eroded, rocky-----	328	0.1
DeD	Dewey silt loam, 12 to 25 percent slopes-----	691	0.2
Ea	Ealy loam, occasionally flooded-----	1,689	0.5
EtB	Etowah silt loam, 2 to 5 percent slopes-----	887	0.3
EtC	Etowah silt loam, 5 to 12 percent slopes-----	289	0.1
FaC	Fullerton gravelly silt loam, 5 to 12 percent slopes-----	8,060	2.6
FbD	Fullerton and Bodine gravelly silt loams, 12 to 25 percent slopes-----	18,841	5.9
FbF	Fullerton and Bodine gravelly silt loams, 25 to 70 percent slopes-----	30,754	9.7
GrD	Gladeville-Rock outcrop complex, 5 to 25 percent slopes-----	2,524	0.8
Ha	Hamblen silt loam, occasionally flooded-----	851	0.3
JeC	Jefferson gravelly loam, 5 to 15 percent slopes-----	2,372	0.7
JeD	Jefferson gravelly loam, 15 to 25 percent slopes-----	760	0.2
JgF	Jefferson-Grimsley complex, 30 to 60 percent slopes-----	40,781	12.9
LyC	Lily fine sandy loam, 5 to 15 percent slopes-----	4,219	1.3
MaD	Minvale gravelly loam, 15 to 25 percent slopes-----	748	0.2
MkF	Muskingum-Sequoia-Petros complex, 30 to 60 percent slopes-----	93,777	29.6
MpF	Muskingum-Petros complex, 30 to 60 percent slopes-----	9,284	2.9
Pt	Pits, quarry-----	285	0.1
RaF	Ramsey-Rock outcrop complex, 30 to 65 percent slopes-----	27,081	8.5
SaB	Sequatchie loam, 1 to 5 percent slopes, occasionally flooded-----	334	0.1
SeC2	Sequoia silt loam, 5 to 12 percent slopes, eroded-----	2,843	0.9
SeC3	Sequoia silty clay loam, 5 to 15 percent slopes, severely eroded-----	838	0.3
SeD2	Sequoia silt loam, 12 to 25 percent slopes, eroded-----	678	0.2
SeD3	Sequoia silty clay loam, 15 to 25 percent slopes, severely eroded-----	1,548	0.5
SeE2	Sequoia silt loam, 25 to 45 percent slopes, eroded-----	607	0.2
Sn	Sewanee silt loam, occasionally flooded-----	639	0.2
Sw	Swafford loam, occasionally flooded-----	175	0.1
TaF	Talbott-Rock outcrop complex, 30 to 50 percent slopes-----	5,959	1.9
Wh	Whitwell loam, occasionally flooded-----	972	0.3
	Water-----	11,000	3.5
	Total-----	317,500	100.0

Table 5.--Prime Farmland

(Only the soils considered prime farmland are listed. Urban or built-up areas of the soils listed are not considered prime farmland. If a soil is prime farmland only under certain conditions, the conditions are specified in parentheses after the soil name)

Map symbol	Soil name
CoB	Collegedale silt loam, 2 to 5 percent slopes
Ea	Ealy loam, occasionally flooded
EtB	Etowah silt loam, 2 to 5 percent slopes
Ha	Hamblen silt loam, occasionally flooded
SaB	Sequatchie loam, 1 to 5 percent slopes, occasionally flooded
Sn	Sewanee silt loam, occasionally flooded
Sw	Swafford loam, occasionally flooded
Wh	Whitwell loam, occasionally flooded

Table 6.--Land Capability Classes 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	Tall fescue- ladino
		<u>Bu</u>	<u>Bu</u>	<u>Lbs</u>	<u>Bu</u>	<u>Tons</u>	<u>AUM*</u>
AeD2----- Allen	IVe	70	26	1,850	45	2.8	6.0
At----- Atkins	IVw	70	25	---	---	---	5.5
Be----- Bethesda	VIIIs	---	---	---	---	---	---
BrF**----- Bland-Rock outcrop	VIIIs	---	---	---	---	---	---
CaC----- Claiborne	IIIe	85	32	2,600	50	3.8	6.5
CaD----- Claiborne	IVe	75	28	2,200	46	3.5	6.0
CaE----- Claiborne	VIe	---	---	---	---	---	5.5
CoB----- Collegedale	IIIe	80	28	2,200	48	3.2	6.0
CoC----- Collegedale	IVe	70	25	2,000	45	3.0	5.5
CoC2----- Collegedale	IVe	60	---	1,900	42	2.8	5.5
CoD2----- Collegedale	VIe	---	---	---	---	2.5	5.0
CrD2**----- Collegedale- Rock outcrop	VIIs	---	---	---	---	---	4.0
CrE2**----- Collegedale- Rock outcrop	VIIIs	---	---	---	---	---	3.5
CuF----- Cutshin	VIIe	---	---	---	---	---	---
CyE2----- Cynthiana	VIIIs	---	---	---	---	---	---
DeD----- Dewey	IVe	70	---	1,800	45	3.5	6.0
Ea----- Ealy	IIw	100	36	---	40	3.5	8.0
EtB----- Etowah	IIe	115	42	2,900	55	4.2	7.5

See footnotes at end of table.

Table 6.--Land Capability Classes and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Tobacco	Wheat	Alfalfa hay	Tall fescue- ladino
		Bu	Bu	Lbs	Bu	Tons	AUM*
EtC----- Etowah	IIIe	105	38	2,750	52	4.0	7.0
FaC----- Fullerton	IIIe	75	28	1,950	45	2.8	5.5
FbD----- Fullerton and Bodine	VIe	---	---	---	---	2.5	4.5
FbF----- Fullerton and Bodine	VIIe	---	---	---	---	---	---
GrD*----- Gladeville- Rock outcrop	VIIIs	---	---	---	---	---	---
Ha----- Hamblen	IIw	100	38	---	---	---	8.0
JeC----- Jefferson	IIIe	85	30	2,400	45	3.5	6.5
JeD----- Jefferson	VIe	---	---	---	---	---	6.0
JgF----- Jefferson- Grimsley	VIIe	---	---	---	---	---	---
LyC----- Lily	IIIe	80	28	2,200	40	---	6.0
MaD----- Minvale	VIe	---	---	---	---	---	6.0
MkF----- Muskingum- Sequoia-Petros	VIIe	---	---	---	---	---	---
MpF----- Muskingum- Petros	VIIe	---	---	---	---	---	---
Pt**. Pits							
RaF*----- Ramsey-Rock outcrop	VIIIs	---	---	---	---	---	---
SaB----- Sequatchie	IIe	110	40	2,300	55	3.8	7.5
SeC2----- Sequoia	IVe	---	---	---	35	---	5.0
SeC3----- Sequoia	VIe	---	---	---	---	---	4.0

See footnotes at end of table.

Table 6.--Land Capability Classes and Yields per Acre of Crops and Pasture--Continued

Soil name and map symbol	Land capability	Corn	Soybeans	Tobacco	Wheat	Alfalfa hay	Tall fescue- ladino
		<u>Bu</u>	<u>Bu</u>	<u>Lbs</u>	<u>Bu</u>	<u>Tons</u>	<u>AUM*</u>
SeD2----- Sequoia	VIe	---	---	---	---	---	4.0
SeD3----- Sequoia	VIIe	---	---	---	---	---	3.5
SeE2----- Sequoia	VIIe	---	---	---	---	---	---
Sn----- Sewanee	IIw	90	38	---	---	---	7.5
Sw----- Swafford	IIw	110	40	2,100	45	---	7.5
TaF**----- Talbot-Rock outcrop	VIIIs	---	---	---	---	---	---
Wh----- Whitwell	IIw	105	38	2,000	40	---	7.5

\* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

\*\* See description of the map unit for composition and behavior characteristics of the map unit.

Table 7.--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	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Common trees	Site index	Volume*	
AeD2----- Allen	Moderate	Moderate	Slight	Slight	Moderate	Yellow-poplar----- Shortleaf pine-----	87 72	86 114	Yellow-poplar, loblolly pine, shortleaf pine.
At----- Atkins	Slight	Severe	Severe	Moderate	Severe	Pin oak----- Loblolly pine----- Sweetgum----- Eastern cottonwood-- Red maple----- American sycamore--	100 83 95 105 --- ---	57 114 114 143 -- --	Eastern white pine, white spruce.
Be----- Bethesda	Moderate	Severe	Severe	Slight	Slight	Yellow-poplar----- Black locust----- Black cherry-----	90 --- ---	86 --- ---	Eastern white pine, scotch pine, black locust, Virginia pine.
BrF**: Bland-----	Severe	Severe	Moderate	Slight	Moderate	Northern red oak---- Virginia pine-----	70 70	57 114	Eastern white pine, Virginia pine.
Rock outcrop.									
CaC----- Claiborne	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar----- Shortleaf pine----- White oak----- Northern red oak---- Black oak-----	90 66 70 70 70	86 100 57 57 57	Yellow-poplar, black walnut, shortleaf pine, loblolly pine.
CaD----- Claiborne	Moderate	Moderate	Slight	Slight	Moderate	Yellow-poplar----- Shortleaf pine----- White oak----- Northern red oak---- Black oak-----	90 66 70 70 70	86 100 57 57 57	Yellow-poplar, black walnut, shortleaf pine, loblolly pine.
CaE----- Claiborne	Severe	Severe	Slight	Slight	Moderate	Yellow-poplar----- Shortleaf pine----- White oak----- Northern red oak---- Black oak-----	90 66 70 70 70	86 100 57 57 57	Yellow-poplar, black walnut, shortleaf pine, loblolly pine.
CoB, CoC, CoC2-- Collegedale	Slight	Moderate	Slight	Slight	Moderate	Southern red oak---- Yellow-poplar----- White oak----- Shortleaf pine----- Virginia pine----- Loblolly pine-----	70 90 70 70 70 80	57 86 57 114 114 114	Yellow-poplar, shortleaf pine, Virginia pine, loblolly 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	Equip-ment limita-tion	Seedling mortal-ity	Wind-throw hazard	Plant competi-tion	Common trees	Site index	Volume*	
CoD2----- Collegedale	Moderate	Moderate	Slight	Slight	Moderate	Southern red oak----- Yellow-poplar----- White oak----- Shortleaf pine----- Virginia pine----- Loblolly pine-----	70 90 70 70 70 80	57 86 57 114 114 114	Yellow-poplar, shortleaf pine, Virginia pine, loblolly pine.
CrD2**: Collegedale----	Slight	Moderate	Slight	Slight	Moderate	Southern red oak----- Yellow-poplar----- White oak----- Shortleaf pine----- Virginia pine----- Loblolly pine-----	70 90 70 70 70 80	57 86 57 114 114 114	Yellow-poplar, shortleaf pine, Virginia pine, loblolly pine.
Rock outcrop.									
CrE2**: Collegedale----	Moderate	Moderate	Slight	Slight	Moderate	Southern red oak----- Yellow-poplar----- White oak----- Shortleaf pine----- Virginia pine----- Loblolly pine-----	70 90 70 70 70 80	57 86 57 114 114 114	Yellow-poplar, shortleaf pine, Virginia pine, loblolly pine.
Rock outcrop.									
CuF----- Cutshin	Severe	Severe	Slight	Slight	Severe	Yellow-poplar----- Northern red oak----- Black walnut----- Sugar maple----- White oak----- Black oak----- White ash-----	108 85 --- --- 78 83 ---	114 57 -- -- 57 57 ---	Yellow-poplar, black walnut, white ash, shortleaf pine, eastern white pine, northern red oak, white oak.
CyE2----- Cynthiana	Severe	Severe	Moderate	Severe	Slight	Eastern redcedar----- Hickory----- Hackberry----- Black walnut----- Black locust-----	42 --- --- --- 75	43 -- -- -- 43	Eastern redcedar, Virginia pine, white ash.
Ea----- Ealy	Slight	Slight	Moderate	Slight	Severe	Yellow-poplar----- Southern red oak----- Shortleaf pine----- Eastern white pine-- American sycamore---	100 80 80 90 90	114 57 129 172 100	Yellow-poplar, black walnut, loblolly pine, eastern white pine.
EtB----- Etowah	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar----- Southern red oak----- Loblolly pine----- Shortleaf pine-----	90 80 90 80	86 57 129 129	Yellow-poplar, loblolly 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	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Volume*	
EtC----- Etowah	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar----- Southern red oak---- Loblolly pine----- Shortleaf pine-----	90 80 90 80	86 57 129 129	Yellow-poplar, loblolly pine.
FaC----- Fullerton	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar----- Southern red oak---- Shortleaf pine-----	90 70 70	86 57 114	Yellow-poplar, loblolly pine.
FbD**: Fullerton-----	Moderate	Moderate	Slight	Slight	Moderate	Yellow-poplar----- Southern red oak---- Shortleaf pine-----	90 70 70	86 57 114	Yellow-poplar, loblolly pine.
Bodine-----	Moderate	Moderate	Slight	Slight	Moderate	Southern red oak---- Yellow-poplar----- Shortleaf pine----- Black oak-----	70 90 70 70	57 86 114 57	Loblolly pine, shortleaf pine.
FbF**: Fullerton-----	Severe	Severe	Slight	Slight	Moderate	Yellow-poplar----- Southern red oak---- Shortleaf pine-----	90 70 70	86 57 114	Yellow-poplar, loblolly pine.
Bodine-----	Severe	Severe	Slight	Slight	Moderate	Southern red oak---- Yellow-poplar----- Shortleaf pine----- Black oak-----	70 90 70 70	57 86 114 57	Loblolly pine, shortleaf pine.
GrD**: Gladeville-----	Slight	Moderate	Severe	Severe	Slight	Eastern redcedar-----	35	29	Eastern redcedar.
Rock outcrop.									
Ha----- Hamblen	Slight	Slight	Slight	Slight	Severe	Yellow-poplar----- Northern red oak---- Loblolly pine-----	100 80 90	114 57 129	Loblolly pine, yellow-poplar.
JeC----- Jefferson	Slight	Slight	Slight	Slight	Moderate	Shortleaf pine----- Yellow-poplar----- White oak----- Northern red oak----	75 108 --- 85	114 114 -- 57	Eastern white pine, yellow- poplar, shortleaf pine.
JeD----- Jefferson	Moderate	Moderate	Slight	Slight	Moderate	Northern red oak---- Yellow-poplar----- Shortleaf pine----- White oak-----	85 108 75	57 114 114	Yellow-poplar, eastern white pine, shortleaf pine.
JgF**: Jefferson-----	Severe	Severe	Slight	Slight	Moderate	Northern red oak---- Yellow-poplar----- Shortleaf pine----- White oak-----	85 108 75 ---	57 114 114 --	Yellow-poplar, eastern white pine, 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	Equip- ment limita- tion	Seedling mortal- ity	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Volume*	
JgF**:									
Grimsley-----	Moderate	Severe	Slight	Slight	Moderate	Yellow-poplar-----	90	86	Yellow-poplar, loblolly pine, shortleaf pine.
						Northern red oak----	75	57	
						Shortleaf pine-----	70	114	
LyC-----	Slight	Slight	Slight	Slight	Moderate	Shortleaf pine-----	63	100	Shortleaf pine.
Lily						Virginia pine-----	80	114	
						Black oak-----	78	57	
						White oak-----	73	57	
						Chestnut oak-----	73	57	
						Northern red oak----	78	57	
MaD-----	Moderate	Moderate	Slight	Slight	Moderate	Yellow-poplar-----	90	86	Yellow-poplar, black walnut, loblolly pine.
Minvale						White oak-----	70	57	
						Shortleaf pine-----	70	114	
						Loblolly pine-----	80	114	
						Virginia pine-----	70	114	
MkF**:									
Muskingum-----	Moderate	Severe	Slight	Slight	-----	Northern red oak----	78	57	Yellow-poplar, Virginia pine, eastern white pine, shortleaf pine, black walnut.
						Yellow-poplar-----	95	100	
						Virginia pine-----	75	114	
						Eastern white pine--	85	157	
						Shortleaf pine-----	80	129	
Sequoia-----	Severe	Severe	Slight	Slight	Moderate	Northern red oak----	70	57	Shortleaf pine, Virginia pine.
						Shortleaf pine-----	63	100	
						Virginia pine-----	71	114	
Petros-----	Moderate	Severe	Moderate	Severe	Slight	Northern red oak----	60	43	Virginia pine, shortleaf pine.
						Virginia pine-----	60	86	
						Black oak-----	60	43	
MpF**:									
Muskingum-----	Moderate	Severe	Slight	Slight	-----	Northern red oak----	78	57	Yellow-poplar, Virginia pine, eastern white pine, shortleaf pine, black walnut.
						Yellow-poplar-----	95	100	
						Virginia pine-----	75	114	
						Eastern white pine--	85	157	
						Shortleaf pine-----	80	129	
Petros-----	Moderate	Severe	Moderate	Severe	Slight	Southern red oak----	60	43	Virginia pine, shortleaf pine, loblolly pine.
						Virginia pine-----	60	86	
						Black oak-----	60	43	
						Loblolly pine-----	70	86	
RaF**:									
Ramsey-----	Moderate	Severe	Moderate	Severe	Slight	Northern red oak----	60	43	Eastern white pine, shortleaf pine, Virginia pine, loblolly pine.
						Shortleaf pine-----	59	86	
						White oak-----	61	43	
						Virginia pine-----	60	86	

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	Wind- throw hazard	Plant competi- tion	Common trees	Site index	Volume*	
RaF**: Rock outcrop.									
SaB----- Sequatchie	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar----- White oak----- Loblolly pine-----	100 80 90	114 57 129	Yellow-poplar, black walnut, loblolly pine.
SeC2----- Sequoia	Slight	Slight	Slight	Slight	Moderate	Northern red oak---- Loblolly pine----- Shortleaf pine----- Virginia pine-----	70 83 63 66	57 114 100 100	Loblolly pine, shortleaf pine, Virginia pine.
SeC3----- Sequoia	Slight	Moderate	Moderate	Slight	Moderate	Northern red oak---- Loblolly pine----- Shortleaf pine----- Virginia pine-----	60 70 60 60	43 86 86 86	Loblolly pine, shortleaf pine, Virginia pine.
SeD2----- Sequoia	Moderate	Moderate	Slight	Slight	Moderate	Northern red oak---- Loblolly pine----- Shortleaf pine----- Virginia pine-----	70 83 63 66	57 114 100 100	Loblolly pine, shortleaf pine, Virginia pine.
SeD3----- Sequoia	Slight	Moderate	Moderate	Slight	Moderate	Northern red oak---- Loblolly pine----- Shortleaf pine----- Virginia pine-----	60 70 60 60	43 86 86 86	Loblolly pine, shortleaf pine, Virginia pine.
SeE2----- Sequoia	Severe	Severe	Slight	Slight	Moderate	Northern red oak---- Loblolly pine----- Shortleaf pine----- Virginia pine-----	70 83 63 66	57 114 100 100	Loblolly pine, shortleaf pine, Virginia pine.
Sn----- Sewanee	Slight	Moderate	Slight	Slight	Severe	Yellow-poplar----- Loblolly pine----- Southern red oak---- Shortleaf pine----- Sweetgum----- Eastern white pine--	100 85 80 80 90 90	114 114 57 129 100 172	Loblolly pine, yellow-poplar, eastern white pine, eastern cottonwood.
Sw----- Swafford	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar----- Northern red oak---- Sweetgum-----	95 75 90	100 57 100	Yellow-poplar, loblolly pine, sweetgum.
TaF**: Talbot	Severe	Severe	Slight	Slight	Moderate	Northern red oak---- Loblolly pine----- Shortleaf pine----- Eastern redcedar----	65 80 64 46	43 114 100 57	Loblolly pine, shortleaf pine, eastern redcedar, Virginia pine.
Rock outcrop.									
Wh----- Whitwell	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar----- Northern red oak---- Sweetgum----- Loblolly pine----- Eastern white pine--	95 75 90 90 90	100 57 100 129 172	Loblolly pine, eastern white pine, sweetgum.

\* Productivity class is the yield in cubic meters per hectare 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
AeD2----- Allen	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
At----- Atkins	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Be----- Bethesda	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: droughty, slope.
BrF*: Bland-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rock outcrop.					
CaC----- Claiborne	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: small stones, slope.
CaD----- Claiborne	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
CaE----- Claiborne	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
CoB----- Collegedale	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Severe: erodes easily.	Slight.
CoC, CoC2----- Collegedale	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CoD2----- Collegedale	Severe: slope.	Severe: slope.	Severe: slope.	Severe: erodes easily.	Severe: slope.
CrD2*: Collegedale-----	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
Rock outcrop.					
CrE2*: Collegedale-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, erodes easily.	Severe: slope.
Rock outcrop.					

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
CuF----- Cutshin	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
CyE2----- Cynthiana	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: large stones, slope, small stones.	Severe: erodes easily.	Severe: slope, thin layer.
DeD----- Dewey	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
Ea----- Ealy	Severe: flooding.	Slight-----	Moderate: small stones, flooding.	Slight-----	Moderate: flooding.
EtB----- Etowah	Slight-----	Slight-----	Moderate: slope, small stones.	Slight-----	Slight.
EtC----- Etowah	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope.
FaC----- Fullerton	Severe: small stones.	Severe: small stones.	Severe: slope, small stones.	Slight-----	Severe: small stones.
FbD*: Fullerton-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Moderate: slope.	Severe: small stones, slope.
Bodine-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones.	Severe: small stones, slope.
FbF*: Fullerton-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope.	Severe: small stones, slope.
Bodine-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, small stones.	Severe: small stones, slope.
GrD*: Gladeville-----	Severe: slope, small stones.	Severe: slope, small stones.	Severe: large stones, slope, small stones.	Severe: small stones.	Severe: small stones, slope, depth to rock.
Rock outcrop.					
Ha----- Hamblen	Severe: flooding.	Moderate: wetness.	Moderate: wetness, flooding.	Slight-----	Moderate: flooding.
JeC----- Jefferson	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Slight-----	Moderate: small stones, 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
JeD----- Jefferson	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope.	Severe: slope.
JgF*: Jefferson-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Grimsley-----	Severe: slope.	Severe: slope.	Severe: slope, large stones, small stones.	Severe: slope.	Severe: slope.
LyC----- Lily	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: slope, depth to rock.
MaD----- Minvale	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
MkF*: Muskingum-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope, erodes easily.	Severe: slope.
Sequoia-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Petros-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
MpF*: Muskingum-----	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope, erodes easily.	Severe: slope.
Petros-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
Pt*. Pits					
RaF*: Ramsey-----	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.	Severe: slope, depth to rock.
Rock outcrop.					
SaB----- Sequatchie	Severe: flooding.	Slight-----	Moderate: slope, small stones.	Slight-----	Moderate: large stones, flooding.
SeC2, SeC3----- Sequoia	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight-----	Moderate: droughty, 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
SeD2, SeD3----- Sequoia	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.
SeE2----- Sequoia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sn----- Sewanee	Severe: flooding, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness, flooding.
Sw----- Swafford	Severe: flooding.	Moderate: wetness, percs slowly.	Moderate: small stones, wetness.	Slight-----	Slight.
TaF*: Talbot-----  Rock outcrop.	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.	Severe: slope.
Wh----- Whitwell	Severe: flooding.	Moderate: wetness.	Moderate: small stones, wetness.	Slight-----	Moderate: flooding.

\* 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
AeD2----- Allen	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
At----- Atkins	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
Be----- Bethesda	Very poor.	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.
BrF*: Bland----- Rock outcrop.	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
CaC, CaD----- Claiborne	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CaE----- Claiborne	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CoB----- Collegedale	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
CoC, CoC2----- Collegedale	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CoD2----- Collegedale	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CrD2*: Collegedale----- Rock outcrop.	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
CrE2*: Collegedale----- Rock outcrop.	Very poor.	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
CuF----- Cutshin	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
CyE2----- Cynthiana	Poor	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
DeD----- Dewey	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Ea----- Ealy	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
EtB----- Etowah	Good	Good	Good	Good	Good	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
EtC----- Etowah	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FaC----- Fullerton	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
FbD*: Fullerton-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Bodine-----	Poor	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
FbF*: Fullerton-----	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Bodine-----	Very poor.	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Poor	Very poor.
GrD*: Gladeville-----	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Rock outcrop.										
Ha----- Hamblen	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
JeC----- Jefferson	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
JeD----- Jefferson	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
JgF*: Jefferson-----	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Grimsley-----	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
LyC----- Lily	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
MaD----- Minvale	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
MkF*: Muskingum-----	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Sequoia-----	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Petros-----	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	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
MpF*:										
Muskingum-----	Very poor.	Poor	Good	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Petros-----	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
Pt*. Pits										
RaF*:										
Ramsey-----	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Rock outcrop.										
SaB-----	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Sequatchie										
SeC2, SeC3-----	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Sequoia										
SeD2, SeD3-----	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Sequoia										
SeE2-----	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Fair	Very poor.
Sequoia										
Sn-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Sewanee										
Sw-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Swafford										
TaF*:										
Talbott-----	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Rock outcrop.										
Wh-----	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Whitwell										

\* 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." Absence of an entry indicates that the soil was not rated. 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
AeD2----- Allen	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
At----- Atkins	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness, frost action.	Severe: wetness, flooding.
Be----- Bethesda	Severe: slope.	Severe: slope, unstable fill.	Severe: slope, unstable fill.	Severe: slope, unstable fill.	Severe: slope, unstable fill.	Severe: droughty, slope.
BrF*: Bland-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rock outcrop.						
CaC----- Claiborne	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: small stones, slope.
CaD, CaE----- Claiborne	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
CoB----- Collegedale	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
CoC, CoC2----- Collegedale	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
CoD2----- Collegedale	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
CrD2*: Collegedale-----	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: slope.
Rock outcrop.						
CrE2*: Collegedale-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rock outcrop.						

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
CuF----- Cutshin	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
CyE2----- 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, thin layer.
DeD----- Dewey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Ea----- Ealy	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
EtB----- Etawah	Moderate: too clayey.	Slight-----	Slight-----	Slight-----	Moderate: low strength.	Slight.
EtC----- Etawah	Moderate: too clayey, slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.	Moderate: slope.
FaC----- Fullerton	Moderate: too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: shrink-swell, low strength, slope.	Severe: small stones.
FbD*, FbF*: Fullerton-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
Bodine-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: small stones, slope.
GrD*: Gladeville-----	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: small stones, slope, depth to rock.
Rock outcrop.						
Ha----- Hamblen	Moderate: wetness, flooding.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: flooding.
JeC----- Jefferson	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: small stones, slope.
JeD----- Jefferson	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
JgF*: Jefferson-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Grimsley-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: 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
LyC----- Lily	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: depth to rock, slope.	Moderate: slope, depth to rock.
MaD----- Minvale	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
MkF*: Muskingum-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Sequoia-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Petros-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
MpF*: Muskingum-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Petros-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.
Pt*. Pits						
RaF*: Ramsey-----	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: depth to rock, slope.	Severe: slope, depth to rock.
Rock outcrop.						
SaB----- Sequatchie	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: large stones, flooding.
SeC2, SeC3----- Sequoia	Moderate: depth to rock, too clayey, slope.	Moderate: shrink-swell, slope.	Moderate: depth to rock, slope, shrink-swell.	Severe: slope.	Severe: low strength.	Moderate: droughty, slope.
SeD2, SeD3, SeE2-- Sequoia	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Sn----- Sewanee	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.
Sw----- Swafford	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Moderate: low strength, wetness, flooding.	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
TaF*: Talbot-----	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope.
Rock outcrop.						
Wh----- Whitwell	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Moderate: flooding.

\* 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," "good," and other terms. Absence of an entry indicates that the soil was not rated. 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
AeD2----- Allen	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
At----- Atkins	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Severe: flooding, wetness, seepage.	Poor: wetness.
Be----- Bethesda	Severe: percs slowly, slope, unstable fill.	Severe: slope, unstable fill.	Severe: slope, unstable fill.	Severe: slope, unstable fill.	Poor: small stones, slope.
BrF*: Bland-----	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
Rock outcrop.					
CaC----- Claiborne	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey, small stones, slope.
CaD, CaE----- Claiborne	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
CoB----- Collegedale	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight-----	Poor: too clayey, hard to pack.
CoC, CoC2----- Collegedale	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
CoD2----- Collegedale	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.
CrD2*: Collegedale-----	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Rock outcrop.					
CrE2*: Collegedale-----	Severe: percs slowly, slope.	Severe: slope.	Severe: slope, too clayey.	Severe: slope.	Poor: too clayey, hard to pack, slope.

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
CrE2*: Rock outcrop.					
CuF----- Cutshin	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Poor: small stones, slope.
CyE2----- Cynthiana	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: area reclaim, slope, too clayey.
DeD----- Dewey	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Ea----- Ealy	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Fair: too sandy.
EtB----- Etowah	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight-----	Fair: too clayey.
EtC----- Etowah	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Fair: too clayey.
FaC----- Fullerton	Moderate: percs slowly, slope.	Severe: slope.	Moderate: slope, too clayey.	Moderate: slope.	Poor: small stones.
FbD*, FbF*: Fullerton-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: small stones, slope.
Bodine-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: small stones, slope.
GrD*: Gladeville-----	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: depth to rock, slope, small stones.
Rock outcrop.					
Ha----- Hamblen	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.
JeC----- Jefferson	Moderate: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Fair: too clayey, small stones, slope.
JeD----- Jefferson	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: seepage, slope.	Poor: slope.

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
JgF*: Jefferson-----	Severe:   slope.	Severe:   seepage,   slope.	Severe:   seepage,   slope.	Severe:   seepage,   slope.	Poor:   slope.
Grimsley-----	Severe:   slope.	Severe:   slope,   seepage,   large stones.	Severe:   depth to rock,   seepage,   slope.	Severe:   seepage,   slope.	Severe:   slope.
LyC----- Lily	Severe:   depth to rock.	Severe:   seepage,   depth to rock,   slope.	Severe:   depth to rock,   seepage.	Severe:   depth to rock,   seepage.	Poor:   depth to rock.
MaD----- Minvale	Severe:   slope.	Severe:   slope.	Severe:   slope.	Severe:   slope.	Poor:   slope.
MkF*: Muskingum-----	Severe:   depth to rock,   slope.	Severe:   depth to rock,   slope.	Severe:   depth to rock,   slope.	Severe:   depth to rock,   slope.	Poor:   depth to rock,   small stones,   slope.
Sequoia-----	Severe:   depth to rock,   percs slowly,   slope.	Severe:   depth to rock,   slope.	Severe:   depth to rock,   slope,   too clayey.	Severe:   depth to rock,   slope.	Poor:   depth to rock,   too clayey,   hard to pack.
Petros-----	Severe:   depth to rock,   slope.	Severe:   seepage,   depth to rock,   slope.	Severe:   depth to rock,   seepage,   slope.	Severe:   depth to rock,   slope.	Poor:   depth to rock,   slope.
MpF*: Muskingum-----	Severe:   depth to rock,   slope.	Severe:   depth to rock,   slope.	Severe:   depth to rock,   slope.	Severe:   depth to rock,   slope.	Poor:   depth to rock,   small stones,   slope.
Petros-----	Severe:   depth to rock,   slope.	Severe:   seepage,   depth to rock,   slope.	Severe:   depth to rock,   seepage,   slope.	Severe:   depth to rock,   slope.	Poor:   depth to rock,   slope.
Pt*. Pits					
RaF*: Ramsey-----	Severe:   depth to rock,   slope.	Severe:   seepage,   depth to rock,   slope.	Severe:   depth to rock,   seepage,   slope.	Severe:   depth to rock,   seepage,   slope.	Poor:   depth to rock,   slope.
Rock outcrop.					
SaB----- Sequatchie	Severe:   flooding.	Severe:   seepage,   flooding.	Severe:   flooding,   seepage.	Severe:   flooding.	Fair:   too clayey,   small stones.

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
SeC2, SeC3----- Sequoia	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
SeD2, SeD3, SeE2---- Sequoia	Severe: depth to rock, percs slowly, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
Sn----- Sewanee	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, depth to rock, wetness.	Severe: flooding, wetness.	Poor: wetness.
Sw----- Swafford	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Fair: too clayey, wetness.
TaF*: Talbott-----	Severe: depth to rock, percs slowly, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, slope, too clayey.	Severe: depth to rock, slope.	Poor: depth to rock, too clayey, hard to pack.
Rock outcrop.					
Wh----- Whitwell	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: too clayey, wetness.

\* 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. Absence of an entry indicates that the soil was not rated. 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
AeD2----- Allen	Fair: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
At----- Atkins	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Be----- Bethesda	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
BrF*: Bland-----	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Rock outcrop.				
CaC----- Claiborne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim, slope.
CaD----- Claiborne	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CaE----- Claiborne	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
CoB, CoC, CoC2----- Collegedale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CoD2----- Collegedale	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
CrD2*: Collegedale-----	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Rock outcrop.				
CrE2*: Collegedale-----	Poor: low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Rock outcrop.				

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
CuF----- Cutshin	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
CyE2----- Cynthiana	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
DeD----- Dewey	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Ea----- Ealy	Good-----	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones.
EtB----- Etowah	Fair: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, too clayey.
EtC----- Etowah	Fair: low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, too clayey, slope.
FaC----- Fullerton	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
FbD*: Fullerton-----	Fair: shrink-swell, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
Bodine-----	Fair: large stones, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
FbF*: Fullerton-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, area reclaim.
Bodine-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
GrD*: Gladeville-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey, small stones.
Rock outcrop.				

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ha----- Hamblen	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, area reclaim.
JeC----- Jefferson	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim.
JeD----- Jefferson	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
JgF*: Jefferson-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
Grimsley-----	Poor: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: large stones, area reclaim, slope.
LyC----- Lily	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: area reclaim, small stones.
MaD----- Minvale	Fair: slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, area reclaim, slope.
MkF*: Muskingum-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Sequoia-----	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Petros-----	Poor: depth to rock, slope.	Improbable: small stones.	Improbable: thin layer.	Poor: depth to rock, small stones, slope.
MpF*: Muskingum-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones, slope.
Petros-----	Poor: depth to rock, slope.	Improbable: small stones.	Improbable: thin layer.	Poor: depth to rock, small stones, slope.
Pt*. Pits				

See footnote at end of table.

Table 12.--Construction Materials--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
RaF*: Ramsey-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones, slope.
Rock outcrop.				
SaB----- Sequatchie	Good-----	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
SeC2, SeC3----- Sequoia	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SeD2, SeD3----- Sequoia	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
SeE2----- Sequoia	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, slope.
Sn----- Sewanee	Fair: depth to rock, thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Moderate: small stones.
Sw----- Swafford	Fair: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
TaF*: Talbot-----	Poor: depth to rock, low strength, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones, slope.
Rock outcrop.				
Wh----- Whitwell	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: small stones, 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." Absence of an entry indicates that the soil was not evaluated. 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	Irrigation	Terraces and diversions	Grassed waterways
AeD2----- Allen	Moderate: seepage.	Severe: piping.	Deep to water	Slope-----	Slope-----	Slope.
At----- Atkins	Severe: seepage.	Severe: piping, wetness.	Flooding, frost action, percs slowly.	Wetness, flooding, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Be----- Bethesda	Severe: slope.	Severe: seepage, piping.	Deep to water	Slope, large stones, droughty.	Slope, large stones, slippage.	Large stones, slope, droughty.
BrF*: Bland-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, depth to rock, erodes easily.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Rock outcrop.						
CaC, CaD, CaE---- Claiborne	Severe: slope.	Moderate: piping, thin layer.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
CoB----- Collegedale	Moderate: slope.	Severe: hard to pack.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
CoC, CoC2, CoD2--- Collegedale	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
CrD2*, CrE2*: Collegedale-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.
Rock outcrop.						
CuF----- Cutshin	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty.	Slope, large stones.	Large stones, slope, droughty.
CyE2----- Cynthiana	Severe: depth to rock, slope.	Severe: hard to pack.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, erodes easily.
DeD----- Dewey	Severe: slope.	Severe: hard to pack.	Deep to water	Slope-----	Slope-----	Slope.
Ea----- Ealy	Severe: seepage.	Severe: piping.	Deep to water	Flooding-----	Favorable-----	Favorable.
EtB----- Etawah	Moderate: seepage, slope.	Moderate: thin layer, piping.	Deep to water	Slope, erodes easily.	Erodes easily	Erodes easily.
EtC----- Etawah	Severe: slope.	Moderate: thin layer, piping.	Deep to water	Slope, erodes easily.	Slope, erodes easily.	Slope, erodes easily.

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	Irrigation	Terraces and diversions	Grassed waterways
FaC----- Fullerton	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope-----	Slope, large stones.	Large stones, slope.
FbD*, FbF*: Fullerton-----	Severe: slope.	Severe: piping, hard to pack.	Deep to water	Slope-----	Slope, large stones.	Large stones, slope.
Bodine-----	Severe: seepage, slope.	Severe: seepage.	Deep to water	Slope, large stones, droughty.	Slope, large stones.	Large stones, slope, droughty.
GrD*: Gladeville-----	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slope, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, droughty.
Rock outcrop.						
Ha----- Hamblen	Moderate: seepage.	Severe: piping.	Flooding-----	Wetness, flooding.	Wetness-----	Favorable.
JeC----- Jefferson	Severe: seepage.	Severe: piping.	Deep to water	Slope-----	Slope-----	Slope.
JeD----- Jefferson	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope-----	Slope-----	Slope.
JgF*: Jefferson-----	Severe: seepage, slope.	Severe: piping.	Deep to water	Slope-----	Slope-----	Slope.
Grimsley-----	Severe: seepage, slope.	Moderate: thin layer, large stones.	Deep to water	Droughty, slope, large stones.	Slope, large stones.	Slope, large stones, droughty.
LyC----- Lily	Severe: seepage.	Severe: piping.	Deep to water	Depth to rock, slope.	Slope, depth to rock.	Slope, depth to rock.
MaD----- Minvale	Severe: slope.	Severe: piping.	Deep to water	Slope-----	Slope-----	Slope.
MkF*: Muskingum-----	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Sequoia-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Petros-----	Severe: depth to rock, slope.	Severe: thin layer, seepage.	Deep to water	Slope, droughty, depth to rock.	Slope, large stones, depth to rock.	Slope, droughty, depth to rock.

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	Irrigation	Terraces and diversions	Grassed waterways
MpF*:						
Muskingum-----	Severe: slope.	Severe: piping.	Deep to water	Slope, droughty, depth to rock.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Petros-----	Severe: depth to rock, slope.	Severe: thin layer, seepage.	Deep to water	Slope, droughty, depth to rock.	Slope, large stones, depth to rock.	Slope, droughty, depth to rock.
Pt*. Pits						
RaF*:						
Ramsey-----	Severe: depth to rock, slope.	Severe: piping.	Deep to water	Droughty, depth to rock, slope.	Slope, depth to rock.	Slope, droughty, depth to rock.
Rock outcrop.						
SaB-----	Severe: seepage.	Severe: piping.	Deep to water	Slope, flooding.	Favorable-----	Favorable.
SeC2-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
SeC3-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, depth to rock.	Slope, droughty.
SeD2-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
SeD3-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, depth to rock.	Slope, droughty.
SeE2-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, droughty.	Slope, depth to rock, erodes easily.	Slope, erodes easily, droughty.
Sn-----	Moderate: seepage, depth to rock.	Severe: piping, wetness.	Flooding-----	Wetness, flooding.	Wetness-----	Wetness.
Sw-----	Moderate: seepage.	Severe: piping.	Flooding-----	Wetness, erodes easily, flooding.	Erodes easily, wetness.	Erodes easily.
TaF*:						
Talbott-----	Severe: slope.	Severe: hard to pack.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop.						
Wh-----	Moderate: seepage.	Severe: piping.	Flooding-----	Wetness, flooding.	Wetness-----	Favorable.

\* 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		
	In				Pct					Pct	
AeD2----- Allen	0-8	Loam-----	ML, CL-ML, SM, SC-SM	A-4	0-5	90-100	75-100	65-98	40-80	<26	NP-10
	8-55	Clay loam, sandy clay loam, loam.	CL-ML, CL, SC	A-4, A-6, A-7-6	0-10	85-100	75-100	65-98	40-80	20-43	4-19
	55-65	Clay loam, sandy clay loam, clay.	CL-ML, CL, SC, SC-SM	A-4, A-6, A-7-6	0-10	85-100	70-98	60-95	45-80	21-48	5-22
At----- Atkins	0-10	Silt loam-----	ML, CL, CL-ML	A-4, A-6	0	90-100	85-100	75-100	60-95	20-40	3-20
	10-61	Silty clay loam, silt loam, sandy loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	65-100	45-85	20-40	3-20
Be----- Bethesda	0-6	Channery silt loam.	ML, GM, GM-GC, CL-ML	A-4, A-6	0-15	65-90	55-80	50-80	35-75	25-40	4-14
	6-61	Very channery clay loam, very channery silty clay loam, channery clay loam.	GM-GC, ML, CL, GM	A-4, A-6, A-7, A-2	10-30	45-80	25-65	25-65	20-60	24-50	3-23
BrF*: Bland-----	0-4	Silty clay loam	CH	A-7	0-5	90-95	85-95	75-95	60-95	50-65	25-35
	4-30	Silty clay, clay	CH	A-7	0-5	90-95	85-95	75-95	65-90	65-80	35-45
	30-34	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
		Rock outcrop.									
CaC, CaD, CaE---- Claiborne	0-15	Silt loam-----	ML, CL, CL-ML	A-4	0-5	85-100	70-95	65-90	55-80	24-35	4-10
	15-46	Silty clay loam, cherty silty clay loam.	CL	A-4, A-6	0-5	85-100	70-95	65-90	60-80	28-40	8-20
	46-72	Clay, cherty clay, silty clay loam.	MH, CH, CL, SC	A-7, A-6	0-10	60-95	50-90	45-85	40-75	35-65	13-35
CoB, CoC----- Collegedale	0-7	Silt loam-----	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	75-95	70-90	24-39	5-16
	7-61	Silty clay, clay	CH, CL	A-7	0-2	95-100	90-100	80-95	75-95	41-75	18-42
CoC2, CoD2----- Collegedale	0-5	Silt loam-----	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	75-95	70-90	24-39	5-16
	5-61	Silty clay, clay, silty clay loam.	CH, CL	A-7	0-2	95-100	90-100	80-95	75-95	41-75	18-42
CrD2*, CrE2*: Collegedale-----	0-5	Silt loam-----	CL-ML, CL	A-4, A-6	0-2	90-100	85-100	75-95	70-90	24-39	5-16
	5-61	Silty clay, clay silty clay loam.	CH, CL	A-7	0-2	95-100	90-100	80-95	75-95	41-75	18-42
		Rock outcrop.									

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		
CuF----- Cutshin	0-19	Channery silt loam.	CL, ML, GC, SC	A-4, A-6, A-2, A-5	0-20	55-85	50-80	40-75	30-60	20-45	3-15
	19-63	Channery loam, channery silt loam, channery clay loam.	CL, ML, GC, SC	A-4, A-6, A-2, A-5	0-20	55-85	50-80	40-75	30-60	20-45	3-15
CyE2----- Cynthiana	0-4	Flaggy silty clay loam.	CL, CL-ML	A-4, A-6, A-7	0-30	70-100	65-100	60-100	55-100	25-42	4-20
	4-14	Flaggy clay, flaggy silty clay, clay.	CH, CL	A-7	5-30	70-100	65-100	60-100	55-100	45-75	20-45
	14-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
DeD----- Dewey	0-6	Silt loam-----	CL-ML, CL	A-4, A-6	0	90-100	80-100	75-95	65-80	24-30	5-11
	6-14	Clay, silty clay, silty clay loam.	CL	A-6	0	90-100	80-100	75-95	70-85	27-40	12-20
	14-61	Clay, silty clay	CH, CL, MH, ML	A-6, A-7	0-2	85-100	75-100	70-95	65-85	38-68	12-34
Ea----- Ealy	0-61	Loam-----	ML, CL-ML, SM, SC-SM	A-4, A-2	0-3	85-100	75-100	55-95	30-70	<30	NP-8
EtB, EtC----- Etowah	0-7	Silt loam-----	ML, CL, SC-SM, CL-ML	A-4	0	80-100	75-100	70-95	45-70	20-30	3-10
	7-45	Silty clay loam, clay loam, silt loam.	CL	A-6	0	80-100	75-100	70-95	65-85	25-35	10-15
	45-70	Silty clay loam, clay loam, clay.	CL, ML, MH	A-6, A-7	0	80-100	75-100	70-95	65-85	39-60	15-25
FaC----- Fullerton	0-11	Gravelly silt loam.	GM-GC, CL-ML, CL, GC	A-2, A-4	2-15	60-94	45-80	40-75	30-70	18-30	3-10
	11-21	Gravelly silty clay loam.	CL, GC, SC, ML	A-2, A-4, A-6, A-7	2-18	60-90	45-80	40-75	30-70	29-42	8-17
	21-61	Gravelly clay, gravelly silty clay.	MH, ML, GM, SM	A-2, A-7	2-18	60-90	45-80	40-75	30-75	48-78	20-42
FbD*, FbF*: Fullerton-----	0-11	Gravelly silt loam.	GM-GC, CL-ML, CL, GC	A-2, A-4	2-15	60-94	45-80	40-75	30-70	18-30	3-10
	11-21	Gravelly silty clay loam.	CL, GC, SC, ML	A-2, A-4, A-6, A-7	2-18	60-90	45-80	40-75	30-70	29-42	8-17
	21-61	Gravelly clay, gravelly silty clay.	MH, ML, GM, SM	A-2, A-7	2-18	60-90	45-80	40-75	30-75	48-78	20-42

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	
FbD*, FbF*: Bodine-----	0-10	Gravelly silt loam.	ML, CL-ML, GM, SM	A-4, A-2, A-1-B	0-10	30-90	20-75	20-67	20-62	<30	NP-7
	10-51	Very gravelly silt loam, very gravelly silty clay loam.	GM-GC, GC, SC, SC-SM	A-1, A-2, A-4, A-6	10-35	30-70	20-65	20-55	15-45	20-38	3-15
	51-62	Gravelly silty clay loam, very gravelly very gravelly clay loam, very gravelly silt loam.	GC, GM, GC, SM	A-2	10-35	20-70	15-65	15-45	12-35	26-42	8-16
GrD*: Gladeville-----	0-11	Flaggy silty clay loam, flaggy clay.	GC, CL, CH	A-2, A-6, A-7	5-20	40-65	30-55	25-55	20-55	38-55	20-34
	11-15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Ha----- Hamblen	0-9	Silt loam-----	CL, CL-ML, ML	A-4, A-6	0-2	190-100	180-100	165-95	155-85	22-38	3-14
	9-31	Silt loam, loam, clay loam.	CL, CL-ML, ML	A-4, A-6	0-2	180-100	175-100	160-95	155-85	22-40	3-17
	31-61	Silt loam, loam, clay loam, gravelly loam.	CL, CL-ML, ML, GC	A-4, A-6, A-2	0-5	155-100	145-95	135-90	130-80	22-40	3-17
JeC, JeD----- Jefferson	0-10	Gravelly loam----	SM, SC, ML, CL	A-2, A-4	0-5	175-90	150-80	150-80	130-65	20-35	2-10
	10-34	Gravelly loam, loam, gravelly clay loam, gravelly sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6	0-5	175-90	150-90	150-80	130-70	15-35	2-15
	34-61	Very gravelly loam, very gravelly clay loam, very gravelly sandy clay loam, gravelly sandy loam.	GM, SM, ML, GM-GC	A-2, A-4, A-1	0-5	155-75	125-75	120-70	110-60	20-35	2-10

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		
JgF*: Jefferson-----	0-10	Gravelly loam----	SM, SC, ML, CL	A-2, A-4	0-5	75-90	50-80	50-80	30-65	20-35	2-10
	10-34	Gravelly loam, loam, gravelly clay loam, gravelly sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6	0-5	75-90	50-90	50-80	30-70	15-35	2-15
	34-61	Very gravelly loam, very gravelly clay loam, very gravelly sandy clay loam, gravelly sandy loam.	GM, SM, ML, GM-GC	A-2, A-4, A-1	0-5	55-75	25-75	20-70	10-60	20-35	2-10
Grimsley-----	0-8	Stony loam-----	ML, CL-ML, SM, SC-SM	A-4, A-2, A-1-B	15-35	65-90	60-85	35-80	20-65	<30	NP-10
	8-54	Stony loam, stony clay loam, stony sandy clay loam.	GC, GM-GC, SC, SC-SM	A-2, A-4, A-6, A-1-B	25-45	50-75	45-70	25-60	15-50	20-39	5-20
	54-58	Weathered bedrock	---	---	---	---	---	---	---	---	---
LyC-----	0-10	Fine sandy loam	SM	A-4, A-2	0-5	90-100	85-100	55-80	25-50	<20	NP-4
Lilly	10-25	Clay loam, sandy clay loam, loam.	SM, SC, ML, CL	A-4, A-6	0-5	90-100	85-100	75-100	40-80	<35	3-15
	25-32	Sandy clay loam, clay loam, gravelly sandy clay loam.	SM, SC, ML, CL	A-4, A-2, A-6, A-1-B	0-10	65-100	50-100	40-95	20-75	<35	3-15
	32-36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
MaD----- Minvale	0-13	Gravelly loam----	ML, CL, CL-ML	A-4	0-5	75-95	75-90	65-85	55-75	<30	NP-10
	13-33	Gravelly silty clay loam, gravelly silt loam, gravelly loam.	CL, CL-ML, GC, GM-GC	A-4, A-6	0-5	50-75	50-75	40-70	36-65	20-40	5-15
	33-61	Gravelly silty clay loam, gravelly silty clay, gravelly clay.	CL, ML, GC, SC	A-4, A-6, A-7	0-5	55-80	50-75	40-70	36-65	25-50	7-23
MkF*: Muskingum-----	0-6	Silt loam-----	ML, CL, SM, SC	A-2, A-4	0-10	75-100	70-95	50-90	30-80	20-35	2-10
	6-30	Silt loam, channery silt loam, channery loam.	GM, SM, ML, CL	A-4	0-15	70-90	55-85	50-80	40-75	20-35	2-10
	30-45	Weathered 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
MkF*:												
Sequoia-----	0-6	Silt loam-----	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	80-95	23-35	5-15	
	6-32	Silty clay, clay, shaly silty clay.	CL, MH, CH	A-7	0	70-100	65-100	60-100	55-95	43-74	20-40	
	32-42	Weathered bedrock	---	---	---	---	---	---	---	---	---	
Petros-----	0-5	Channery silt loam.	CL, ML, CL-ML, GM	A-4	5-15	60-80	55-75	50-70	40-60	<30	NP-8	
	5-16	Very channery silt loam, very channery silty clay loam.	GM, GC, GM-GC, GP-GM	A-2, A-4, A-6, A-1	10-25	25-49	20-45	15-40	10-36	20-39	3-17	
	16-26	Weathered bedrock	---	---	---	---	---	---	---	---	---	
	26-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	
MpF*:												
Muskingum-----	0-6	Silt loam-----	ML, CL, SM, SC	A-2, A-4	0-10	75-100	70-95	50-90	30-80	20-35	2-10	
	6-30	Silt loam, channery silt loam, channery loam.	GM, SM, ML, CL	A-4	0-15	70-90	55-85	50-80	40-75	20-35	2-10	
	30-45	Weathered bedrock	---	---	---	---	---	---	---	---	---	
Petros-----	0-5	Channery silt loam.	CL, ML, CL-ML, GM	A-4	5-15	60-80	55-75	50-70	40-60	<30	NP-8	
	5-16	Very channery silt loam, very channery silty clay loam.	GM, GC, GM-GC, GP-GM	A-2, A-4, A-6, A-1	10-25	25-49	20-45	15-40	10-36	20-39	3-17	
	16-26	Weathered bedrock	---	---	---	---	---	---	---	---	---	
	26-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	
Pt*. Pits												
RaF*:												
Ramsey-----	0-7	Sandy loam-----	SM, CL-ML, ML, SC-SM	A-4, A-2	0-10	85-100	75-95	60-75	30-70	<25	NP-7	
	7-18	Loam, sandy loam, fine sandy loam.	SM, CL-ML, ML, SC-SM	A-4, A-2	0-10	85-100	75-95	60-77	30-70	<25	NP-7	
	18-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---	
Rock outcrop.												
SaB-----	0-9	Loam-----	ML, CL-ML, CL, SM	A-2, A-4	0-10	85-100	75-100	65-95	30-70	15-27	2-10	
Sequatchie	9-41	Clay loam, loam, silt loam.	CL-ML, CL	A-4, A-6	0-10	85-100	75-100	65-95	55-85	20-32	5-15	
	41-62	Sandy loam, loam, fine sandy loam.	ML, CL-ML, CL, SM	A-2, A-4	0-15	75-100	65-100	45-85	25-65	15-25	2-10	

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 Pct	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SeC2----- Sequoia	0-6	Silt loam-----	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	80-95	23-35	5-15
	6-30	Silty clay, clay, shaly silty clay.	CL, MH, CH	A-7	0	70-100	65-100	60-100	55-95	43-74	20-40
	30-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
SeC3----- Sequoia	0-4	Silty clay loam	CL, CH	A-6, A-7	0	95-100	95-100	90-100	85-95	35-65	12-35
	4-30	Silty clay, clay, shaly silty clay.	CL, MH, CH	A-7	0	70-100	65-100	60-100	55-95	43-74	20-40
	30-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
SeD2----- Sequoia	0-6	Silt loam-----	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	80-95	23-35	5-15
	6-30	Silty clay, clay, shaly silty clay.	CL, MH, CH	A-7	0	70-100	65-100	60-100	55-95	43-74	20-40
	30-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
SeD3----- Sequoia	0-4	Silty clay loam	CL, CH	A-6, A-7	0	95-100	95-100	90-100	85-95	35-65	12-35
	4-30	Silty clay, clay, shaly silty clay.	CL, MH, CH	A-7	0	70-100	65-100	60-100	55-95	43-74	20-40
	30-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
SeE2----- Sequoia	0-6	Silt loam-----	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	80-95	23-35	5-15
	6-30	Silty clay, clay, shaly silty clay.	CL, MH, CH	A-7	0	70-100	65-100	60-100	55-95	43-74	20-40
	30-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
Sn----- Sewanee	0-8	Silt loam-----	ML, CL-ML, CL	A-4	0-2	80-100	75-100	70-95	55-85	<35	3-10
	8-59	Loam, silt loam, fine sandy loam.	ML, CL-ML, CL, SM	A-4	0-3	80-100	75-100	65-95	36-65	<35	NP-10
	59-63	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Sw----- Swafford	0-12	Loam-----	ML, CL-ML, CL	A-4	0	90-100	85-100	75-100	55-85	20-35	2-10
	12-30	Loam, clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	90-100	85-100	75-95	51-80	25-40	6-16
	30-59	Loam, clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	90-100	85-100	75-95	51-80	25-40	6-16
	59-65	Loam, clay loam, silt loam.	CL, ML, CL-ML	A-4, A-6	0	90-100	85-100	75-95	51-80	25-40	6-16
TaF*: Talbott-----	0-15	Gravelly loam---	CL-ML, CL, GM-GC, ML	A-4	0-5	65-80	60-75	55-70	40-60	18-30	3-10
	15-20	Silty clay loam	CL, CH, MH	A-6, A-7	0-5	95-100	85-100	80-100	75-95	32-55	12-28
	20-36	Silty clay, clay	CH, CL, MH	A-7	0-5	95-100	90-100	80-100	75-95	41-80	20-45
	36-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
Wh----- Whitwell	0-6	Loam-----	ML, CL-ML, CL	A-4	0-3	80-100	75-100	70-100	55-95	18-28	3-10
	6-61	Clay loam, loam, silt loam.	CL, CL-ML, ML, SC	A-4, A-6	0-3	80-100	75-100	60-90	40-80	18-35	3-15

\* 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	Permeability	Available	Soil	Shrink-swell	Erosion		Organic
			bulk		water	reaction	potential	factors		matter
	In	Pct	g/cc	In/hr	In/in	pH		K	T	Pct
AeD2----- Allen	0-8 8-55 55-65	6-25 18-35 20-45	1.30-1.50 1.40-1.60 1.40-1.60	0.6-2.0 0.6-2.0 0.6-2.0	0.14-0.19 0.12-0.17 0.10-0.17	4.5-5.5 4.5-5.5 4.5-5.5	Low----- Low----- Low-----	0.28 0.20 0.20	5	.5-2
At----- Atkins	0-10 10-61	18-30 18-35	1.20-1.40 1.20-1.50	0.6-2.0 0.06-2.0	0.14-0.22 0.14-0.18	4.5-5.5 4.5-5.5	Low----- Low-----	0.32 0.32	4	1-2
Be----- Bethesda	0-6 6-61	18-27 18-35	1.40-1.55 1.60-1.90	0.6-2.0 0.2-0.6	0.10-0.16 0.04-0.10	3.6-5.5 3.6-5.5	Low----- Low-----	0.28 0.32	5	<.5
BrF*: Bland-----	0-4 4-30 30-34	15-35 45-60 ---	1.20-1.50 1.30-1.60 ---	0.6-2.0 0.2-0.6 0.00-0.06	0.16-0.20 0.10-0.15 ---	5.1-7.3 5.1-7.3 ---	Moderate----- Moderate----- -----	0.43 0.43 ---	2	1-3
Rock outcrop.										
CaC, CaD, CaE---- Claiborne	0-15 15-46 46-72	20-32 27-35 35-50	1.30-1.50 1.35-1.55 1.35-1.55	0.6-2.0 0.6-2.0 0.6-2.0	0.17-0.21 0.17-0.20 0.14-0.17	4.5-6.0 4.5-5.5 4.5-5.5	Low----- Moderate----- Moderate-----	0.37 0.32 0.24	5	1-3
CoB, CoC----- Collegedale	0-7 7-61	20-35 40-60	1.30-1.50 1.45-1.60	0.6-2.0 0.2-0.6	0.18-0.22 0.12-0.16	4.5-5.5 4.5-5.5	Low----- Moderate-----	0.37 0.24	5	1-2
CoC2, CoD2----- Collegedale	0-5 5-61	20-35 40-60	1.30-1.50 1.45-1.60	0.6-2.0 0.2-0.6	0.18-0.22 0.12-0.16	4.5-5.5 4.5-5.5	Low----- Moderate-----	0.37 0.24	5	1-2
CrD2*, CrE2*: Collegedale-----	0-5 5-61	20-35 40-60	1.30-1.50 1.45-1.60	0.6-2.0 0.2-0.6	0.18-0.22 0.12-0.16	4.5-5.5 4.5-5.5	Low----- Moderate-----	0.37 0.24	5	1-2
Rock outcrop.										
CuF----- Cutshin	0-19 19-63	12-30 12-30	1.20-1.40 1.20-1.40	0.6-2.0 0.6-2.0	0.08-0.16 0.08-0.16	4.1-7.3 4.5-6.0	Low----- Low-----	0.28 0.28	4	2-4
CyE2----- Cynthiana	0-4 4-14 14-18	15-40 40-60 ---	1.20-1.40 1.35-1.60 ---	0.6-2.0 0.2-0.6 0.0-0.06	0.15-0.20 0.08-0.15 ---	6.1-7.8 6.1-7.8 ---	Moderate----- Moderate----- -----	0.37 0.28 ---	2	1-2
DeD----- Dewey	0-6 6-14 14-61	17-27 35-50 45-60	1.35-1.50 1.45-1.55 1.45-1.55	0.6-2.0 0.6-2.0 0.6-2.0	0.18-0.20 0.12-0.18 0.12-0.17	4.5-5.5 4.5-5.5 4.5-5.5	Low----- Moderate----- Moderate-----	0.32 0.24 0.24	5	1-3
Ea----- Ealy	0-61	5-18	1.40-1.60	2.0-6.0	0.14-0.18	4.5-5.5	Low-----	0.32	5	1-3
EtB, EtC----- Etowah	0-7 7-45 45-70	15-27 23-35 32-45	1.30-1.45 1.35-1.50 1.40-1.55	0.6-2.0 0.6-2.0 0.6-2.0	0.15-0.20 0.16-0.20 0.16-0.20	4.5-5.5 4.5-5.5 4.5-5.5	Low----- Low----- Low-----	0.37 0.32 0.32	5	1-3
FaC----- Fullerton	0-11 11-21 21-61	15-27 23-35 40-70	1.45-1.55 1.45-1.55 1.45-1.55	0.6-2.0 0.6-2.0 0.6-2.0	0.10-0.16 0.10-0.15 0.10-0.14	4.5-5.5 4.5-5.5 4.5-5.5	Low----- Low----- Moderate-----	0.28 0.24 0.20	5	.5-2

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 pH	Shrink-swell potential	Erosion factors		Organic matter
	In	Pct	g/cc	In/hr	In/in			K	T	Pct
FbD*, FbF*:										
Fullerton-----	0-11	15-27	1.45-1.55	0.6-2.0	0.10-0.16	4.5-5.5	Low-----	0.28	5	.5-2
	11-21	23-35	1.45-1.55	0.6-2.0	0.10-0.15	4.5-5.5	Low-----	0.24		
	21-61	40-70	1.45-1.55	0.6-2.0	0.10-0.14	4.5-5.5	Moderate----	0.20		
Bodine-----	0-10	8-20	1.35-1.55	2.0-6.0	0.07-0.12	3.6-5.5	Low-----	0.28	5	.5-2
	10-51	20-35	1.40-1.60	2.0-6.0	0.05-0.10	3.6-5.5	Low-----	0.24		
	51-62	23-38	1.40-1.60	2.0-6.0	0.05-0.10	3.6-5.5	Low-----	0.24		
GrD*:										
Gladeville-----	0-11	35-45	1.30-1.50	0.6-2.0	0.05-0.11	6.6-8.4	Moderate----	0.17	1	2-4
	11-15	---	---	0.0-0.06	---	---	-----	---		
Rock outcrop.										
Ha-----	0-9	15-25	1.30-1.45	0.6-2.0	0.18-0.20	5.1-7.3	Low-----	0.32	5	1-3
Hamblen	9-31	18-32	1.30-1.45	0.6-2.0	0.17-0.20	5.1-7.3	Low-----	0.32		
	31-61	18-32	1.30-1.45	0.6-2.0	0.17-0.20	5.1-7.3	Low-----	0.32		
JeC, JeD-----	0-10	10-25	1.30-1.50	2.0-6.0	0.07-0.14	4.5-5.5	Low-----	0.17	4	.5-2
Jefferson	10-34	18-34	1.30-1.65	2.0-6.0	0.10-0.16	4.5-5.5	Low-----	0.28		
	34-61	15-30	1.30-1.65	2.0-6.0	0.08-0.14	4.5-5.5	Low-----	0.17		
JgF*:										
Jefferson-----	0-10	10-25	1.30-1.50	2.0-6.0	0.07-0.14	4.5-5.5	Low-----	0.17	4	.5-2
	10-34	18-34	1.30-1.65	2.0-6.0	0.10-0.16	4.5-5.5	Low-----	0.28		
	34-61	15-30	1.30-1.65	2.0-6.0	0.08-0.14	4.5-5.5	Low-----	0.17		
Grimsley-----	0-8	10-20	1.35-1.45	2.0-6.0	0.07-0.12	4.5-5.5	Low-----	0.20	4	.5-2
	8-54	20-35	1.40-1.50	2.0-6.0	0.05-0.11	4.5-5.5	Low-----	0.20		
	54-58	---	---	0.0-0.06	---	---	-----	---		
LyC-----	0-10	5-20	1.20-1.40	2.0-6.0	0.09-0.16	3.6-5.5	Low-----	0.28	2	.5-2
Lily	10-25	18-35	1.25-1.35	2.0-6.0	0.12-0.18	3.6-5.5	Low-----	0.28		
	25-32	20-35	1.25-1.35	2.0-6.0	0.08-0.17	3.6-5.5	Low-----	0.17		
	32-36	---	---	0.0-0.2	---	---	-----	---		
MaD-----	0-13	15-30	1.30-1.45	0.6-2.0	0.16-0.22	4.5-5.5	Low-----	0.32	5	.5-2
Minvale	13-33	20-35	1.40-1.55	0.6-2.0	0.12-0.18	4.5-5.5	Low-----	0.28		
	33-60	25-45	1.40-1.55	0.6-2.0	0.11-0.17	4.5-5.5	Low-----	0.28		
MkF*:										
Muskingum-----	0-6	10-25	1.20-1.40	0.6-6.0	0.12-0.18	4.5-6.0	Low-----	0.37	3	.5-2
	6-30	18-27	1.20-1.50	0.6-2.0	0.08-0.14	4.5-5.5	Low-----	0.28		
	30-45	---	---	0.00-0.2	---	---	-----	---		
Sequoia-----	0-6	15-27	1.30-1.50	0.6-2.0	0.17-0.20	4.5-5.5	Low-----	0.37	3	.5-2
	6-32	35-60	1.35-1.55	0.2-0.6	0.08-0.16	4.5-5.5	Moderate----	0.24		
	32-42	---	---	0.00-0.2	---	---	-----	---		
Petros-----	0-5	15-25	1.30-1.50	0.6-6.0	0.10-0.14	4.5-5.5	Low-----	0.20	1	.5-2
	5-16	18-32	1.30-1.55	0.6-6.0	0.04-0.09	4.5-5.5	Low-----	0.15		
	16-26	---	---	0.00-0.2	---	---	-----	---		
	26-30	---	---	0.00-0.06	---	---	-----	---		
MpF*:										
Muskingum-----	0-6	10-25	1.20-1.40	0.6-6.0	0.12-0.18	4.5-6.0	Low-----	0.37	3	.5-2
	6-30	18-27	1.20-1.50	0.6-2.0	0.08-0.14	4.5-5.5	Low-----	0.28		
	30-45	---	---	0.00-0.2	---	---	-----	---		

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
	In	Pct	g/cc	In/hr	In/in	pH		K	T	Pct
MpF*:										
Petros-----	0-5	15-25	1.30-1.50	0.6-6.0	0.10-0.14	4.5-5.5	Low-----	0.20	1	.5-2
	5-16	18-32	1.30-1.55	0.6-6.0	0.04-0.09	4.5-5.5	Low-----	0.15		
	16-26	---	---	0.00-0.2	---	---	-----	---		
	26-30	---	---	0.00-0.06	---	---	-----	---		
Pt*.										
Pits										
RaF*:										
Ramsey-----	0-7	8-25	1.25-1.50	6.0-20	0.09-0.12	4.5-5.5	Low-----	0.20	1	.5-2
	7-18	8-25	1.20-1.40	6.0-20	0.09-0.12	4.5-5.5	Low-----	0.17		
	18-22	---	---	0.0-0.2	---	---	-----	---		
Rock outcrop.										
SaB-----	0-9	10-25	1.50-1.65	0.6-2.0	0.12-0.18	4.5-5.5	Low-----	0.32	5	1-3
Sequatchie	9-41	18-30	1.55-1.70	0.6-2.0	0.15-0.20	4.5-5.5	Low-----	0.24		
	41-62	12-25	1.55-1.70	0.6-6.0	0.09-0.14	4.5-5.5	Low-----	0.24		
SeC2-----	0-6	15-27	1.30-1.50	0.6-2.0	0.17-0.20	4.5-5.5	Low-----	0.37	3	.5-2
Sequoia	6-30	35-60	1.35-1.55	0.2-0.6	0.08-0.16	4.5-5.5	Moderate----	0.24		
	30-40	---	---	0.00-0.2	---	---	-----	---		
SeC3-----	0-4	27-45	1.35-1.50	0.6-2.0	0.15-0.19	4.5-5.5	Moderate----	0.32	3	<1
Sequoia	4-30	35-60	1.35-1.55	0.2-0.6	0.08-0.16	4.5-5.5	Moderate----	0.24		
	30-40	---	---	0.00-0.2	---	---	-----	---		
SeD2-----	0-6	15-27	1.30-1.50	0.6-2.0	0.17-0.20	4.5-5.5	Low-----	0.37	3	.5-2
Sequoia	6-30	35-60	1.35-1.55	0.2-0.6	0.08-0.16	4.5-5.5	Moderate----	0.24		
	30-40	---	---	0.00-0.2	---	---	-----	---		
SeD3-----	0-4	27-45	1.35-1.50	0.6-2.0	0.15-0.19	4.5-5.5	Moderate----	0.32	3	<1
Sequoia	4-30	35-60	1.35-1.55	0.2-0.6	0.08-0.16	4.5-5.5	Moderate----	0.24		
	30-40	---	---	0.00-0.2	---	---	-----	---		
SeE2-----	0-6	15-27	1.30-1.50	0.6-2.0	0.17-0.20	4.5-5.5	Low-----	0.37	3	.5-2
Sequoia	6-30	35-60	1.35-1.55	0.2-0.6	0.08-0.16	4.5-5.5	Moderate----	0.24		
	30-40	---	---	0.00-0.2	---	---	-----	---		
Sn-----	0-8	10-18	1.35-1.55	0.6-2.0	0.17-0.21	4.5-6.0	Low-----	0.32	3	1-3
Sewanee	8-59	10-18	1.35-1.55	0.6-2.0	0.14-0.20	4.5-5.5	Low-----	0.28		
	59-63	---	---	0.00-0.06	---	---	-----	---		
Sw-----	0-12	12-25	1.35-1.50	0.6-2.0	0.16-0.20	4.5-6.0	Low-----	0.37	5	1-2
Swafford	12-30	18-32	1.40-1.50	0.6-2.0	0.14-0.20	4.5-6.0	Low-----	0.32		
	30-59	18-32	1.45-1.60	0.2-0.6	0.13-0.17	4.5-6.0	Low-----	0.32		
	59-65	18-32	1.40-1.55	0.6-2.0	0.13-0.17	4.5-6.0	Low-----	0.32		
TaF*:										
Talbott-----	0-15	15-25	1.30-1.45	2.0-6.0	0.10-0.15	4.5-6.0	Low-----	0.32	2	.5-2
	15-20	28-40	1.35-1.55	0.6-2.0	0.16-0.20	4.5-6.0	Moderate----	0.32		
	20-36	40-60	1.40-1.60	0.2-0.6	0.12-0.16	5.1-7.3	Moderate----	0.24		
	36-40	---	---	0.00-0.06	---	---	-----	---		
Rock outcrop.										
Wh-----	0-6	10-25	1.35-1.55	0.6-2.0	0.15-0.20	4.5-6.0	Low-----	0.32	5	1-2
Whitwell	6-60	18-32	1.40-1.70	0.6-2.0	0.14-0.20	4.5-5.5	Low-----	0.32		

\* 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 less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro- logic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard- ness	Uncoated steel	Concrete
					Ft			In			
AeD2----- Allen	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate.
At----- Atkins	D	Frequent----	Very brief	Dec-Apr	0-1.0	Apparent	Dec-May	>60	---	High-----	Moderate.
Be----- Bethesda	C	None-----	---	---	>6.0	---	---	>60	---	Moderate	High.
BrF*: Bland-----	C	None-----	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
Rock outcrop.											
CaC, CaD, CaE----- Claiborne	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
CoB, CoC, CoC2, CoD2----- Collegedale	C	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
CrD2*, CrE2*: Collegedale-----	C	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Rock outcrop.											
CuF----- Cutshin	B	None-----	---	---	>6.0	---	---	>40	Soft	Low-----	Low.
CyE2----- Cynthiana	D	None-----	---	---	>6.0	---	---	10-20	Hard	Moderate	Low.
DeD----- Dewey	B	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Ea----- Ealy	B	Occasional	Very brief	Jan-Mar	5.0-6.0	Apparent	Dec-Mar	>60	---	Low-----	Moderate.
EtB, EtC----- Etowah	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	Moderate.
FaC----- Fullerton	B	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
FbD*, FbF*: Fullerton-----	B	None-----	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Bodine-----	B	None-----	---	---	>6.0	---	---	>60	---	Low-----	High.
GrD*: Gladeville-----	D	None-----	---	---	>6.0	---	---	3-12	Hard	High-----	Low.
Rock outcrop.											

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	Hard- ness	Uncoated steel	Concrete
					Ft						In
Ha----- Hamblen	C	Occasional	Very brief	Dec-Mar	2.0-3.0	Apparent	Dec-Mar	>60	---	Moderate	Moderate.
JeC, JeD----- Jefferson	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	High.
JgF*: Jefferson-----	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	High.
Grimsley-----	B	None-----	---	---	>6.0	---	---	40-60	Soft	Low-----	High.
LyC----- Lily	B	None-----	---	---	>6.0	---	---	20-40	Hard	Moderate	High.
MaD----- Minvale	B	None-----	---	---	>6.0	---	---	>60	---	Moderate	Low.
MkF*: Muskingum-----	C	None-----	---	---	>6.0	---	---	20-40	Soft	Low-----	High.
Sequoia-----	C	None-----	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
Petros-----	D	None-----	---	---	>6.0	---	---	10-20	Soft	Low-----	Moderate.
MpF*: Muskingum-----	C	None-----	---	---	>6.0	---	---	20-40	Soft	Low-----	High.
Petros-----	D	None-----	---	---	>6.0	---	---	10-20	Soft	Low-----	Moderate.
Pt*. Pits											
RaF*: Ramsey-----	D	None-----	---	---	>6.0	---	---	10-20	Hard	Low-----	Moderate.
Rock outcrop.											
SaB----- Sequatchie	B	Occasional	Very brief	Jan-May	>6.0	---	---	>60	---	Low-----	Moderate.
SeC2, SeC3, SeD2, SeD3, SeE2----- Sequoia	C	None-----	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
Sn----- Sewanee	B	Occasional	Very brief	Dec-Mar	1.0-2.0	Apparent	Dec-Mar	40-60	Hard	Moderate	Moderate.
Sw----- Swafford	C	Occasional	Very brief	Jan-Mar	2.0-3.0	Perched	Jan-Mar	>60	---	Moderate	Moderate.
TaF*: Talbot-----	C	None-----	---	---	>6.0	---	---	20-40	Hard	High-----	Moderate.
Rock outcrop.											
Wh----- Whitwell	C	Occasional	Very brief	Dec-Mar	2.0-3.0	Apparent	Dec-Mar	>60	---	Moderate	Moderate.

\* See description of the map unit for composition and behavior characteristics of the map unit.

Table 17.--Classification of the Soils

Soil name	Family or higher taxonomic class
Allen-----	Fine-loamy, siliceous, thermic Typic Paleudults
Atkins-----	Fine-loamy, mixed, acid, mesic Typic Fluvaquents
Bethesda-----	Loamy-skeletal, mixed, acid, mesic Typic Udorthents
Bland-----	Fine, mixed, mesic Typic Hapludalfs
Bodine-----	Loamy-skeletal, siliceous, thermic Typic Paleudults
Claiborne-----	Fine-loamy, siliceous, mesic Typic Paleudults
Collegedale-----	Clayey, mixed, thermic Typic Paleudults
Cutshin-----	Fine-loamy, mixed, mesic Typic Haplumbrepts
Cynthiana-----	Clayey, mixed, mesic Lithic Hapludalfs
Dewey-----	Clayey, kaolinitic, thermic Typic Paleudults
Ealy-----	Coarse-loamy, siliceous, mesic Fluventic Dystrachrepts
Etowah-----	Fine-loamy, siliceous, thermic Typic Paleudults
Fullerton-----	Clayey, kaolinitic, thermic Typic Paleudults
Gladeville-----	Clayey-skeletal, mixed, thermic Lithic Rendolls
Grimsley-----	Loamy-skeletal, siliceous, mesic Typic Hapludults
Hamblen-----	Fine-loamy, siliceous, thermic Fluvaquentic Eutrochrepts
Jefferson-----	Fine-loamy, siliceous, mesic Typic Hapludults
Lily-----	Fine-loamy, siliceous, mesic Typic Hapludults
Minvale-----	Fine-loamy, siliceous, thermic Typic Paleudults
Muskingum-----	Fine-loamy, mixed, mesic Typic Dystrachrepts
Petros-----	Loamy-skeletal, mixed, mesic, shallow Typic Dystrachrepts
Ramsey-----	Loamy, siliceous, mesic Lithic Dystrachrepts
Sequatchie-----	Fine-loamy, siliceous, thermic Humic Hapludults
Sequoia-----	Clayey, mixed, mesic Typic Hapludults
Sewanee-----	Coarse-loamy, siliceous, mesic Fluvaquentic Dystrachrepts
Swafford-----	Fine-loamy, siliceous, thermic Fraguaquic Paleudults
Talbott-----	Fine, mixed, thermic Typic Hapludalfs
Whitwell-----	Fine-loamy, siliceous, thermic Aquic Hapludults

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