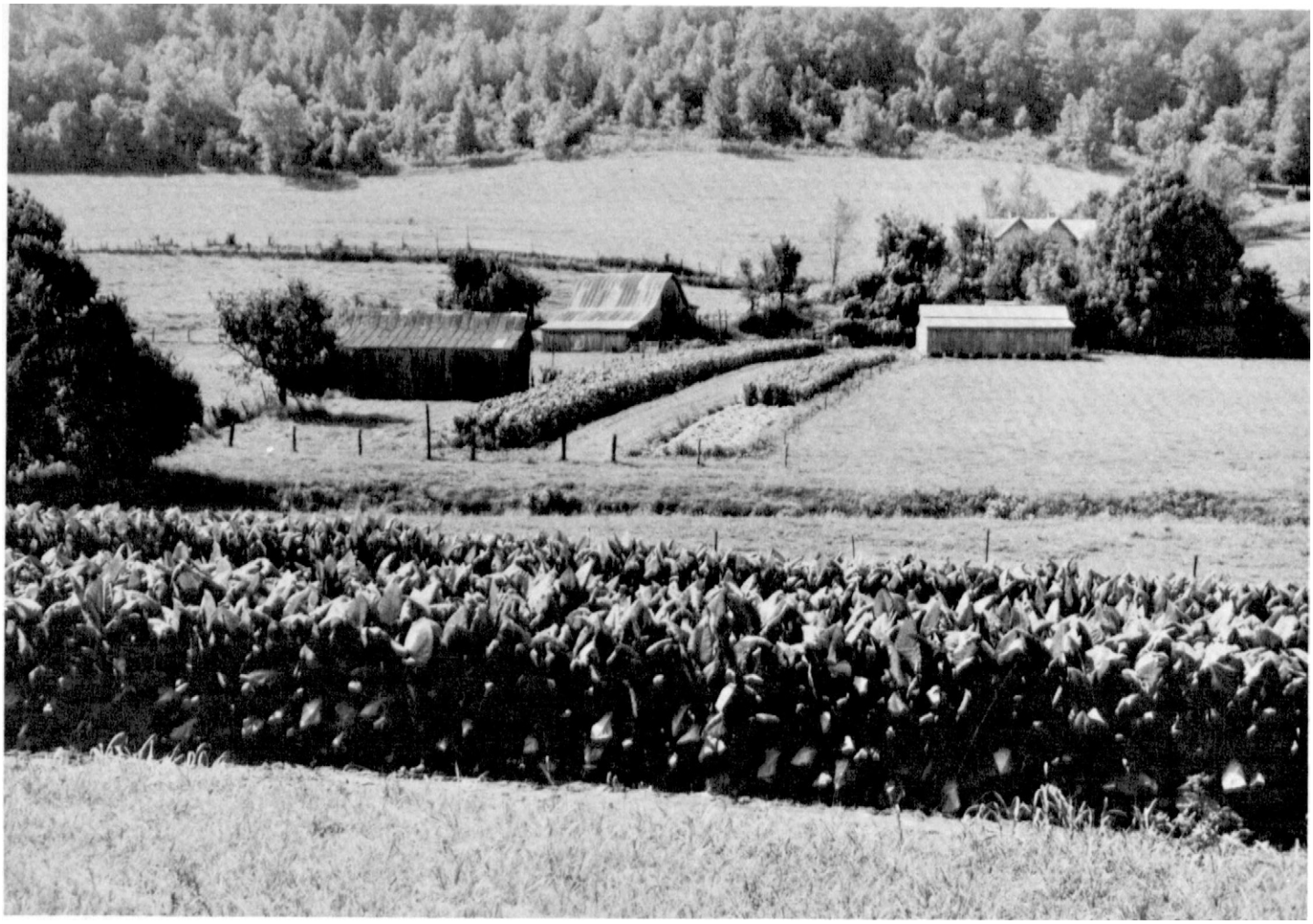
SOIL SURVEY OF

White and Van Buren Counties, Tennessee



United States Department of Agriculture
Soil Conservation Service
in corporation with
Tennessee Agricultural Experiment Station

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the states, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservaton Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1966-73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1974. This survey was made cooperatively by the Soil Conservation Service and the Tennessee Agricultural Experiment Station. It is part of the technical assistance furnished to the White County Soil Conservation District and the Van Buren County Soil Conservation District.

HOW TO USE THIS SOIL SURVEY

THIS SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, or recreation.

Locating Soils

All of the soils of White and Van Buren Counties are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information in this publication. This guide lists all the soils of the two counties in alphabetic order by map symbol. It shows the capability unit and the woodland group for each soil. It also shows the page where each soil and each capability unit is described.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and information in the text. Translucent material, used as an overlay to the soil map, can be colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions, from the discussions of the capability units, and from the sections "Woodland Management and Productivity" and "Wildlife Habitat."

Foresters and others can refer to the section "Woodland Management and Productivity" for information useful in the management of woodland.

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

Community planners and others can read about soil properties that affect the choice of sites for dwellings or other structures in the section "Engineering." Tables in this section give the degree of soil limitation for a number of land uses.

Engineers and builders can find, under "Engineering," tables that contain estimates of soil properties and information about soil features that affect engineering practices and structures.

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

Students, teachers, and others will find information about soils and their management in various parts of the survey, depending on their particular interest.

Newcomers to White and Van Buren Counties may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the section "General Nature of White and Van Buren Counties."

Cover: Burley tobacco on Etowah silt loam, 2 to 5 percent slopes. The partly harvested tobacco patch is on Sequatchie loam, and the pastured hillside and wooded area are on Etowah silt loam, 12 to 20 percent slopes.

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SOIL SURVEY OF WHITE AND VAN BUREN COUNTIES, TENNESSEE

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IN COOPERATION WITH THE TENNESSEE AGRICULTURAL EXPERIMENT STATION

WHITE AND VAN BUREN COUNTIES are in the central part of Tennessee (fig. 1). They have a total land area of about 636 square miles, or 407,100 acres. White County has a total land area of about 382 square miles, or 244,500 acres, and Van Buren County has a total land area of about 254 square miles, or 162,600 acres. Sparta, the county seat of White County and its principal town, is about 80 miles southeast of Nashville. Spencer, the county seat and principal town in Van Buren County, is about 15 miles south of Sparta.

The survey area is in the Highland Rim and Cumberland Plateau regions and is almost equally divided between these two major land resource areas. The major part of White County is in the Highland Rim area, and major part of Van Buren County is in the Cumberland Plateau area.

General Nature of White and Van Buren Counties

In this section the development of White and Van Buren Counties is briefly described, and information about physiography, population, and main sources of income are presented. Also, the climate of the counties is described, and information about farming is given. The agricultural statistics used are from records of the U.S. Bureau of the Census and the Tennessee Crop Reporting Service.

White County was established on September 11, 1806, from a part of Smith County. It was named for John White, one of the first settlers. The first settlement was in the Valley of the Calfkiller River. In 1809 the Legislature passed an act for the establishment of Sparta, the county seat. By 1920 the population of White County had reached about 15,000 and that of Sparta about 1,500.

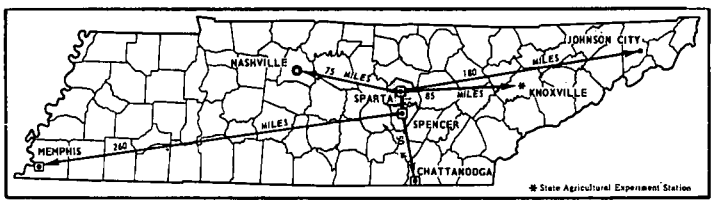

Figure 1.—Location of White and Van Buren Counties in Tennessee.

Van Buren County was established in 1840 from parts of White, Warren, and Bledsoe Counties. It was named for Martin Van Buren, who was President at that time. Spencer, the county seat, was named for Thomas Sharp Spencer, one of the early settlers. By 1920 the population of Van Buren County had reached about 2,600 and that of Spencer 300 *(3)*.[1] In 1970 the population of White County was 16,239 and that of Van Buren was 3,758.

White and Van Buren Counties are in the Highland Rim and Cumberland Plateau regions. About 65 percent of White County is in the Highland Rim area, and 35 percent is in the Cumberland Plateau area. About 30 percent of Van Buren County is in the Highland Rim area, and 70 percent is in the Cumberland Plateau area.

The Highland Rim, sometimes called the Rimlands and Highlands, lies to the west of the Cumberland Plateau. It extends, like the rim of a plate, around and encloses the great limestone Central Basin in which Nashville is located. This Highland Rim is greatly diversified with low rolling hills, upland flats, and wide valleys. For the most part, it appears originally to have been a flat plain, which through long ages, has been moderately dissected by the many streams which flow through it. Much of the eastern edge of the Highland Rim in White and Van Buren Counties is deeply pitted by limestone sinks and marked by scattered outcroppings of limestone (fig. 2). Here, most of the surface water flows into these sinks and disappears underground. The general elevation of the Highland Rim is about 960 feet above sea level. It is underlain almost entirely by limestone, and most of the soils formed in material weathered from this rock. In the distant past, 1 to 3 feet of loess have been deposited on the surface of the more level parts. In the eastern part, there are thick deposits of alluvium. For the most part, the soils are well drained, rich in clay, deep to bedrock, low in natural fertility, and responsive to management.

The Cumberland Plateau, often called the Cumberland tableland, is an elevated plateau rising about 2,000 feet above sea level and about 1,000 feet above the Highland Rim which lies to the west of it. The general elevation of the Cumberland Plateau is about 1,840 feet above sea level. It is separated from the Highland Rim by a rough, steep, and rocky slope called the Cumberland Plateau Escarpment. The

[1] Italic numerals in parentheses refer to References, p. 84.

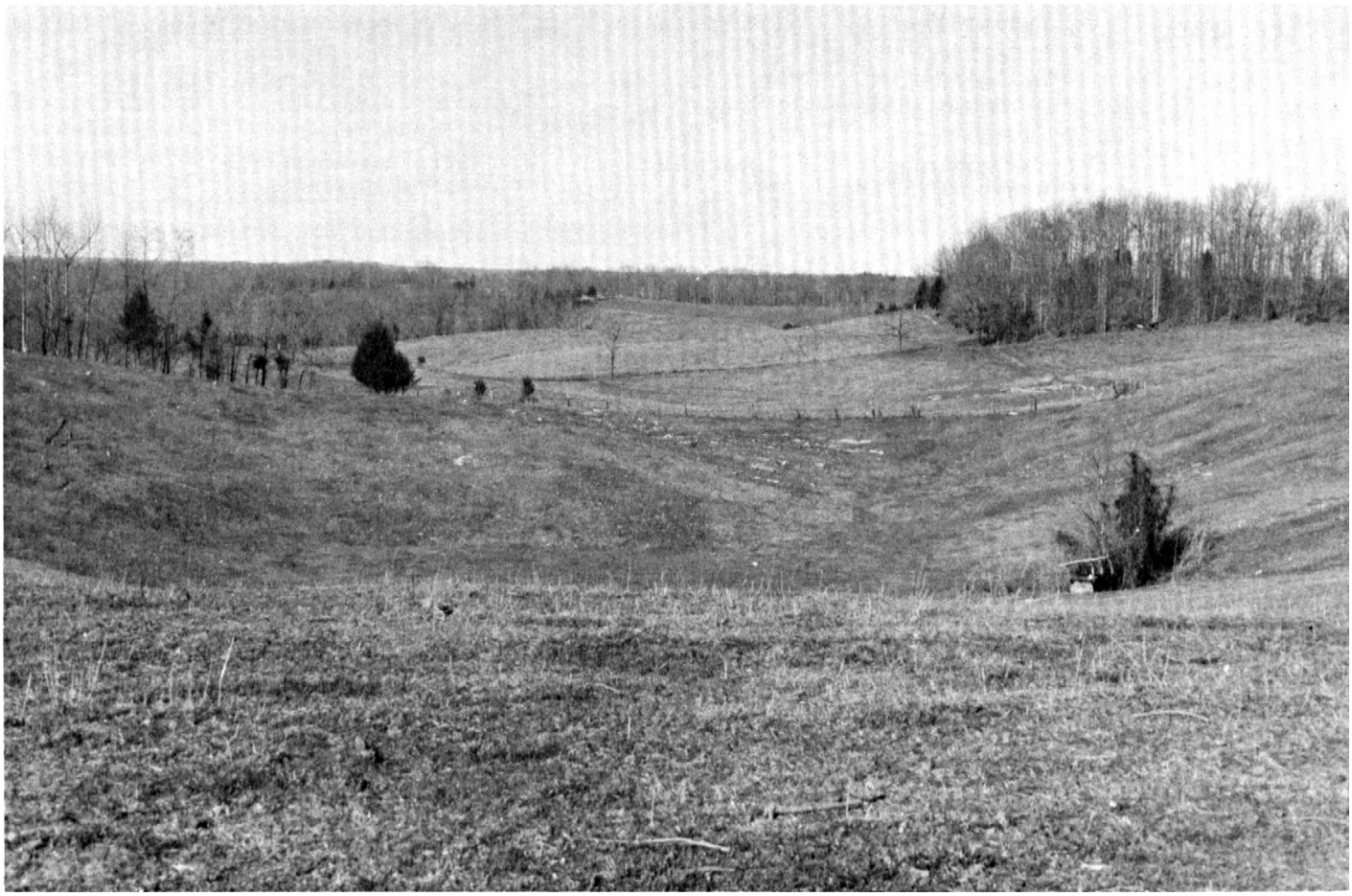

Figure 2.—Typical landscape along the eastern part of the Highland Rim. The clump of bushes in foreground is the open bottom of a limestone sink. Outcroppings of limestone are along the fence.

plateau, or tableland, is dominantly undulating and rolling. All of it is underlain by sandstone and shale, and for the most part the soils formed in material weathered from these rocks. Generally the soils are well drained, pale-colored, loamy, and poor in natural fertility. The soil is between depths of 1 foot on the short hillsides and about 4 or 5 feet on the broad, smooth interstream divides. The favorable physical properties of these soils and the favorable climate make this area highly responsive to management. Some of the highest crop yields in the State have been obtained on these soils. The Plateau contains deposits of coal and extensive strip mining is done here. (fig. 3).

Farming

According to the 1969 Census of Agriculture, 66 percent of the land in White County and 26 percent of that in Van Buren County were in farms. There were 1,355 farms in White County averaging 119 acres in size, and 291 farms in Van Buren County averaging 144 acres in size. Some of the Cumberland Plateau is in land areas of several thousand acres held by industries. These large holdings are used for timber and pulpwood production, coal mining, and recreational areas. Fall Creek Falls State Park includes about 13,000 acres in Van Buren County.

Farms are mainly of the general type. Livestock farming and dairy farming are the most important. In 1973 there were 34,700 head of cattle in White County and 7,900 head in Van Buren County. Tobacco is the most important cash crop, but in places corn, wheat, soybeans, and vegetables are also grown as cash crops. In 1973 there were 570 acres of tobacco grown in White County and 26 acres in Van Buren County. Pasture and hay occupy the largest total acreage. The main pasture plants are tall fescue, lespedeza, and some orchardgrass.

Climate

White and Van Buren Counties, located in the eastern Highland Rim and Cumberland Plateau areas of middle Tennessee, normally receive abundant annual rainfall and have relatively mild winters and warm summers. Because the Cumberland Plateau, which occupies about one-half of these two counties, is about

Figure 3.—**These pits left by strip mining hold several feet of water all year.**

800 to 1,000 feet higher than the general elevation of the Highland Rim area, climatological data are presented in four tables for the survey area.[2] The data in table 1 for McMinnville, located in adjacent Warren County, are generally applicable to the part of the survey area in the Highland Rim area. The data in table 2 for the Crossville Experiment Station, located in adjacent Cumberland County, are generally applicable to the part of the survey area in the Cumberland Plateau.

The climate of the area is mainly influenced by two types of airmasses. One airmass overruns the Gulf of Mexico and brings warm, moist air over Tennessee; the other comes from the north and west and brings generally cool, dry continental air to the State. Frequent changes in these two airmasses over the area in spring and in fall, and less frequent changes in other seasons, provide invigorating changes in the weather.

The average annual temperature at McMinnville, which is applicable to the Highland Rim area in White

[2]Climatological data in tables 1, 2, 3, 4, furnished by National Climatic Center, Asheville, North Carolina.

TABLE 1.—*Temperature and precipitation data*
[Recorded in McMinnville, Tennessee. Elevation 940 feet]

Month	Temperature			Precipitation
	Average daily maximum	Average daily minimum	Average monthly total	Average monthly total
	°F	°F	°F	*Inches*
January	49.8	30.1	40.0	5.47
February	53.0	31.8	42.4	5.28
March	60.8	38.2	49.5	5.39
April	72.2	48.0	60.1	4.42
May	79.7	55.3	67.5	4.11
June	85.9	63.1	74.6	4.50
July	80.2	66.4	77.3	4.66
August	87.8	65.5	76.7	3.65
September	82.7	59.2	71.0	3.93
October	73.3	47.5	60.4	2.49
November	60.6	37.2	48.9	3.86
December	51.5	31.4	41.4	5.20
Yearly	70.5	47.8	59.2	52.96

TABLE 2.—*Temperature and precipitation data*
[All data from Crossville Experiment Station. Elevation 1,810 feet]

Month	Temperature			Precipitation
	Average daily maximum	Average daily minimum	Average monthly total	Average total
	°F	°F	°F	Inches
January	44.2	24.7	34.5	5.62
February	47.2	25.6	36.4	5.51
March	54.7	33.2	44.0	6.08
April	66.3	43.9	55.1	5.08
May	75.0	51.5	63.3	4.16
June	81.2	58.6	69.9	4.48
July	84.0	61.8	72.9	5.09
August	83.4	60.7	72.1	4.09
September	78.2	54.7	66.5	3.98
October	68.6	43.6	56.1	2.75
November	55.6	33.5	44.6	4.38
December	46.0	26.1	36.0	5.60
Yearly	65.4	43.2	54.3	56.82

TABLE 3. — *Probabilities of last freezing temperatures in spring and first in fall*
[All data from McMinnville, Warren County, Tennessee, 1941-70]

Probability	Dates for given probability and temperature				
	16°F or lower	20°F or lower	24°F or lower	28°F or lower	32°F or lower
Spring:					
1 year in 10 later than	Mar. 15	Mar. 27	Apr. 4	Apr. 13	Apr.22
2 years in 10 later than	Mar. 5	Mar. 16	Mar. 28	Apr. 7	Apr. 17
5 years in 10 later than	Feb. 13	Feb. 24	Mar. 13	Mar. 26	Apr. 7
Fall:					
1 year in 10 earlier than	Nov. 21	Nov. 7	Oct. 30	Oct. 22	Oct. 13
2 years in 10 earlier than	Nov. 30	Nov. 13	Nov. 4	Oct. 27	Oct. 18
5 years in 10 earlier than	Dec. 17	Nov. 25	Nov. 15	Nov. 5	Oct. 27

TABLE 4. — *Probabilities of last freezing temperatures in spring and first in fall at Crossville Experiment Station, Cumberland County, Tennessee, 1941-70*

Probability	Dates for given probability and temperature				
	16°F or lower	20°F or lower	24°F or lower	28°F or lower	32°F or lower
Spring:					
1 year in 10 later than	Mar. 29	Apr. 6	Apr. 16	Apr. 24	May 14
2 years in 10 later than	Mar. 21	Mar. 30	Apr. 11	Apr. 19	May 7
5 years in 10 later than	Mar. 4	Mar. 16	Apr. 1	Apr. 10	Apr. 24
Fall:					
1 year in 10 earlier than	Nov. 5	Oct. 27	Oct. 21	Oct. 17	Oct. 3
2 years in 10 earlier than	Nov. 12	Nov. 3	Oct. 26	Oct. 21	Oct. 8
5 years in 10 earlier than	Nov. 27	Nov. 17	Nov. 4	Oct. 28	Oct. 18

and Van Buren Counties, is 59.2° F. The average annual temperature at the Crossville Experiment Station, which is applicable to the Cumberland Plateau area of these counties, is 54.3° F.

Table 1 shows that the average lowest daily temperature at McMinnville ranges from near freezing in winter to the middle sixties in summer, and the average highest daily temperature ranges from near 50° F in winter to the middle and upper eighties in summer. The averages at the Crossville Experiment Station are about 4 to 5 degrees cooler. A temperature above 100° F or below 0° F is rare, but extremes of 104° F and −19° F have been recorded. Prolonged periods of very cold or very hot, humid weather are unusual, because they are broken by many warm periods in winter and by occasional mild periods with low humidity in summer.

At McMinnville the average date of the last freeze in spring is April 7, and the average date of the first freeze in fall is October 27. At the Crossville Experiment Station the average date of the last freeze in spring is April 24, and the average date of the first freeze in fall is October 18 (tables 3 and 4). These data indicate that the average growing season is 202 days on the Highland Rim and 176 days on the Cumberland Plateau.

The average annual precipitation at McMinnville and at Crossville is 52.96 and 56.82 inches, respectively. These data indicate that the Cumberland Plateau area receives nearly 4 inches more rainfall per year than the Highland Rim area. Normally, precipitation is greatest in winter and in early spring (tables 1 and 2). At these times low pressure systems pass more frequently through the area and cause general rains. In summer, when local showers and thunderstorms are most frequent, precipitation is near the average for all months. Average precipitation is lightest in fall because of the greater frequency of high pressure systems.

Severe storms are infrequent in White and Van Buren Counties. Only three tornadoes were reported in these counties between 1916 and 1962. The counties are too far inland for tropical storms to cause damage. Thunderstorms occur on about 55 days a year at any one place, and most of them come late in spring and in summer. Hailstorms occur at a given locality about twice a year.

The average annual relative humidity is about 70 percent. Throughout the day it generaly rises or falls inversely as the temperature rises and falls and is,

therefore, highest early in the morning and lowest early in afternoon. At 5:00 a.m. the relative humidity is 90 percent or higher about half the time, and at 3:00 p.m. it is 50 percent or lower about half the time. Also, the relative humidity is highest in winter and lowest in spring.

The prevailing wind is from the south, and the average monthly windspeed ranges from about 5 miles per hour in August to 9 miles per hour in March. Generally, the wind is lightest early in the morning and strongest early in the afternoon.

The average cloud coverage is less than 60 percent between sunrise and sunset. Coverage ranges from slightly less than 70 percent in winter to slightly less than 50 percent in fall. Thus, sunshine is abundant during the growing season because there are fewer clouds and many hours of daylight.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soils are in White and Van Buren Counties, where they are located, and how they can be used. The soil scientists went into the survey area knowing they would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes; the size and speed of streams; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers or horizons in a soil. It extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied and they compared these profiles with those in nearby counties and in more distant places. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey *(5)*.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all of the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Curtistown and Etowah, for example, are the names of two soil series. All the soils in the United States that have the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in the texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Etowah silt loam, 2 to 5 percent slopes, is one of several phases within the Etowah Series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. The photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from the aerial photographs.

The areas shown on a soil map are called mapping units. On most maps that are detailed enough to be useful for planning and management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent because it is not practical to show on such a map all the small, scattered bits of soil that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series or of different phases within one series, or of soil and nonsoil. A soil complex is one such kind of mapping unit shown on the soil map of White and Van Buren Counties.

A soil complex consists of areas of two or more soils, or of soil and nonsoil, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a soil complex contains some of each of the two or more dominant components, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant components joined by a hyphen Talbott-Rock outcrop complex, 5 to 20 percent slopes, is an example.

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

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

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

General Soil Map

The general soil map at the back of this publication shows, in color, the soil associations in White and Van

Buren Counties. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil and it is named for the major soils. The soils in one association may occur in another, but in different patterns.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide for managing a watershed, a wooded tract, or a wildlife area, or for planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, texture, stoniness, drainage, and other characteristics that affect their management.

The 12 soil associations in White and Van Buren Counties are described in the following pages. For more detailed information about the individual soils in each association, refer to the detailed map and to the section "Descriptions of the Soils."

1. Waynesboro-Bewleyville Association

Undulating and rolling soils that are deep, well drained, and have a loamy surface layer and a loamy and clayey subsoil

This association consists of low, gently rolling hills and broad upland flats. In places the topography is modified by shallow depressions and limestone sinks. The low hills have short side slopes and broad tops that are nearly level to gently sloping. Short, meandering drainageways are nearly everywhere, and many of them terminate in depressions where, apparently, the water seeps down into channels of the underlying limestone. Slopes are mostly 2 to 15 perecent.

Most of the soils formed in old alluvium, which is capped in the less sloping places by a layer of loess 1 to 3 feet thick. These soils are mostly well drained and deep. Limestone bedrock is generally at a depth of more than 8 feet.

This association makes up about 10 percent of the survey area. About 55 percent of the association is Waynesboro soils, and 15 percent is Bewleyville soils. The rest is minor soils.

Waynesboro soils, which formed in old alluvium, are deep and well drained. They have a surface layer of brown loam. The subsoil is red or yellowish red, friable clay loam in the upper part and dark red, friable clay in the lower part.

Bewleyville soils, which formed in loess and the underlying old alluvium, are deep and well drained. They have a surface layer of brown silt loam and a subsoil that is yellowish red. The upper part of the subsoil is red, friable silty clay loam, and the lower part of the subsoil is dark red, firm clay.

Minor soils in this association are mostly in the Dickson, Mountview, Etowah, Curtistown, and Taft series. The moderately well drained Dickson soils and the well drained Mountview soils are in small areas on the low, broad hilltops. The well drained, loamy Etowah and Curtistown soils are in small tracts on foot slopes and broad, smooth upland areas, respectively. The somewhat poorly drained Taft soils are mainly in small tracts in shallow basins and along drainageways.

Almost all of the acreage is cleared except for small scattered farm woodlots on the steeper slopes and in the low wet areas. A wide variety of crops are grown including corn, small grain, soybeans, tobacco, hay, and pasture. Tobacco is the main cash crop and beef cattle is the main farm enterprise. The average farm is about 100 acres in size.

Almost all of the acreage is well suited to hay and pasture. Because of slope, little of the acreage is suitable for cultivation every year, but a large part is suitable for cultivation in short cropping systems.

Slope is the main limitation to use of these soils for highway construction, residential building, and most kinds of recreation. In most places, however, the slope is not strong enough to impose a severe limitation. Nearly all the soils have good drainage and favorable permeability for these uses. The favorable permeability limits the suitability of these soils for pond reservoirs. Treatment is required in many instances to prevent excess seepage.

2. Waynesboro-Etowah Association

Undulating to hilly soils that are deep, well drained, and have a loamy surface layer and a loamy and clayey subsoil

This association consists of low, rolling hills. The hills have gently sloping, broad rounded tops and moderately steep, short side slopes. In a few areas, limestone sinks and depressions contain up to 2 to 3 acres of nearly level bottom land. In the southern part of this association some areas are deeply pitted by a close network of deep limestone sinks. The easternmost part of this association terminates at the base of the Cumberland Mountain Escarpment. Here, fairly large, gently rolling areas extend from the base of the escarpment; slopes are mostly 2 to 20 percent.

Most of the soils in this association formed in old alluvium or in old valley fill, both of which apparently were deposited as the Cumberland Mountain eroded eastward. The dominant soils are deep and well drained. Limestone bedrock is at a depth of more than 6 feet.

This association makes up about 15 percent of the survey area. About 40 percent of the association is Waynesboro soils, and 30 percent is Etowah soils. The rest is minor soils.

Both Waynesboro and Etowah soils are deep and well drained. Waynesboro soils have a surface layer of brown loam and a subsoil of red and yellowish red, friable clay loam in the upper part and red and dark red, friable clay in the lower part. Etowah soils have a

surface layer of dark brown silt loam and a subsoil of yellowish red, friable silty clay loam. Some of the Etowah soils have a few chert fragments scattered over the surface.

Small areas of the moderately well drained Dickson soils and the well drained Mountview and Bewleyville soils are on the broad, smooth tops of the low hills. Well drained, dark reddish brown, loamy Emory soils are in depressions and narrow strips along drainageways. Well drained, loamy Staser soils and moderately well drained, loamy Hamblen soils are in the narrow strips of bottom land along creeks and branches.

Nearly all the acreage is cleared except for small farm woodlots on the steeper slopes and in low, wet places. Hay and pasture are the main crops. Small grain, corn, soybeans, and tobacco are grown in small acreages. The main type of farming is beef cattle, supplemented by small acreages of tobacco and grain crops. The average farm is about 90 acres in size.

The soils in this association have high potential for farming. Practically all the acreage is well suited to hay and pasture. The acreage suitable to row crops every year is relatively small and is in scattered tracts of 2 to 10 acres in size. A great part of this association is suited to row crops in short cropping systems.

Slope is the main limitation to use of the soils for highway construction, residential building, and most kinds of recreation. Most of the soils have good drainage and favorable permeability for these uses. The favorable permeability limits the suitability of these soils for such uses as pond reservoirs and lagoons. Treatment is required in many instances to prevent excessive seepage. Where the topography is rough and uneven because of numerous limestone sinks, the soils are difficult to manage for all common uses.

3. Decatur-Curtistown Association

Undulating and rolling soils that are deep, well drained, and have a loamy surface layer and a clayey and loamy subsoil

This association consists of gently rolling hills. Very short, moderately steep side slopes flank some of the drainageways and surround limestone sinks and depressions. In a few areas, depressions contain up to 2 acres of nearly level bottom land. Slopes are dominantly 2 to 12 percent.

The soils in this association are deep and well drained. They formed in old alluvium, some of which is capped by a layer of loess 2 to 3 feet thick. Depth to limestone bedrock generally exceeds 8 feet.

This association makes up about 1 percent of the survey area. About 35 percent of the association is Decatur soils, and 30 percent is Curtistown soils. The rest is minor soils.

Decatur soils have a surface layer of dark reddish brown silt loam and a subsoil of dark red firm clay. Curtistown soils have a surface layer of dark brown silt loam. The subsoil is yellowish red and red, friable silty clay loam in the upper part and dark red firm clay at a depth of about 3 feet.

Small areas of well drained, loamy Etowah soils are on benches and on the broad hilltops. Well drained, dark brown, loamy Emory soils are in depressions and narrow strips along short drainageways. The well drained, deep Waynesboro soils are on a few of the stronger slopes of the landscape.

Almost all the acreage is cleared and used mainly for hay and pasture. The soils are well suited to these uses. The average farm is about 110 acres in size. Tobacco is the most important cash crop, though the acreage of this crop is small. Most farms raise beef cattle and in small areas grow a variety of crops, such as corn, small grain, soybeans, and tobacco.

The soils in this association have high potential for farming (fig. 4). Very little acreage is suitable for intensive cropping, except in small scattered tracts. Most of the acreage is suited to cropping in short and medium cropping systems. The soils in this association are probably the best ones in the survey area for deep-rooted legumes, such as alfalfa.

Slope and, to a lesser extent, the clay subsoil are the main limitations to use of the soils for residential building, highway construction, and most kinds of recreation. Nearly all the soils have good drainage and favorable permeability for these uses. The favorable permeability, however, limits the suitability of these soils for such uses as pond reservoirs and lagoons. Treatment is often required to prevent excessive seepage. Where the topography is rough and uneven because of limestone sinks and depressions, use of the soils is limited to pasture and possibly hay.

4. Guthrie-Taft Association

Nearly level soils that are poorly drained and somewhat poorly drained, and have a fragipan in the subsoil

This association consists mainly of numerous flat basins. Some basins lack drainage outlets; in other

Figure 4.—View of a smoother part of the Decatur-Curtistown association.

basins the water flows slowly down sluggish, meandering drainageways. Almost all the basins are wet in winter and in spring, but they commonly dry out in summer and in fall. During rainy spells in winter and in spring the basins may be under a few inches of standing water for several successive days.

All of the association is covered with 2 to 4 or more feet of loess. Beneath the loess is old alluvium or residuum of limestone, both of which were parent material for the soils in this association.

This association makes up about 1 percent of the survey area. About 50 percent of the association is Guthrie soils, and 40 percent is Taft soils. The rest is minor soils.

Guthrie soils are gray and wet and Taft soils are mottled gray, brown, and yellow. Both Guthrie and Taft soils have a fragipan. Minor soils are mainly the moderately well drained Dickson soils, which also have a fragipan, and the well drained, loamy Mountview soils.

About 70 percent of the acreage is cleared. The average farm is about 100 acres in size, but probably no farm is entirely within this association. The soils of this association are use for pasture and hay, mainly tall fescue and soybeans.

Wetness is the main limitation of these soils. Because the soils dry out slowly and not until late in spring, planting is delayed, and the choice of crops is limited. Open ditches remove excess water in some areas; in other areas outlets are not available to remove surface water, and little can be done to improve drainage. Tile drainage is impractical because of the lack of suitable outlets, the fragipan, and slow permeability. The better suited crops are those that are water tolerant, such as tall fescue, and those that can be planted late, such as soybeans.

Wetness is a severe limitation of the soils for highway construction and other uses. For the most part, suitable building sites are not present in this association. The slow permeability favors the soils for uses such as pond reservoirs and lagoons.

5. Waynesboro-Christian Association

Hilly and rolling soils that are deep, well drained, and have a loamy surface layer and a loamy and clayey subsoil

This association consists of a range of low hills (fig. 5). The hills have short, moderately steep side slopes

Figure 5.—Typical view in Waynesboro-Christian association. Waynesboro soils are in pasture on the rolling hills in foreground, and Christian soils are in the idle fields and woods in background.

and fairly broad rolling tops. In a few places the surface is pitted by numerous oval or irregular-shaped limestone sinks and depressions. Short, meandering drainageways are common in the association, but very few of them carry water except runoff that immediately follows heavy rains. Slopes are dominantly 5 to 20 percent, but there are small scattered areas, mainly on hilltops and along drainageways, where slopes are less than 5 percent.

The soils formed in old alluvium, and in residuum from limestone, which contains some shale and siltstone. These soils are mostly deep, well drained, and have a subsoil of reddish clay. Depth to limestone bedrock is more than 4 feet, and in most places it is more than 6 feet.

This association makes up about 5 percent of the survey area. About 35 percent of the association is Waynesboro soils, and 30 percent is Christian soils. The rest is minor soils.

Waynesboro soils are on the broad rolling hilltops and on the less steep hillsides. These soils are deep and well drained. They have a surface layer of brown loam and a subsoil that is dominantly red clay loam in the upper part and dark red clay in the lower part. Christian soils are on the hillsides and on the walls surrounding depressions. They have a surface layer of brown silt loam and a subsoil that is dominantly yellowish red, firm clay. Christian soils have a few fragments of chert on the surface and throughout the soil.

Small areas of steep, cherty Bodine soils, which are minor in the association, border Center Hill Lake. Small tracts of the well drained, loamy Greendale soils are along drainageways. A few small areas of the well drained, loamy Mountview soils and the moderately well drained Dickson soils are on the broader, smoother hilltops.

About two-thirds of the acreage is cleared and is used mainly for pasture. The wooded areas are mainly on the steeper hillsides, especially those leading down to Center Hill Lake. The average farm is about 100 acres in size. On some farms small patches of tobacco are grown.

The soils in this association have good potential for grassland farming. Most of the acreage is suitable for pasture, but the acreage suitable for cultivation is very small and in small scattered tracts on hilltops and in narrow strips of bottom land.

Sites for homes and other accomodations requiring septic-tank filter fields are not plentiful in the area because of unfavorable permeability of some of the soils. Because of hilly terrain, road construction requires deep cuts in the clayey subsoil and high fills.

6. Christian-Mountview Association

Hilly and rolling soils that are deep, well drained, and have a loamy surface layer and a clayey and loamy subsoil

This association consists dominantly of hills that have short, moderately steep side slopes. The hilltops range from sharp crests to broad rolling or plateaulike areas large enough to accomodate 5- to 10-acre fields. Very narrow, elongated strips of bottom land are along the numerous meandering drainageways. Slopes are dominantly 5 to 25 percent.

The soils formed in residuum of limestone, which is capped in the smoother areas with a layer of loess 2 to 3 feet thick. The soils are commonly reddish clay on the hillsides and yellowish loam on the broad, rolling hilltops.

This association makes up about 5 percent of the survey area. About 50 percent of the association is Christian soils, and 20 percent is Mountview soils. The rest is minor soils.

Christian soils, which are on the hillsides, have a surface layer of brown silt loam and a subsoil of yellowish red, firm clay. These soils have a few fragments of chert on the surface and in the soil. Mountview soils, which are on the broader, smoother hilltops, have a surface layer of brown silt loam. The upper part of the subsoil is yellowish brown and strong brown, friable silty clay loam, and at a depth of about 30 inches the subsoil is yellowish red, firm clay.

Minor soils in this association are mainly the well drained, loamy Greendale soils on the narrow strips of bottom land and the moderately well drained Dickson soils on upland flats. A few areas of the well drained, loamy Minvale soils are on foot slopes.

About three-fourths of the acreage is cleared of its original hardwood forest and is used mainly for pasture and hay. Corn and tobacco are grown in small patches. Tobacco is the main cash crop; however, the main farm enterprise is beef cattle. An average farm is about 90 acres in size.

Most of the soils in this association are well suited to pasture and hay. Soils that can be cultivated every year or used in short cropping systems are mostly in scattered tracts of less than 10 acres in size and are on hilltops and along drainageways.

Hilly terrain and clayey subsoil are the main limitations for most engineering uses. Road construction requires deep cutting and filling in many places. Permeability of the soils varies and care should be exercised in the location of dwellings and other accommodations requiring septic-tank filter fields. The restricted permeability of some of the soils favors uses such as pond reservoirs, and water impoundment generally can be expected to be successful.

7. Sequatchie-Staser Association

Nearly level and gently sloping soils that are deep, well drained, and have a loamy surface layer and subsoil

This association consists mainly of long, narrow coves which finger deeply into the Cumberland Plateau (fig. 6). These coves begin in V-shaped mountain gorges and gradually widen as they emerge from the mountains onto the Highland Rim. These narrow strips of nearly level, fertile bottom land are adjacent to the mountain streams and flanked on either side by nearly level and gently sloping low terraces. Most of the areas

Figure 6.—The level and undulating soils, commonly in mountain coves, are in the Sequatchie-Staser association. The steep wooded slopes are in the Bouldin-Ramsey association.

are less than 1 mile wide and permanent streams meander through the approximate center of them.

The soils in this association formed in alluvium. They are dominantly well drained, deep, loamy, and productive. Sandstone cobbles are common in places, especially near the heads of the coves.

This association makes up about 2 percent of the survey area. About 40 percent of the association is Sequatchie soils, and 30 percent is Staser soils. The rest is minor soils.

Sequatchie soils, which are on the low terraces, are deep, well drained, and loamy. They have a surface layer of dark brown loam and a subsoil of brown and yellowish brown, friable loam and clay loam. Staser soils, which are on the first bottoms, are also deep, well drained, and loamy. They have a surface layer of dark brown silt loam and a subsoil of brown, friable silt loam.

The most important minor soils in the association are in the Welchland, Hamblen, Allen, and Etowah series. Welchland soils, which are on low terraces, are deep, well drained, and loamy. They have many cobbles on the surface and throughout the soil material. The moderately well drained, loamy Hamblen soils are in small areas on the bottom lands. The deep, well drained Etowah and Allen soils are in small areas, mainly along the base of the steep mountainsides.

Except for small scattered farm woodlots, all the acreage is cleared and is used to grow corn, small grain, tobacco, hay, and pasture. Tobacco is the main cash crop. The average farm is about 125 acres in size, and most farms include a sizable acreage on the adjacent steep mountainsides that lead up to the Cumberland Plateau.

Although of small extent, the soils of this association have high potential for farming. They are among the most fertile in the survey area. They are well suited to grain crops such as corn, small grain, and soybeans, as well as to hay and pasture. Flooding on the first bottoms and cobbles on a few of the soils are the main limitations. Flooding generally lasts for only a few hours in areas along the high-velocity streams. This brief flooding is also the main limitation to engineering uses, such as residential building and road construction. Suitable material for road fill is plentiful in the area.

8. Mountview-Allen Association

Undulating and rolling soils that are deep, well drained, and have a loamy surface layer and a loamy and clayey subsoil

This association consists of small, plateaulike areas atop outlier mountains which have become detached by geologic erosion from the main range of the Cumberland Mountains and from the Cumberland Plateau. These relatively flat-topped areas are dominantly undulating and rolling; slopes are mostly 2 to 12 percent. Some short, meandering drainageways terminate in shallow limestone sinks and depressions. These shallow drainageways and the adjacent short slopes separate the gently sloping areas into 5- to 30-acre tracts.

Most of the soils formed in old alluvium or in old valley fill, both of which are capped in less sloping places by a layer of loess 1 to 3 feet thick. These soils are mostly well drained, deep, and loamy. Limestone or sandstone bedrock is generally at a depth of more than 6 feet. In a few places, however, there are some outcrops of limestone.

This association makes up about 1 percent of the survey area. About 35 percent of the association is Mountview soils, and 35 percent is Allen soils. The rest is minor soils.

Mountview soils, which formed in loess and in the underlying residuum of limestone and sandstone, are deep and well drained. They have a surface layer of brown silt loam. The subsoil is yellowish brown and strong brown, friable silty clay loam in the upper part and yellowish red, firm clay in the lower part. The deep, well drained Allen soils, which formed in old alluvium and old valley fill, have a surface layer of brown loam and a subsoil of yellowish red, and red, friable clay loam.

Minor soils in this association are mostly in the Dickson and Jefferson series. The moderately well drained Dickson soils are in small tracts on upland flats. The deep, well drained, loamy Jefferson soils are in small tracts at the base of slopes.

About two-thirds of the acreage is cleared and used mainly for pasture and hay. Small areas are used for corn and vegetable crops, and some are idle. The rest is in hardwood forest. The average farm in this association is about 80 acres in size, but very few farms are entirely within this association. Most farms include some acreage on the steep, wooded, rocky mountainsides which surround this association.

The soils in this association have good potential for farming. They are suited to all locally grown crops. The main limitations are small sizes of the farms and the limited opportunities for expansion because of the adjacent mountainsides. Also, some areas are not easily accessible because they are on mountains.

The soils generally have favorable features for engineering uses such as road construction, residential building, and most kinds of recreation. The soils have favorable permeability for residences and other accommodations requiring septic tank filter fields. There is little surface water in the association. The water supply comes from deep wells and farm ponds. Since the soils have favorable permeability, pond reservoirs do not hold water in many instances unless compacted or specially treated.

9. Talbott-Rock Outcrop Association

Steep and very steep soils among outcrops of limestone that are moderately deep, well drained, and have a thin loamy surface layer and a plastic clayey subsoil

This association consists entirely of steep to very steep mountainsides. Throughout the area, outcrops of limestone rock extend from less than 1 to 4 or 5 feet above the soil surface, and the soil occurs as small patches among the rocks. In the rockiest places nearly one-half of the land surface has outcrops. In other places, outcrops are as little as 5 percent.

Most of the soils in this association formed in residuum of limestone. These soils have a subsoil of reddish, plastic clay, and limestone bedrock is mainly at a depth of 1½ to 3½ feet. Patches of soil free of outcrops are generally less than one-half acre in size.

This association makes up about 6 percent of the survey area. About 50 percent of the association is Talbott soils, and 25 percent is outcrops of limestone. The rest is minor soils.

Talbott soils are moderately deep to bedrock and well drained. These soils have a surface layer of brown silt loam and a subsoil of yellowish red, firm plastic clay. Rock outcrops consist of bare limestone rock.

Minor soils in this association are mostly in the Allen, Nella, and Bouldin series. The deep, well drained Allen soils have a surface layer of brown loam and a subsoil of yellowish red loam. Nella soils are similar to Allen soils except the Nella soils have many cobbles on the surface and throughout the soil material. Some of the deep, well drained, stony Bouldin soils are on the lower parts of the hillsides.

Almost all the acreage is in forest. In places the forest consists of almost pure stands of eastern redcedar. In others, it is dominantly hardwoods, such as oaks and hickory, with some eastern redcedar mixed in the stands.

Probably no farm is entirely within this association. The farms extend into it or through it from adjacent associations. Fence posts and small amounts of lumber are harvested. Most of the limestone quarries in the survey area are in this association.

Soil limitations for engineering uses are severe. Road construction requires deep cuts in limestone and, in some instances, in sandstone. Furthermore, these cuts must be made on steep terrain, and when cuts are made, landslides are likely to occur.

10. Bouldin-Ramsey Association

Steep, stony and loamy soils that are deep and shallow, well drained, and have a loamy surface layer and subsoil

This association is typically long, steep mountainsides. These mountainsides, sometimes called the

Cumberland Plateau Escarpment, lead from the Highland Rim to the Cumberland Plateau, a rise in elevation of about 1,000 feet. On these mountainsides are deep, stony soils; shallow, loamy soils; and outcrops of bare sandstone and limestone ledges. The most common pattern is a nearly vertical sandstone cliff that encircles the uppermost part of the slope, deep, stony soils below the cliff that extend about two-thirds of the way down the mountainside, and outcrops of limestone in the reddish clay on the lower one-third of the mountainside. The boundary between the deep, loamy soils and the rock outcrops in the clay can be seen in the spring, because trees blossom a few days earlier on the rocky areas, presumably because the limestone gives a higher calcium content to the soil. Slopes are mostly 20 to 75 percent.

Most of the soils formed in colluvium that has moved downslope over a very long period. Some soils, however, formed in residuum of sandstone and of limestone, which underlies most all of the association.

This association makes up about 16 percent of the survey area. About 50 percent of the association is Bouldin soils, and 30 percent is Ramsey soils. The rest is minor soils.

Bouldin soils, which formed in colluvium, are deep and well drained. They have a surface layer of brown stony sandy loam and a subsoil of yellowish red stony clay loam. These soils have many stones on the surface and in the soil, some as large as 15 feet across. Ramsey soils are loamy and are less than 20 inches deep to sandstone rock. Some of these soils are in small patches among outcrops of sandstone rock. A small part of the sandstone outcrops is on the cliff at the top of the slope. This cliff is bare except for small trees and bushes in the rock crevices.

Minor soils in the association are mostly the deep, well drained, loamy Allen soils and the deep, well drained Nella soils in small tracts on foot slopes and benches. Small areas of the sloping, clayey, plastic Talbott soils are among lower outcrops of limestone.

Most of the association is in heavily cutover forest, predominantly hardwood. The association has good potential for forestry. The major part of the association is deep, loamy, and stony soils. These soils produce high quality hardwoods, such as yellow-poplar and oaks.

Soil limitations for engineering work, especially highway construction, are severe. Deep cuts and removal of rocks are required. Large landslides are likely to occur when cuts are made in the long, steep slopes.

11. Ramsey-Hartsells Association

Hilly and rolling soils that are shallow and moderately deep, well drained, and have a loamy surface layer and subsoil

This association consists of the more highly dissected parts of the Cumberland Plateau. It is dominantly hilly and rolling (fig. 7). Throughout the area, a close network of deeply entrenched drainageways has cut down to the sandstone rock and exposed it in many places. Many of these drainageways converge into common channels as they approach the deep mountain gorges. Fairly broad rolling hilltops and short, moderately steep hillsides flank the nearly V-shaped drainageways. Slopes are mostly 4 to 25 percent.

The soils formed in residuum of sandstone, which underlies all of the association. In a few places shale is in the bedrock. These soils are well drained and loamy. The depth to bedrock generally is a few inches to about 3½ feet. Outcrops of sandstone are common on the steeper terrain.

This association makes up about 13 percent of the survey area. About 65 percent of the association is Ramsey soils, and 10 percent is Hartsells soils. The rest is minor soils.

Ramsey soils are loamy and well drained. They are less than 20 inches deep to sandstone rock. These soils are frequently in small patches among ledges of sandstone, which extend 1 to 4 feet above the surface. Hartsells soils are also loamy and well drained. The depth to bedrock is 20 to 40 inches.

Minor soils in this association are mostly of the Lonewood, Gilpin, and Tilsit series. The Lonewood soils are deep, well drained, and loamy. They are in small tracts on a few of the broader, smoother hilltops. The Gilpin soils are moderately deep, well drained, and loamy and are in small areas on some of the hillsides where a component of shale is in the bedrock. The moderately well drained Tilsit soils, which have a fragipan, are in small tracts on upland flats.

About three-fourths of the acreage is in heavily cutover hardwood forest. The cleared part is mainly on the small plateaulike areas and on the broader, smoother hilltops. Hay, pasture, and products of home gardens are the main crops. This association is thinly populated. A large part of the acreage is in large timber holdings, some of which exceed 1,000 acres. The farms are small, less than 100 acres in size. Off-farm employment is common throughout the association.

This association has good potential for forestry and for recreational use. It has fair potential for grassland farming. Soils suitable for cultivation are in small fields, most of which are less than 10 to 15 acres in size.

Soil limitations for engineering works, especially highway construction, are generally severe. Deep cuts and removal of sandstone rocks are required. In places hillside slippage is likely to occur when cuts are made in the slopes. Because the soil above the bedrock is shallow, the amount of material available for road fill is limited.

12. Hartsells-Lonewood Association

Undulating and rolling soils that are moderately deep and deep, well drained, and have a loamy surface layer and subsoil

This association consists of the smoother part of the Cumberland Plateau. It is marked by frequent shallow, crooked, U-shaped drainageways, which interrupt an otherwise smooth plateau or tableland. The association is dominantly undulating and rolling, but some

Figure 7.—Cleared field seeded to pasture in an area of Ramsey-Hartsells association. Outcrops of sandstone, common in the sloping Ramsey soils, are to the left of the pond. Hartsells soils are on the hilltops where the depth to bedrock is greater.

areas have moderately steep, short hillsides next to the deeper drainageways. Slopes are mostly 2 to 12 percent.

The soils formed in residuum of sandstone or of sandstone interbedded with shale. These soils are mostly well drained and loamy. Depth of the soil to bedrock is mostly 2 to 5 feet.

This association makes up about 25 percent of the survey area. About 40 percent of the association is Hartsells soils and 25 percent is Lonewood soils. The rest is minor soils.

Hartsells soils are well drained and are 20 to 40 inches deep to bedrock. They have a surface layer of brown loam and a subsoil of yellowish brown, friable loam and clay loam. Lonewood soils are well drained and are 40 to 65 inches deep to bedrock. They have a surface layer of brown silt loam. The upper part of the subsoil is yellowish brown, friable silt loam, and the lower part of the subsoil is yellowish red, firm clay loam.

Minor soils in this association are mostly of the Gilpin, Ramsey, Tilsit, and Sewanee series. The moderately deep, well drained Gilpin soils are in small tracts on hillsides. The shallow, well drained Ramsey soils are also in small tracts on hillsides, and in places these soils occur as small patches among outcrops of sandstone. The moderately well drained Tilsit soils, which have a fragipan, are in small tracts on upland flats. The moderately well drained Sewanee soils are in long narrow strips along drainageways.

About one-third of the acreage is cleared. The rest is a dominantly hardwood forest that has been heavily cutover. Some of the forested part is in large timber holdings of 1,000 acres or more in size. The main crops are hay and pasture, but small acreages of corn, small grain, soybeans, and tobacco are grown. An average farm is about 100 acres in size. Off-farm employment is high.

This association has fairly high potential for farming, especially beef cattle supplemented by a small

acreage of row crops. Nearly all the acreage is suitable for pasture and hay. A large part is suitable for row crops in short and moderately long cropping systems. Very little acreage is level enough for row crops every year.

Soil limitations for engineering works are generally slight or moderate. For highway construction, cutting in sandstone rock is usually required to cross the short hillsides. Water impoundment is nearly always successful because the level-bedded rock is impervious in most places. Septic-tank drainage fields function successfully on these soils provided the soil is deep enough to bedrock.

Descriptions of the Soils

The soils of White and Van Buren Counties are described in detail in this section. First, the soil series is described, and then the mapping units, or kinds of soil, in that series. Thus, to get full information on any one mapping unit, it is necessary to read both the description of that unit and the description of the soil series to which the unit belongs.

Each soil series description contains a short narrative description of a profile considered representative of the series and then a much more detailed description of the same profile that scientist, engineers, and others can use to make highly technical interpretations. The colors described are for moist soil, unless otherwise indicated.

The mapping unit symbol precedes the name of each mapping unit. This symbol identifies the mapping unit on the detailed soil map.

Some of the terms used in the soil descriptions are defined in the Glossary, and some are defined in the section "How This Survey Was Made." The approximate acreage and proportionate extent of each soil mapped are shown in table 5. At the back of this soil survey is the "Guide to Mapping Units," which lists the mapping units in the counties and gives the capability unit and woodland group for each and the page where each of these groups is described.

Allen Series

The Allen series consists of deep, loamy, well drained soils on benches and foot slopes of the Cumberland Plateau Escarpment. The soils formed in material that washed or rolled down the mountainsides. Slopes range from about 5 to 35 percent.

In a representative profile the surface layer is brown loam about 7 inches thick. The subsoil is yellowish brown, friable loam to a depth of 12 inches. Between depths of 12 and 50 inches, the subsoil is yellowish red, friable clay loam. Below a depth of 50 inches, it is red, friable clay loam.

The Allen soils are strongly or very strongly acid throughout, except in the surface layer in limed areas. Permeability is moderate, and the available water capacity is high. These soils are easy to work, and crops respond well to management.

About half the acreage is cleared and is used to produce pasture, hay, corn, small grain, and tobacco. The rest is in hardwood forest or, in some formerly cleared fields, it is reverting to pine and hardwood forest.

Representative profile of Allen loam, 12 to 20 percent slopes:

Ap—0 to 7 inches; brown (10YR 5/3) loam; weak fine granular structure; very friable; many roots; medium acid; clear smooth boundary.

B1—7 to 12 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common roots; strongly acid; clear smooth boundary.

B21t—12 to 24 inches; yellowish red (5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; few fine roots; discontinuous clay films on faces of peds; strongly acid; clear smooth boundary.

B22t—24 to 35 inches; yellowish red (5YR 5/6) clay loam, few medium distinct yellowish brown (10YR 5/4) and red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; friable; clay films on faces of peds; strongly acid; clear smooth boundary.

B23t—35 to 50 inches; yellowish red (5YR 5/6) clay loam; common medium distinct red (2.5YR 4/6) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; friable; clay films on faces of peds; strongly acid; clear smooth boundary.

B24t—50 to 75 inches; red (2.5YR 4/6) clay loam; many medium distinct dark red (2.5YR 3/6) and yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; friable; clay films on faces of peds; strongly acid.

Depth to bedrock is more than 6 feet. Sandstone fragments less than 1 inch to as much as 10 inches across range from a few feet to about 15 percent by volume. The A2 or Ap horizon is brown, pale brown, or yellowish brown loam or fine sandy loam 5 to 10 inches thick. In the severely eroded Allen soil the A2 or Ap horizon is yellowish brown, strong brown, or yellowish red clay loam. The upper part of the B horizon is yellowish brown loam, and the lower part is red clay loam or clay.

AeC—Allen loam, 5 to 12 percent slopes. This deep, well drained, loamy soil is on benches and foot slopes at the base of the Cumberland Plateau Escarpment and mountain outliers such as Goulden Mountain. The soil formed in sediment that moved downslope from soils underlain by sandstone and limestone. The surface layer, about 5 to 10 inches thick, is brown, very friable loam. In a few areas there are occasional spots of eroded soil that has a surface layer of yellowish red clay loam. The subsoil is dominantly yellowish red and red, friable clay loam several feet thick. Depth to bedrock, most commonly limestone, is more than 6 feet. Slopes are mostly 5 to 10 percent though they range to 12 percent.

Included with this soil in mapping were some small areas of a similar soil that has slopes of more than 12 percent. Small areas of a soil that is more than 15 percent cobbles throughout the profile are in some mapped areas. Also included are small areas of soils that have a subsoil of yellowish brown silt loam about 2 feet thick underlain by yellowish red clay loam.

This soil has medium potential for row crops and small grain. Its potential is limited by slope and by the small and irregular shape of the areas. This soil has high potential for hay, pasture, and for all plants suited to the local climate.

TABLE 5.—*Approximate acreage and proportionate extent of the soils*

Soils	White County	Van Buren County	Total	
			Area	Extent
	Acres	*Acres*	*Acres*	*Pct*
Allen loam, 5 to 12 percent slopes	2,760	1,370	4,130	1.0
Allen loam, 12 to 20 percent slopes	3,110	560	3,670	.9
Allen loam, 20 to 35 percent slopes	3,150	340	3,490	.9
Allen clay loam, 12 to 25 percent slopes, severely eroded	1,000	140	1,140	.3
Atkins silt loam	330	420	750	.2
Bewleyville silt loam, 2 to 5 percent slopes	4,400	50	4,450	1.1
Bewleyville silt loam, 5 to 12 percent slopes	3,610	20	3,630	.9
Bodine cherty silt loam, 25 to 50 percent slopes	840	10	850	.2
Bonair silt loam	240	270	510	.1
Bouldin stony loam, 25 to 50 percent slopes	17,060	14,590	31,650	7.8
Christian silt loam, 5 to 12 percent slopes, eroded	2,750	10	2,760	.7
Christian silt loam, 12 to 20 percent slopes, eroded	3,600	20	3,620	.9
Christian cherty silt loam, 5 to 12 percent slopes, eroded	400	10	410	.1
Christian cherty silt loam, 12 to 20 percent slopes, eroded	6,800	130	6,930	1.7
Christian cherty silt loam, 20 to 35 percent slopes, eroded	3,840	190	4,030	1.0
Christian cherty silty clay loam, 5 to 20 percent slopes, severely eroded	1,020	70	1,090	.3
Curtistown silt loam, 2 to 5 percent slopes	3,000		3,000	.7
Decatur silt loam, 2 to 5 percent slopes	1,040	110	1,150	.3
Decatur silt loam, 5 to 12 percent slopes, eroded	1,430	270	1,700	.4
Dickson silt loam, 1 to 3 percent slopes	3,280	460	3,740	.9
Emory silt loam	2,570	220	2,790	.7
Etowah silt loam, 2 to 5 percent slopes	1,600	250	1,850	.4
Etowah silt loam, 5 to 12 percent slopes	5,520	1,050	6,570	1.6
Etowah silt loam, 12 to 20 percent slopes	1,270	200	1,470	.3
Etowah cherty silt loam, 5 to 12 percent slopes	3,480	220	3,700	.9
Etowah cherty silt loam, 12 to 20 percent slopes	6,630	620	7,250	1.8
Etowah cherty silt loam, 20 to 35 percent slopes	2,280	330	2,610	.6
Gilpin silt loam, 12 to 20 percent slopes	900	6,880	7,780	1.9
Gilpin silt loam, 20 to 40 percent slopes	1,020	1,840	2,860	.7
Greendale silt loam	400	10	410	.1
Guthrie silt loam	2,160	10	2,170	.5
Hamblen silt loam	3,720	120	3,840	.9
Hartsells loam, 2 to 5 percent slopes	1,160	1,090	2,250	.6
Hartsells loam, 5 to 12 percent slopes	15,200	28,360	43,560	10.7
Jefferson loam, 5 to 12 percent slopes	240	10	250	.1
Jefferson loam, 12 to 20 percent slopes	1,310	1,540	2,850	.7
Jefferson loam, 20 to 35 percent slopes	520	290	810	.2
Lonewood silt loam, 2 to 5 percent slopes	1,310	2,120	3,430	.8
Lonewood silt loam, 5 to 12 percent slopes	4,320	11,030	15,350	3.8
Lonewood loam, 3 to 12 percent slopes	720	2,770	3,490	.9
Melvin silt loam	380	10	390	.1
Minvale cherty silt loam, 5 to 12 percent slopes	530	190	720	.2
Minvale cherty silt loam, 12 to 20 percent slopes	470	340	810	.2
Mountview silt loam, 2 to 5 percent slopes	4,330	220	4,550	1.1
Mountview silt loam, 5 to 12 percent slopes	2,260	290	2,550	.6
Nella cobbly loam, 5 to 20 percent slopes	860	550	1,410	.3
Nella cobbly loam, 20 to 45 percent slopes	3,900	2,050	5,950	1.5
Ramsey loam, 5 to 20 percent slopes	6,900	32,820	39,720	9.8
Ramsey loam, 20 to 40 percent slopes	2,450	4,920	7,370	1.8
Ramsey-Rock outcrop complex, 5 to 20 percent slopes	5,150	4,470	9,620	2.4
Ramsey-Rock outcrop complex, 20 to 50 percent slopes	6,210	6,610	12,820	3.1
Rock outcrop-Ramsey complex, 35 to 75 percent slopes	6,880	5,430	12,310	3.0
Sequatchie loam	2,040	970	3,010	.7
Sewanee loam	300	820	1,120	.3
Staser silt loam	2,200	710	2,910	.7
Taft silt loam	2,440		2,440	.6
Talbott silt loam, 5 to 12 percent slopes, eroded	1,500	500	2,000	.5
Talbott silty clay loam, 5 to 20 percent slopes, rocky areas	3,000	1,270	4,270	1.0
Talbott silty clay loam, 20 to 50 percent slopes, rocky areas	3,030	1,770	4,800	1.2
Talbott-Rock outcrop complex, 5 to 20 percent slopes	2,450	710	3,160	.8
Talbott-Rock outcrop complex, 20 to 50 percent slopes	17,750	6,550	24,300	6.0
Tilsit silt loam, 2 to 5 percent slopes	210	530	740	.2
Udorthents-Mine pits complex	800	2,740	3,540	.9
Waynesboro loam, 2 to 5 percent slopes	1,720	60	1,780	.4
Waynesboro loam, 5 to 12 percent slopes	27,160	4,000	31,160	7.7
Waynesboro loam, 12 to 20 percent slopes	12,240	3,340	15,580	3.8
Waynesboro loam, 20 to 35 percent slopes, eroded	1,220	890	2,110	.5
Waynesboro clay loam, 5 to 12 percent slopes, severely eroded	1,950	50	2,000	.5
Waynesboro clay loam, 12 to 20 percent slopes, severely eroded	3,880	1,070	4,950	1.2
Welchland cobbly loam	300	720	1,020	.3
Totals	244,500	162,600	407,100	100.0

This soil has medium to high potential for urban uses. The slope is the main limitation, but this can be easily overcome by good design and installation procedures. Capability unit IIIe-1; woodland group 3o.

AeD — Allen loam, 12 to 20 percent slopes. This deep, loamy, well drained soil is on mountain foot slopes. The soil formed in material that washed or rolled from soils on the sandstone and siltstone mountains. It has the profile described as representative of the series. The surface layer is brown friable loam about 6 to 8 inches thick. Small spots of eroded soil that has a surface layer of reddish clay loam are present in places. The subsoil of yellowish red, friable clay loam extends to a depth of several feet. A few fragments of sandstone 1 to 5 inches across are on the surface and in the soil.

Included with this soil in mapping were a few small areas of similar soils that are about 15 to 25 percent by volume sandstone cobbles and gravel throughout. A few small areas of a soil that has shale or siltstone bedrock at a depth of about 3 feet were also included.

This soil has low potential for row crops, and a medium to high potential for hay and pasture. Its potential is limited by strong slope and by the steep slope of the adjacent soils. All commonly grown hay and pasture plants are suitable for this soil, and all commonly grown row crops and small grains can be grown if long cropping systems and water control practices are used.

The potential for urban uses is low to medium. Strong slopes, the main limitation, require very careful design and management for uses such as residential building and road construction. This soil is susceptible to landslides when cuts are made in the slopes. When the soil becomes saturated, it tends to slip and slide on the underlying limestone rock or on the clayey layer that commonly lies on the limestone. Capability unit IVe-1; woodland group 3o.

AeE—Allen loam, 20 to 35 percent slopes. This deep, loamy, well drained soil is on the foot slopes below steep mountainsides. The surface layer is brown, friable loam about 6 inches thick, and 1 to 2 inches of the upper part is stained darker by organic matter in wooded areas. The subsoil is yellowish red or red clay loam at a depth of 5 feet or more. A few sandstone pebbles and cobbles are on the surface and in the soil.

Included with this soil in mapping were a few areas of deep, loamy soil that is about 15 to 25 percent by volume of sandstone cobbles and gravel. Also included were a few small areas of a soil that are 3 to 4 feet deep to limestone, sandstone, or siltstone bedrock.

This soil has very low potential for row crops, small grain, and hay. It has medium potential for pasture. The soil is too steep for row crops, and slope makes it difficult to establish and maintain pasture. Common pasture plants, such as tall fescue, white clover, and orchardgrass, provide good pasture.

This soil has high potential for growing quality hardwood trees such as yellow-poplar. Much of the soil is on the lower parts of mountainsides where moisture is plentiful.

The potential for most urban uses is very low because the soil is likely to slip and slide if cuts are made in the slopes. This limitation is extremely difficult, if not impossible, to overcome. Capability unit VIe-1; woodland group 3r.

AnD3—Allen clay loam, 12 to 25 percent slopes, severely eroded. This deep, well drained, loamy soil is on moderately steep to steep foot slopes of mountains. It formed in soil material that washed or rolled from higher lying soils underlain by sandstone. The 4-to 6-inch surface layer, composed mostly of former subsoil material, is yellowish brown, strong brown, or yellowish red. In most areas this material is clay loam, but in places it is loam. The subsoil is dominantly yellowish red or red, friable clay loam several feet thick. Shallow gullies are in some areas. Size of areas and total acreage are small.

Included with this soil in mapping were small patches where slopes are less than 12 and more than 25 percent. In some small areas the soil is more than 15 percent by volume sandstone fragments.

This soil is cleared and is used for row crops. Much of the area is idle or has reverted to forest, composed mainly of Virginia pine, oaks, maple, sourwood, hickory, and dogwood.

This soil has low potential for row crops and small grain. Its potential is limited by strong slopes and, to a lesser degree, by the somewhat clayey surface layer. It has medium potential for pasture and plants such as tall fescue, white clover, and lespedeza and produces well, if heavily fertilized and otherwise well managed.

The potential for urban uses is low. The soil is likely to slip and slide if cuts are made in the slopes, and this severe limitation is extremely difficult to overcome. Capability unit VIe-1; woodland group 4c.

Atkins Series

The Atkins series consists of deep, poorly drained, gray, loamy soils on flood plains. These soils consist of sediment washed from soils underlain by sandstone and shale. Slopes are less than 2 percent.

In a representative profile the surface layer is dark gray silt loam about 7 inches thick. The subsoil, to a depth of 24 inches, is gray, friable, silt loam mottled in shades of brown and yellow. Between depths of 24 and 60 inches, the subsoil is mottled, gray, friable silty clay loam or loam.

Atkins soils are occasionally flooded for short periods, mostly in winter and spring. During those seasons the water table stays near the surface for long periods. The soils are strongly acid except for the surface layer in limed areas. They are moderately permeable and have high available water capacity.

Atkins soils are largely wooded. A few areas are cleared and are used for pasture.

Representative profile of Atkins silt loam:

A2—0 to 7 inches; dark gray (10YR 4/1) silt loam; few fine distinct mottles of yellowish brown (10YR 5/6); weak fine granular structure; friable; strongly acid; clear smooth boundary.

B21—7 to 24 inches; gray (N 5/0) silt loam; common fine distinct mottles of dark brown (7.5YR 4/4); weak fine

granular structure; friable; strongly acid; gradual smooth boundary.

B22g—24 to 48 inches; mottled gray (N 5/0) and yellowish brown (10YR 5/6) silty clay loam; weak fine granular structure; friable; strongly acid; gradual smooth boundary.

Cg—48 to 60 inches; mottled gray (N 6/0) and yellowish brown (10YR 5/6) loam; massive; friable; strongly acid.

Coarse fragments, mainly waterworn sandstone and shale gravel, make up as much as 15 percent of the A and B horizons and up to 40 percent of the C horizon in a few areas. The A horizon is dark gray, grayish brown, or dark grayish brown loam. Present in a few undisturbed areas are A1 horizons, 1 to 5 inches thick, that are very dark gray to black. The B horizon is dominantly olive gray, gray, or light brownish gray; or it is mottled, gray, brown, and yellow and lacks a dominant color. It is fine sandy loam, silt loam, silty clay loam, or loam. The C horizon is dominantly gray or mottled gray, brown, and yellow. It is silt loam, loam, silty clay loam, or fine sandy loam.

At—Atkins silt loam. This soil is in 2-to 3-acre tracts on the flood plains of creeks and branches on the Cumberland Plateau. It is grayish, loamy, and poorly drained. The soil is flooded occasionally, and the water table is near the surface for long periods during winter and spring. Slope is less than 2 percent.

This soil has medium potential for farming. Its potential is limited by wetness and flooding. If better drainage is provided by tiles or open ditches, use can be broadened to include such crops as corn and vegetables, which could be grown every year. Without improved drainage, the best suited crops are those that can be planted late, such as soybeans, or those that are water tolerant, such as tall fescue.

The potential for urban uses is very low because of flooding and a high water table. Major drainage work and flood prevention are required to overcome this limitation. Capability unit IIIw-1; woodland group 2w.

Bewleyville Series

The Bewleyville series consists of deep, well drained, loamy soils on gently rolling uplands of the Highland Rim. These soils formed in a 15- to 30-inch thick layer of loess and in the underlying old alluvium or limestone residuum. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is brown silt loam 8 inches thick. The subsoil, to a depth of 14 inches, is strong brown, friable silt loam. Between a depth of 14 and 36 inches, the subsoil is yellowish red and red, friable silty clay loam, and between a depth of 36 and 72 inches the subsoil is dark red firm clay.

Bewleyville soils are strongly acid or very strongly acid except for the surface layer in limed areas. They are moderately permeable and have high available water capacity.

These soils are easy to work, and crops respond well to management. They are used to grow corn, tobacco, small grain, and all other crops common to the area.

Representative profile of Bewleyville silt loam, 2 to 5 percent slopes:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; many roots, medium acid; clear smooth boundary.

B21t—8 to 14 inches; strong brown (7.5YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; few discontinuous clay films on faces of peds; strongly acid; clear smooth boundary.

B22t—14 to 22 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; few fine roots; clay films on faces of peds; strongly acid; gradual smooth boundary.

B23t—22 to 28 inches; yellowish red (5YR 4/6) silty clay loam; few fine distinct strong brown mottles; moderate medium subangular blocky structure; friable; few fine roots; clay films on faces of peds; strongly acid; gradual smooth boundary.

B24t—28 to 36 inches; red (2.5YR 4/6) silty clay loam; few medium distinct brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; friable; clay films on faces of peds; strongly acid; gradual smooth boundary.

B25t—36 to 48 inches; dark red (2.5YR 3/6) clay; few medium distinct yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; clay films on faces of peds; strongly acid; gradual smooth boundary.

B26t—48 to 72 inches; dark red (2.5YR 3/6) clay; common medium strong brown (7.5YR 5/6) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; firm; clay films on faces of peds; strongly acid.

The A horizon is brown silt loam, 5 to 10 inches thick. The B21t is strong brown, yellowish red, or reddish brown silt loam or silty clay loam. The B22 and B23t horizons are yellowish red, red, or reddish brown silty clay loam or (rarely) silt loam. The B24t to B26t horizons are red, dark red, or yellowish red clay, clay loam, or silty clay loam. Depth to rock is more than 8 feet.

BeB—Bewleyville silt loam, 2 to 5 percent slopes. This deep, well drained, gently sloping, loamy soil is on broad uplands of the Highland Rim. It has the profile described as representative of the series. The surface layer is brown silt loam, 5 to 10 inches thick. The upper part of the subsoil is yellowish red, and red friable silty clay loam; the lower part is dark red firm clay.

Included with this soil in mapping are small areas where the surface layer is dark brown. Also included are a few areas where the subsoil is yellowish brown or strong brown and few areas where slopes are short and the subsoil is red clay.

This soil has high potential for farming and urban uses. The mild slope is the only significant limitation, and it can be easily overcome by good management. Capability unit IIe-1; woodland group 3o.

BeC—Bewleyville silt loam, 5 to 12 percent slopes. This deep, well drained, sloping, loamy soil is on uplands of the Highland Rim. It formed in loess or silty material 15 to 30 inches thick and in limestone residuum or old alluvium that underlies the loess.

The surface layer is brown silt loam, 5 to 8 inches thick. The upper part of the subsoil is yellowish red, friable silty clay loam and silt loam, about 25 inches thick. The lower part of the subsoil is red or dark red, firm silty clay loam, clay loam, or clay. It is several feet thick.

Included with this soil in mapping are a few areas where the surface layer is dark brown silt loam and a few small areas where the subsoil is red clay.

This soil is easy to work, responsive to good management, and well suited to all crops and pasture plants

common to the area. It has medium potential for row crops. Its potential is limited by slopes and, in some places, by the small size and irregular shape of the individual areas. The potential for small grain, hay, and pasture is high.

The potential for urban uses, such as residential building and road construction, is high. Slopes, the main limitation, can be overcome by good design and installation practices. Capability unit IIIe-1; woodland group 3o.

Bodine Series

The Bodine series consists of deep, somewhat excessively drained, strongly acid, steep, cherty soils. These soils are on hillsides along Center Hill Lake in the western part of White County. They formed in residuum derived from cherty limestone. Slopes range from 25 to 50 percent.

In a representative profile the surface layer is pale brown, cherty silt loam about 8inches thick. In wooded areas the upper 2 inches is dark grayish brown because of organic matter. The subsoil, to a depth of 78 inches, is yellowish brown and strong brown, friable cherty silt loam and cherty silty clay loam.

Bodine soils are strongly acid or very strongly acid throughout. They have moderately rapid permeability and low available water capacity.

These soils are largely in mixed hardwood and pine forest. A few of the less steep tracts are cleared and are used for pasture.

Representative profile of Bodine cherty silt loam, 25 to 50 percent slopes:

A1—0 to 2 inches; dark grayish brown (10YR 4/2) cherty silt loam; moderate medium granular structure; very friable; common angular ½- to 3-inch fragments of chert; many fine roots; strongly acid; abrupt smooth boundary.

A2—2 to 8 inches; pale brown (10YR 6/3) cherty silt loam; moderate fine and medium granular structure; friable; about 20 percent by volume ½- to 3-inch fragments of chert; common fine roots; strongly acid; clear wavy boundary.

B1—8 to 16 inches; yellowish brown (10YR 5/4) cherty silt loam; weak fine subangular blocky structure; friable; about 40 percent by volume ½- to 3-inch chert fragments; few fine and medium roots; strongly acid; clear wavy boundary.

B21t—16 to 39 inches; strong brown (7.5YR 5/6) cherty silty clay loam; moderate medium subangular blocky structure; friable; clay films discontinuous on ped surfaces and chert fragments; about 65 percent by volume chert fragments; strongly acid; gradual wavy boundary.

B22t—39 to 60 inches; strong brown (7.5YR 5/6) cherty silty clay loam; moderate medium subangular blocky structure; friable; few patchy clay films; about 70 percent by volume ½- to 4-inch chert fragments; strongly acid; gradual wavy boundary.

B3—60 to 78 inches; yellowish brown (10YR 5/4) cherty silt loam; weak medium subangular blocky structure; friable; clay films on faces of peds; about 70 percent by volume ½- to 5-inch chert fragments; strongly acid.

In the A horizon chert fragments are 20 to 35 percent by volume and in the B horizon 35 to 75 percent. Thickness of the A horizon is 5 to 12 inches. In cleared areas the A horizon is commonly brown, dark yellowish brown, or yellowish brown. The B horizon is yellowish brown, light yellowish brown, strong brown, or reddish yellow, and the fine earth fraction is silt loam or silty clay loam. Depth to bedrock exceeds 6 feet.

BdF—Bodine cherty silt loam, 25 to 50 percent slopes. This steep, cherty soil is on the hillsides around Center Hill Lake. Chert fragments increase in size and amount with increasing depth. The subsoil is 35 to 75 percent, by volume, chert fragments.

Included with this soil in mapping are a few areas of soils that have a thick, dark brown surface layer and a few areas of soils that have scattered outcrops of limestone rock. In few areas bedrock is 20 to 40 inches deep.

This soil has very low potential for farming and urban uses, because it is too steep and too cherty. It has medium potential for trees, wildlife habitat, and such extensive recreational uses as hunting, hiking, and nature study areas. Capability unit VIIs-1; woodland group 4f.

Bonair Series

The Bonair series consists of deep, dark, poorly drained, loamy soils. These soils are mostly in depressions or on flood plains of small streams and are either level or nearly level. They formed in loamy alluvium derived from acid sandstones and shales.

In a representative profile the surface soil is very dark gray silt loam 9 inches thick. The subsoil, extending to a depth of 45 inches, is dominantly gray and dark gray, friable silt loam mottled with shades of olive and brown. Below the subsoil to a depth of 62 inches is gray, mottled loam and fine sandy loam.

The Bonair soils have moderate permeability, high available water capacity, and are subject to flooding. Ponding is common in some of the depressions. These soils have a water table about 12 inches below the surface 1 to 3 months each year. They are strongly acid or very strongly acid except for the surface layer in limed areas.

About one-half the acreage is in cutover hardwoods, mostly maple and gums. The cleared areas are used mostly for pasture.

Representative profile of Bonair silt loam:

A1—0 to 9 inches; very dark gray (10YR 3/1) silt loam; few fine distinct mottles of dark grayish brown (2.5Y 4/2); moderate medium granular structure; very friable; many roots; strongly acid; gradual smooth boundary.

B21g—9 to 14 inches; dark gray (10YR 4/1) silt loam, common medium faint dark grayish brown (2.5Y 4/2) mottles; moderate medium granular structure; friable; many roots; very strongly acid; gradual smooth boundary.

B22g—14 to 28 inches; gray (10YR 5/1) silt loam; common medium faint mottles of grayish brown (2.5Y 5/2); weak coarse prismatic structure parting to moderate medium angular and subangular blocky structure; friable; common roots; very strongly acid; gradual smooth boundary.

B23g—28 to 36 inches; grayish brown (2.5Y 5/2) silt loam; common medium distinct mottles of light olive brown (2.5Y 5/4) and few fine distinct light gray (10YR 6/1) mottles; weak coarse prismatic structure parting to medium angular and subangular blocky structure; friable; few roots; very strongly acid; gradual smooth boundary.

B3g—36 to 45 inches; gray (10YR 5/1) silt loam; common medium distinct mottles of light olive brown (2.5Y 5/4); weak medium subangular blocky structure; friable; very strongly acid; gradual smooth boundary.

C1g—45 to 54 inches; gray (10YR 5/1) loam; few medium distinct mottles of grayish brown (2.5Y 5/2) and light olive brown (2.5Y 5/6); massive; friable; very strongly acid; gradual smooth boundary.

C2g—54 to 62 inches; gray (N 5/0) fine sandy loam; few medium faint mottles of grayish brown (2.5Y 5/2); massive; friable; very strongly acid.

The A horizon is 6 to 10 inches thick. In plowed areas the A1 horizon or Ap horizon is very dark gray or black silt loam or loam. The B horizon is mottled gray, dark gray, or grayish brown silt loam, loam, or (in a few areas) fine sandy loam. Depth to sandstone rock is 40 to 70 inches.

Bn—Bonair silt loam. This nearly level, poorly drained, dark loamy soil is along small streams and in depressions mainly on the Cumberland Plateau.

Included with this soil in mapping are a few where the subsoil is silty clay loam. Also included are some small areas where the surface layer is brown silt loam and the subsoil is mottled, brown silt loam. In a few small areas sandstone is 20 inches deep or less.

This soil has medium potential for farming and very low potential for urban uses. Its potential is limited by wetness and occasional flooding. These limitations can be overcome only by major flood control and drainage measures. Without improved drainage the best suited crops are those that can be planted late, such as soybeans. If better drainage is provided either by tile or by open ditches, uses can be broadened to include such crops as corn and vegetables, which could be grown every year. Capability unit IIIw-1; woodland group 2w.

Bouldin Series

The Bouldin series consists of deep and well drained soils. These soils occupy the long talus slopes below the cliffs of the Cumberland Plateau Escarpment. In places the soils extend to the base of these long slopes, and in others, they extend no more than one-third of the way down the escarpment. Many loose stones are on the soil surface, some as large as 15 feet across. Slopes range from 25 to 50 percent.

In a representative profile the surface layer is brown stony loam about 8 inches thick. The upper 2 inches of it is stained by darker organic matter. The subsoil is strong brown and yellowish red, friable, stony loam and stony clay loam to a depth of 90 inches. The subsoil is about 35 to 65 percent, by volume, sandstone cobbles and stones.

Permeability is moderately rapid. Available water capacity is medium to low. The soil material is strongly or very strongly acid throughout. The high stone content makes cultivation of these soils impracticable.

Nearly all the acreage is wooded, and good stands of mixed hardwoods grow in these soils. A few small areas are cleared of surface stones and are in pasture.

Representative profile of Bouldin stony loam, 25 to 50 percent slopes:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) stony loam; weak medium and fine granular structure; very friable; many roots; about 15 to 20 percent of surface area covered with stones; strongly acid; abrupt smooth boundary.

A2—2 to 8 inches; brown (10YR 4/3) stony loam; weak medium granular structure; very friable; many roots; 25 percent by volume angular sandstone fragments dominantly 5 to 18 inches in size; strongly acid; clear smooth boundary.

B1—8 to 18 inches; strong brown (7.5YR 5/6) stony loam; moderate fine and medium subangular blocky structure; friable; common roots; 30 percent by volume angular fragments of sandstone dominantly 5 to 20 inches in size; strongly acid; clear smooth boundary.

B21t—18 to 40 inches; yellowish red (5YR 4/6) stony clay loam; moderate medium subangular blocky structure; friable; common roots; discontinuous clay films on peds and in pores; 50 percent by volume angular fragments of sandstone dominantly 5 to 20 inches in size; very strongly acid; gradual wavy boundary.

B22t—40 to 75 inches; yellowish red (5YR 4/6) stony clay loam; moderate medium and fine subangular blocky structure; friable; few fine roots; discontinuous clay films on peds and in pores; 60 percent by volume of angular fragments of sandstone dominantly 5 to 20 inches in size; very strongly acid; gradual wavy boundary.

B3—75 to 90 inches; yellowish red (5YR 4/6) stony loam, common fine to coarse distinct yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; thin patchy clay films on faces of peds, in pores, and on rock fragments; 65 percent by volume of angular fragments of sandstone mostly 10 to 20 inches in size; very strongly acid.

The fine-earth fraction of the A horizon is loam or sandy loam. The fine-earth fraction of the B horizon is strong brown or yellowish red clay loam, sandy clay loam, or loam. In the A horizon, sandstone fragments are less than 1 foot to several feet across. They make up 15 to 40 percent, by volume, of this horizon. Sandstone fragments make up 35 to 65 percent, by volume of the B horizon. Depth to bedrock, mainly limestone, is more than 5 feet.

BoF—Bouldin stony loam, 25 to 50 percent slopes. This deep, well drained, steep, stony soil is on mountain foot slopes and mountainsides of the Cumberland Plateau Escarpment. It formed in material that has washed or rolled down from steep mountain slopes. It has numerous stones on the surface and in the soil material, some as large as 15 feet across.

Included with this soil in mapping were a few small areas in narrow drainageways where running water has removed most of the soil material and left material that is as much as 90 percent, by volume, stones. Also included are short, nearly vertical, sandstone cliffs that mark the tops of the slopes. In some areas, especially along the lower parts of the slopes, there are scattered outcrops of limestone. Near these limestone outcrops are soils that have a subsoil of red plastic clay.

Bouldin stony loam has very low potential for farming and urban uses. It has high potential for trees and for extensive recreation such as hunting, hiking, and nature study areas. It has medium to high potential for woodland wildlife habitat. Hardwood trees, such as oaks, hickory, and yellow-poplar, grow well because the soil is on the lower part of steep slopes where moisture is plentiful.

This soil is extremely susceptible to massive landslides if cuts are made in the steep slopes for roads or

for building foundations. This limitation is very difficult, if not impossible, to overcome. Capability unit VIIs-1; woodland group 3x.

Christian Series

The Christian series consists of deep, well drained soils on uplands of the Highland Rim, mainly in the western part of White County. They formed in material weathered from limestone that contains pockets or seams of siltstone, sandstone, shale, and chert. Slopes range from 5 to 35 percent.

In a representative profile the surface layer is brown silt loam about 6 inches thick. The subsoil, to a depth of 14 inches, is yellowish red, friable silty clay loam. Below this, and extending to a depth of 58 inches, it is yellowish red, very firm and firm clay that has brownish and yellowish mottles underlying the subsoil, between depths of 58 and 65 inches, is very firm clay mottled in shades of red, yellow and brown.

Permeability is moderately slow. Available water capacity is medium. The soil is strongly acid or very strongly acid except in the surface layer in limed areas.

Christian soils are used mostly for pasture and hay. Small tracts are in hardwood forest.

Representative profile of Christian silt loam, 5 to 12 percent slopes, eroded:

Ap—0 to 6 inches; brown (10YR 4/3) silt loam; weak fine granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

B21t—6 to 14 inches; yellowish red (5YR 5/8) silty clay loam; moderate fine and medium subangular blocky structure; friable; many roots; few thin clay films; very strongly acid; clear smooth boundary.

B22t—14 to 30 inches; yellowish red (5YR 5/6) clay; strong fine and medium subangular blocky structure; firm, sticky and plastic; common roots; common clay films; few streaks and fragments of brownish yellow (10YR 6/6) partly weathered sandstone; 5 percent by volume chert fragments; very strongly acid; gradual wavy boundary.

B23t—30 to 58 inches; yellowish red (5YR 5/6) clay, many medium and coarse distinct red (2.5YR 5/6) brownish yellow (10YR 6/6) and pale yellow (5Y 7/3) mottles; strong medium and coarse subangular blocky structure; very firm, sticky and plastic; few roots; common clay films; very strongly acid; gradual wavy boundary.

C—58 to 65 inches; mottled red (2.5YR 5/6) brownish yellow (10YR 6/6), and pale yellow (5Y 7/3) clay, relic platy structure; very firm; very strongly acid.

The A horizon is strong brown, brown, or yellowish brown silt loam or cherty silt loam. It is yellowish red, cherty silty clay loam or silty clay loam or finer material in several areas of eroded soil. The upper few inches of the B horizon is yellowish red or strong brown silty clay loam or cherty silty clay loam. The lower part is yellowish red or red, firm or very firm clay. Depth to bedrock ranges from 4 to 7 feet. Each layer is 2 or 3 to about 20 percent by volume chert fragments that are less than 1 inch to about 4 inches across. Most commonly, the amount of chert decreases as depth increases. Most of these fragments are concentrated in the A horizon and in the upper few inches of the B horizon. Scattered, erratic, vertical seams of chert extend to bedrock.

ChC2—Christian silt loam, 5 to 12 percent slopes, eroded. This soil is mainly on hilltops in the western and northwestern part of White County. It is well drained and deep to rock. It has the profile described as representative of the series. The surface layer is brown silt loam, 3 to 6 inches thick, and the subsoil is reddish plastic clay. In most places a few small fragments of chert are on the surface and in the soil. In most fields there are frequent eroded places that have a surface layer of reddish silty clay loam or silty clay.

Included with this soil in mapping were small areas where slopes are greater than 12 percent and a few areas where slopes are less than 5 percent. Also included are small areas of soils that have a surface layer of brown loam or dark reddish brown silt loam and a subsoil of red or dark red clayey material that is many feet thick.

Most of this soil is cleared and used mainly for hay and pasture. Small tracts are in farm woodlots. This soil has low potential for cultivated crops. Its potential is limited by slopes, the clayey subsoil, and the small size of the areas on top of hills. This soil has medium to high potential for small grain, hay, and pasture. Hay and pasture plants, such as tall fescue, white clover, and common lespedeza are suited and produce medium yields, if well fertilized and well managed.

This soil has medium potential for urban uses. Its potential for these uses is limited mainly by slope, clayey subsoil, and moderately slow permeability. The clayey subsoil percolates slowly, and this limits its use for residential buildings that require septic tank absorption fields. This limitation probably can be overcome by increasing the size of the absorption area or by using a dual filter field system. Capability unit IVe-2; woodland group 3o.

ChD2—Christian silt loam, 12 to 20 percent slopes, eroded. This soil is on hillsides along short drains and around sinks in the Highland Rim. The surface layer, 4 to 6 inches thick, is brown friable silt loam. The subsoil is yellowish red, firm plastic clay mottled in the lower part in shades of yellow and brown. In most cleared areas there are frequent eroded spots that have a surface layer of reddish silty clay loam or silty clay.

Included with this soil in mapping were areas where slopes are as much as 25 percent and where chert fragments make up more than 15 percent by volume in the surface layer.

This soil has low potential for row crops. Its potential is limited by strong slopes, the clayey subsoil, and high erodibility. It has medium potential for hay and pasture. The commonly grown hay and pasture plants, such as tall fescue, white clover, and common lespedeza grow well if they are well managed and fertilized according to recommendations based on soil tests.

The strong slope, clayey subsoil, and moderately slow permeability combine to severely limit urban uses, such as residential building and road construction. For septic tank filter fields, the slow percolation rate can be at least partly overcome by using a dual filter field system and by increasing the size of the absorption area. Capability unit VIe-2; woodland group 3o.

CnC2—Christian cherty silt loam, 5 to 12 percent slopes, eroded. This deep, well drained soil is on the low hills of the Highland Rim. The surface layer is

brown cherty silt loam and is 4 to 7 inches thick. The subsoil is yellowish red, firm plastic clay mottled in the lower part in shades of yellow and brown. Most fields have small spots of eroded soil that has a surface layer of reddish cherty silty clay loam or cherty clay. Most of the chert fragments are concentrated in the surface layer, but a few are scattered through the subsoil.

Included with this soil in mapping were small areas where there are very few fragments of chert in the surface layer. Also included were small areas where there is an 8- to 10-inch surface layer of dark brown cherty silt loam.

Angular chert fragments on the surface, slope, clayey subsoil, and moderately slow permeability make this soil marginal for crops. Yields of warm season row crops are not always profitable. This soil has moderate potential for hay, pasture, and small grain. The clayey subsoil and the moderately slow permeability are the main limitations for most urban uses (fig. 8). The clayey subsoil has low strength for roads and a slow percolation rate for septic tank filter fields. Before making decisions for uses such as residential buildings with onsite sewage disposal, consider installing dual filter field systems and enlarging the absorption area to overcome the slow percolation rate. Capability unit IVe-2; woodland group 3r.

CnD2—Christian cherty silt loam, 12 to 20 percent slopes, eroded. This deep, well drained soil is on hillsides of the Highland Rim. The surface layer is brown and is 4 to 6 inches thick. The upper few inches of the subsoil is strong brown cherty silty clay loam, and the rest is yellowish red to red, firm plastic clay mottled in the lowest part in shades of yellow and brown. In most cleared fields there are frequent small spots of eroded soil that has a surface layer of reddish cherty silty clay loam or cherty clay. Most of the chert fragments are concentrated in the surface layer and in the upper few inches of the subsoil. Scattered erratic cherty seams or tongues extend to depths of several feet.

Figure 8.—Farm pond on Christian cherty silt loam, 5 o 12 percent slopes, eroded. Because of the moderately slow permeability of this soil, water impoundment is nearly always successful.

Included with this soil in mapping were some areas where the soil lacks chert fragments in the surface layer. Also included were a few small areas where the surface layer is dark brown cherty silt loam and the subsoil is yellowish red silty clay loam that is several feet thick.

This soil has low potential for row crops and for annual crops that are grown in summer. It has medium potential for pasture, hay, and small grain. Its potential is limited mainly by the strong slopes, clayey subsoil, and medium available water capacity. The response to fertilizer and management is moderately good. About 15 percent of this soil is in small farm woodlots, and the rest is used mostly for pasture. The combination of strong slopes, high clay content, and moderately slow permeability create moderate to severe limitations for constructing residential buildings and roads. Capability unit VIe-2; woodland group 3r.

CnE2—Christian cherty silt loam, 20 to 35 percent slopes, eroded. This deep, steep cherty soil is on the sides of the Highland Rim. The surface layer commonly is brown and is 4 to 6 inches thick. The subsoil is yellowish red, firm plastic clay mottled in the lower part in shades of yellow and brown. In most fields there are numerous small eroded spots where the surface layer is reddish cherty silty clay loam or cherty clay. The amount of fragments of chert are 10 to 20 percent by volume in the surface layer and 5 to 15 percent in the subsoil.

Included with this soil in mapping were areas where the surface layer is dark brown and the subsoil is yellowish red silty clay loam. Also included were areas where there is a yellowish brown subsoil of cherty silt loam or cherty silty clay loam that is 50 percent or more chert fragments by volume below a depth of 24 inches.

This soil has low potential except for pasture and trees. It also has low potential for urban uses. Its potential is restricted by the steep slopes, clayey subsoil, and moderately slow permeability. Pasture plants, such as tall fescue, white clover, and common lespedeza grow fairly well if they are well managed and are fertilized according to recommendations based on soil tests. The medium available water capacity limits the yield of forage. Capability unit VIe-2; woodland group 3r.

CsD3—Christian cherty silty clay loam, 5 to 20 percent slopes, severely eroded. This well drained soil is on the hillsides or around limestone sinks of the Highland

Rim. Erosion has removed most of the original surface layer, and rills and shallow gullies are common. The surface layer commonly is yellowish brown to yellowish red. The subsoil is dominantly a yellowish red, firm plastic clay. The chert fragments are largely in the surface layer and in the upper few inches of the subsoil, except for scattered cherty streaks that extend to depths of several feet.

Included with this soil in mapping were areas where the soil material is yellowish brown cherty silt loam or cherty silty clay loam and have 50 percent or more chert fragments by volume below a depth of 24 inches. Also included were a few areas where the subsoil is yellowish red, friable cherty silty clay loam.

This soil generally is in poor tilth and has a very low content of organic matter. It is low in fertility, and the response of crops to fertilizer and management is low to medium. It has low potential for row crops and small grain. This soil has medium potential for hay and pasture. The strong slopes, clayey subsoil, moderately slow permeability, and somewhat clayey surface layer severely limit it for such urban uses as buildings, roads, playgrounds, and septic tank filter fields. Capability unit VIe-2; woodland group 4c.

Curtistown Series

Curtistown series consists of deep, loamy, and well drained soils. These soils are gently sloping. They are on the broad plains of the Highland Rim. The soils formed in material that appears to be a mixture of loess and old alluvium in the upper part and old alluvium in the lower part. Slopes are 2 to 5 percent.

In a representative profile the surface layer is dark brown silt loam 8 inches thick. The subsoil, to a depth of 38 inches, is friable silty clay loam. It ranges from yellowish red in the upper part to dark red in the lower part. Between depths of 38 and 75 inches the subsoil is dark red firm clay.

This soil is easy to work. Permeability is moderate. The available water capacity is high. The soil is strongly acid or very strongly acid except for the surface layer in limed areas. Crops respond extremely well to good management.

Curtistown soils are cleared and are used for general farm crops, including tobacco, corn, small grain, and pasture. They are among the most productive soils in the survey area.

Representative profile of Curtistown silt loam, 2 to 5 percent slopes:

Ap—0 to 8 inches; dark brown (7.5YR 3/2) silt loam; moderate fine granular structure; friable; many fine roots; slightly acid; abrupt smooth boundary.

B21t—8 to 17 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; few discontinuous clay films; few fine dark brown concretions; strongly acid; clear smooth boundary.

B22t—17 to 28 inches; red (2.5YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable; common fine roots; clay films on faces of peds and in pores; few dark brown concretions; strongly acid; gradual wavy boundary.

B23t—28 to 38 inches; dark red (2.5YR 3/6) silty clay loam; strong medium and fine subangular blocky structure; friable; clay films on faces of peds; few dark brown concretions; strongly acid; gradual wavy boundary.

B24t—38 to 55 inches; dark red (2.5YR 3/6) clay; strong medium and fine subangular blocky structure; firm; clay films on faces of peds; strongly acid; gradual wavy boundary.

B25t—55 to 75 inches; dark red (2.5YR 3/6) clay, few medium distinct brown (7.5YR 5/4) mottles; strong fine subangular blocky structure; firm, clay films on faces of peds; strongly acid; gradual wavy boundary.

The dark brown or very dark grayish brown A horizon is 6 to 12 inches thick. The B21t horizon is reddish brown, yellowish red, or brown. The rest of the B horizon is silty clay loam or silt loam in the upper part, grading gradually to clay about 3 feet below the soil surface. Depth to rock is more than 8 feet.

CuB—Curtistown silt loam, 2 to 5 percent slopes. This deep, well drained, gently sloping, loamy soil is on the broad plains of the Highland Rim. The surface layer is dark brown silt loam 6 to 12 inches thick. The subsoil grades from yellowish red friable silt loam or silty clay loam in the upper part to dark red firm clay at a depth of about 3 feet.

Included with this soil in mapping were small areas where the surface layer is light brown silt loam. Also included were a few small areas where the surface layer and subsoil are 5 to 15 percent chert fragments by volume and a few areas where slopes are 5 to 12 percent.

This soil has very high potential for farming and for urban uses. It is one of the most productive soils in White and Van Buren Counties. Its only limitation is the mild slope, and this can be easily overcome by proper management. Capability unit IIe-1; woodland group 2o.

Decatur Series

The Decatur series consists of deep, dark red, well drained soils. These soils are on low rolling hills in the Highland Rim where they formed in limestone residuum or in old alluvium. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is dark reddish brown silt loam 7 inches thick. The upper 6 inches of the subsoil is dark reddish brown, friable silty clay loam. Below this layer, to a depth of several feet, is dark red, firm clay. Limestone bedrock is at a depth of more than 8 feet.

Permeability is moderate. The available water capacity is medium to high. These soils are fairly easy to work, and crops respond well to good mangement. The soil is strongly acid or very strongly acid except for the surface layer in limed areas.

Decatur soils are used for corn, tobacco, small grain, hay, and pasture. They are especially productive and highly valued for the latter three crops.

Representative profile of Decatur silt loam, 2 to 5 percent slopes:

Ap—0 to 7 inches; dark reddish brown (5YR 3/3) silt loam; moderate medium granular structure; friable; many roots; slghtly acid; clear smooth boundary.

B21t—7 to 13 inches; dark reddish brown (2.5YR 3/4) silty clay loam; moderate fine and medium subangu-

lar blocky structure; friable; many roots; patchy clay films; medium acid; gradual smooth boundary.
B22t—13 to 22 inches; dark red (2.5YR 3/6) clay; moderate medium subangular blocky structure; firm; common roots; clay films on most faces of peds; few black concretions; strongly acid; gradual smooth boundary.
B23t—22 to 42 inches; dark red (2.5YR 3/6) clay; moderate medium subangular blocky structure; firm, sticky and plastic; continuous clay films; few roots; strongly acid; gradual smooth boundary.
B24t—42 to 62 inches; dark red (10YR 3/6) clay; moderate medium subangular blocky structure; firm; sticky and plastic, nearly continuous clay films; very strongly acid.

The Ap horizon, 4 to 10 inches thick, is dark reddish brown or dark red silt loam, silty clay loam, or (rarely) loam. The major part of the B horizon is dark red, dark reddish brown, or dusky red clay several feet thick. Depth to limestone is more than 8 feet.

DeB—Decatur silt loam, 2 to 5 percent slopes. This deep, well drained soil is in tracts of 2 to 10 acres on the low, rolling hilltops. The soil has the profile described as representative of the series. The surface layer is 4 to 10 inches thick and is dark reddish brown. In many places subsoil material has been mixed into it by plowing. The subsoil, many feet thick, is mostly dark red, firm clay.

Included with this soil mapping were a few areas of soil that has a dark brown surface layer and a red subsoil.

This soil has medium potential for row crops. Its potential is somewhat limited by the clayey subsoil, slopes, and the small size and irregular shape of the areas. This soil has high potential for small grain, hay, and pasture. It is one of the most productive soils in the area for grasses and legumes used for hay and pasture.

Limitations for most urban uses are mainly the clayey subsoil and, to a lesser extent, the mild slopes. These limitations can be easily overcome by good design and installation practices. Capability unit IIe-1; woodland group 3o.

DeC2—Decatur silt loam, 5 to 12 percent slopes, eroded. This deep, well drained soil is on low, rolling hills. It is in tracts of 2 to 15 acres. The surface layer is dark reddish brown and is about 4 to 7 inches thick. In most places subsoil material has been mixed into the surface layer. The subsoil is dark red firm clay several feet thick. Limestone bedrock is at a depth of more than 8 feet.

Included with this soil in mapping were a few 1- or 2-acre areas of soils that have slopes of 2 to 5 percent and a few that have slopes of 12 to 20 percent.

This soil is suited to all climatically adapted crops. It has medium potential for row crops. Its potential is limited by slopes and by the small, irregular shape of many of the areas. Row crops can be grown in long cropping systems. The soil has high potential for small grain, hay, and pasture. It is among the best soils of the area for grasses and legumes.

The potential for urban uses is high. The main limitations are the clayey subsoil, moderate shrink swell potential, and slopes. The limitations for such common uses as building sites and roads can be overcome by good design of foundations. Capability unit IIIe-1; woodland group 3o.

Dickson Series

The Dickson series consists of moderately well drained loamy soils on uplands of the Highland Rim. These soils have a fragipan. Slopes are 1 to 3 percent.

In a representative profile the surface layer is brown silt loam about 7 inches thick. The subsoil, to a depth of about 24 inches, is yellowish brown friable silt loam. Below this, to a depth of 38 inches, is a fragipan of mottled, light brownish gray, yellowish brown and strong brown silt loam that is firm and brittle. Below the fragipan is yellowish red, mottled cherty clay.

Dickson soils are strongly acid or very strongly acid in unlimed areas. The upper 24 inches of these soils is easily penetrated by roots, water, and air. The fragipan restricts roots and slows the movement of water. This causes waterlogging during rainy periods and slight droughtiness during dry periods. Permeability is moderately slow. Available water capacity is medium.

Dickson soils are used for corn, tobacco, small grain, hay, and pasture. A few small areas of soils are in mixed hardwood forest.

Representative profile of Dickson silt loam, 1 to 3 percent slopes:

Ap—0 to 7 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; strongly acid; clear smooth boundary.
B1—7 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; very strongly acid; clear smooth boundary.
B2—11 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; very strongly acid; clear wavy boundary.
A'2 and B'x—24 to 28 inches; yellowish brown (10YR 5/6) silt loam, common medium faint pale brown (10YR 6/3) and light brownish gray (10YR 6/2) mottles and few fine strong brown (7.5YR 5/6) mottles; moderate medium angular blocky structure; slightly firm and brittle; very strongly acid; gradual wavy boundary.
B'x—28 to 38 inches; mottled light brownish gray (10YR 6/2) yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) silt loam; moderate medium and coarse subangular blocky structure; firm, brittle; thick discontinuous clay films; very strongly acid; gradual wavy boundary.
IIB2t—38 to 60 inches; yellowish red (5YR 4/6) cherty clay; common medium distinct yellowish brown (10YR 5/6), grayish brown (10YR 5/2), and red (2.5YR 4/8) mottles; moderate medium angular blocky structure; firm; clay films on ped faces; very strongly acid.

Depth to the fragipan is 20 to 32 inches. Thickness of the fragipan ranges from 6 to 18 inches. The B horizon above the fragipan is silt loam. It is generally yellowish brown, but in a few places it is strong brown. The B'x horizon is silt loam or silty clay loam. The IIB2 horizon is dominantly yellowish red, red, or strong brown. It is clay, or silty clay loam. Chert fragments in the IIB2 horizon are 5 to 35 percent by volume. Depth to limestone bedrock is more than 8 feet.

DkB—Dickson silt loam, 1 to 3 percent slopes. This soil is in broad areas on uplands of the Highland Rim. It is moderately well drained and has a fragipan that begins at a depth of 24 inches. The surface layer is brown silt loam, 6 to 9 inches thick. The subsoil, to a depth of about 24 inches, is yellowish brown, friable silt loam. Below this is a fragipan of silt loam that is mottled in shades of yellow, brown, and gray. It is hard and brittle and about 6 to 18 inches thick. The

fragipan is underlain by reddish, mottled clay or silty clay loam that contains varying amounts of chert fragments.

Included with this soil in mapping were small bumps and spots of a soil that lacks a fragipan. Also included were a few spots in sinks where the soil is somewhat poorly drained.

This soil has fairly high potential for farming and for urban uses. It is limited mainly by slow permeability and a seasonally perched water table above the fragipan. Crops that are highly sensitive to wetness, such as tobacco, should be grown only where there is enough slope to provide adequate surface drainage.

The slow percolation rate severely limits the use of this soil for residential buildings that require septic tank filter fields. Where better sites are not available, this soil can possibly be used for this purpose by expanding the absorption area and by using dual field filter systems. Capability unit IIe-3; woodland group 3o.

Emory Series

The Emory series consists of deep, loamy, well drained soils along small drainageways and in depressions. They formed in sediment washed from reddish soils of the uplands underlain by limestone. Slopes are 0 to 3 percent.

In a representative profile the surface layer is dark reddish brown silt loam about 8 inches thick. The subsoil is dark reddish brown, friable silt loam about 24 inches thick. It is underlain by reddish brown, friable silty clay loam.

Permeability is moderate. Available water capacity is high. The soils are highly productive and responsive to good management. They are strongly acid or medium acid except in the surface layer in limed areas.

These soils are used for tobacco, corn, hay, and pasture. They are among the most productive soils in White and Van Buren Counties.

Representative profile of Emory silt loam:

Ap—0 to 8 inches; dark reddish brown (5YR 3/3) silt loam; moderate medium granular structure; medium acid; clear smooth boundary.

B2—8 to 32 inches; dark reddish brown (5YR 3/4) silt loam; weak medium and fine subangular blocky structure; friable; about 5 percent by volume angular chert fragments up to ½ inch across; medium acid; clear smooth boundary.

A1b—32 to 42 inches; reddish brown (5YR 4/4) silt loam; weak medium granular structure; friable; medium acid; clear wavy boundary.

B2tb—42 to 60 inches; reddish brown (5YR 4/4) silty clay loam; few streaks and coatings of dark reddish brown (5YR 3/2); weak medium subangular blocky structure; thin clay films on some ped faces; few chert fragments as much as 1 inch across; strongly acid.

The Ap horizon is dark reddish brown or dark brown silt loam or silty clay loam. The B horizon is dark reddish brown or reddish brown silt loam or silty clay loam. The A1b horizon is dark brown or reddish brown silt loam or loam. The B2tb horizon is silty clay loam, clay loam, or silty clay. Limestone bedrock is at a depth of more than 8 feet.

Em—Emory silt loam. This deep, well drained, nearly level and gently sloping, highly productive soil is on small benches or foot slopes, along small drainageways, and in depressions. It is dark reddish brown and friable to a depth of 3 or more feet.

Included with this soil in mapping were a few small areas where the surface layer is dark brown and the subsoil is yellowish red silty clay loam. Also included were a few small areas of cherty soils and a few areas where the surface layer is brown silt loam with gray mottles at a depth of about 18 inches.

This soil is one of the most productive in the survey area. It has high potential for farming. It is well suited to all the locally grown crops. Some low areas, especially those in depressions, collect a few inches of standing water following heavy rains. Also, some areas are subject to flooding. Crops are not ordinarily affected but the flooding is a severe limitation for homesites and roads. Capability unit I-1; woodland group 2o.

Etowah Series

The Etowah series consists of deep, well drained, loamy soils. These soils are on terraces and foot slopes. They formed in sediment deposited by streams and in sediment that has moved downslope. Slopes range from 2 to 35 percent but are most commonly 5 to 12 percent.

In a representative profile the surface layer is dark brown silt loam about 7 inches thick. The subsoil, to a depth of 14 inches, is brown friable silt loam. Between depths of 14 and 50 inches it is yellowish red friable silt loam. Between depths of 14 and 50 inches it is yellowish red friable silty clay loam. Between depths of 50 and 72 inches the subsoil is red firm clay. Limestone bedrock is at a depth of more than 6 feet.

Permeability is moderate. Available water capacity is high. The soils are easy to work and are among the most productive in White and Van Buren Counties. Crops respond very well to good management. The soil is strongly acid throughout except in the surface layer in limed areas.

Etowah soils are used for corn, tobacco, small grain, hay, and pasture.

Representative profile of Etowah silt loam, 2 to 5 percent slopes:

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

B1—7 to 14 inches; brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; strongly acid; clear smooth boundary.

B21t—14 to 28 inches; yellowish red (5YR 4/6) silty clay loam; moderate medium subangular blocky structure; friable discontinuous clay films; strongly acid; gradual wavy boundary.

B22t—28 to 50 inches; yellowish red (5YR 4/6) silty clay loam; common medium distinct mottles of dark red (2.5YR 3/6) and pale brown (10YR 6/3); moderate medium angular and subangular blocky structure; friable; discontinuous clay films; few rounded pebbles; strongly acid; gradual wavy boundary.

B23t or IIB23t—50 to 72 inches; red (2.5YR 4/6) clay; moderate medium and fine subangular blocky structure; firm; common clay films; few round quartzite pebbles; strongly acid.

The Ap horizon is dark brown or dark reddish brown silt loam, cherty silt loam, or loam. It is about 6 to 12 inches thick. The upper 2 feet or more of the B2t horizon

is dominantly yellowish red, red, or reddish brown silty clay loam or clay loam. The lower part of the B2t horizon is reddish brown, yellowish red, or red silty clay loam, clay loam, or clay. Depth to limestone bedrock is more than 6 feet. The amount of waterworn gravel or fragments of chert in the soil ranges from 0 to about 20 percent by volume in the surface layer and from 0 to about 15 percent in the B horizon.

EtB—Etowah silt loam, 2 to 5 percent slopes. This deep, well drained, gently sloping, productive soil is on terraces and on foot slopes and benches in the uplands. It has the profile described as representative of the series. The surface layer is dark brown and is 7 to 12 inches thick, and the subsoil is yellowish red or reddish brown friable silty clay loam several feet thick.

Included with this soil in mapping were a few small areas where the surface layer is brown cherty or gravelly silt loam and the subsoil is yellowish red cherty or gravelly silty clay loam. Also included were a few areas of brown loamy soils along small drainageways.

This soil is highly productive. It is well suited to all crops commonly grown in White and Van Buren Counties. It has high potential for farming and for urban uses. The mild slopes are the only limitation, and this limitation can be easily overcome by proper management. Capability unit IIe-1; woodland group 2o.

EtC—Etowah silt loam, 5 to 12 percent slopes. This deep, well drained, sloping, productive soil is on terraces high above the present streams and on foot slopes in the uplands. The surface layer is dark brown, friable silt loam about 5 to 9 inches thick. The subsoil is reddish brown or yellowish red, friable silty clay loam several feet thick.

Included with this soil in mapping were a few small areas of soils that are 10 to 20 percent chert by volume and a few areas where there is a light brown surface layer and a yellowish red subsoil. Also included were a few strips of brown loamy soils along drainageways. Small areas, mainly in sinks, were included that have a surface layer and a subsoil of dark reddish brown silt loam.

This soil has medium potential for row crops and high potential for small grain, hay, and pasture. It also has high potential for most urban uses. The only significant limitation is slopes, which do not seriously limit the soil for most uses. Common row crops grow well in 3-year cropping systems or perhaps grow well more often by using stripcropping systems and minimum tillage practices. For urban uses, such as residential building and road construction, slopes are slight or no limitation. If a limitation does exist, it can be easily overcome by proper design and layout. Capability unit IIIe-1; woodland group 2o.

EtD—Etowah silt loam, 12 to 20 percent slopes. This deep, productive, loamy soil is on terraces, benches, and foot slopes at the base of hills. The surface layer is dark brown silt loam about 5 to 10 inches thick. The subsoil is reddish brown or yellowish red, friable silty clay loam which commonly grades to red or yellowish red firm clay at depths of 4 to 5 feet. Depth to bedrock is more than 6 feet.

Included with this soil in mapping were a few small areas of soils containing many fragments of chert. Also, in a few small areas the surface layer is light brown silt loam.

This soil has medium to low potential for row crops and small grain, but it has high potential for hay and pasture. Fairly good production of all common row crops is obtained in 4- to 6-year cropping system or, perhaps more often, in stripcropping systems or by use of minimum tillage practices. All the commonly grown grasses and legumes for hay and pasture grow well in this soil.

Slope is a moderate to severe limitation to urban uses of this permeable soil. Good design, layout, and installation procedures are required to overcome it. Where this soil lies below mountain slopes, hillside slippage is a high risk if cuts are made in the slopes. Such areas should be avoided in road construction. Capability unit IVe-1; woodland group 2o.

EwC—Etowah cherty silt loam, 5 to 12 percent slopes. This deep, well drained, loamy soil commonly is on foot slopes of high hills or mountains. The surface layer is dark brown cherty silt loam, 6 to 10 inches thick. The subsoil is yellowish red, friable silty clay loam several feet thick. Amount of fragments of chert is 10 to 20 percent by volume in the surface layer and 5 to 15 percent in the subsoil. Size of the chert fragments ranges from less than 1 inch to about 3 inches.

Included with this soil in mapping were areas where there is a light brown surface layer. Also included were a few small areas where the subsoil is cherty silty clay and clay and a few areas where slopes are 2 to 5 percent.

This soil has medium potential for row crops. Its potential is limited mainly by slope and, in places, by the steep slope of adjacent soils. Chert fragments are a nuisance, but they do not seriously hinder cultivation. This soil has high potential for small grain, and grasses and legumes for hay and pasture.

The potential for urban uses is high. The slope can be easily managed by proper design, layout, and installation procedures. Capability unit IIIe-1; woodland group 2o.

EwD—Etowah cherty silt loam, 12 to 20 percent slopes. This deep, well drained, loamy soil is mainly on foot slopes below high hills and steep mountains. It formed in old cherty alluvium that has moved downslope from the higher ridges. The surface layer is dark brown cherty silt loam, 5 to 9 inches thick. The subsoil is yellowish red or reddish brown, friable silty clay loam several feet thick. Chert fragments ½ inch to 4 inches in diameter are 10 to 20 percent by volume in the surface layer and 5 to 15 percent in the subsoil. In a few spots where the soil is severely eroded, the surface layer is reddish brown or yellowish red cherty silty clay loam.

Included with this soil in mapping were a few small areas where the surface layer is less than 10 percent by volume of chert fragments and a few areas where the surface layer is light brown. Also included were small areas of soils that have a subsoil of yellowish red cherty silty clay loam and clay.

This soil has low potential for row crops and small

grain mainly because of strong slopes. Fairly good production of all common row crops can be obtained in long cropping systems that maintain the soil. The potential of the soil for grasses and legumes for hay and pasture is high.

The strong slopes are the main limitations for most urban uses, but these can be overcome by careful planning and proper design and installation procedures. The susceptibility to hillside slippage should be considered before cuts are made in the slopes for roads and foundations. Capability unit IVe-1; woodland group 2o.

EwE—Etowah cherty silt loam, 20 to 35 percent slopes. This deep, well drained, loamy soil is mainly on foot slopes of the Cumberland Plateau Escarpment and outlier mountains. The surface layer is dark brown and is 5 to 9 inches thick. The subsoil is dominantly yellowish red or reddish brown, friable silty clay loam. Chert fragments are common in the surface layer, but there are only a few in the subsoil. In a few severely eroded patches the surface layer is reddish brown or yellowish red cherty silt loam or cherty silty clay loam.

Included with this soil in mapping were some areas where the surface layer is brown. A few areas have very few chert fragments in the surface layer and a few have slopes of more than 35 percent.

This soil has very low potential for row crops, small grain, and hay. Its potential is limited mainly by steep slopes. It has high potential for any of the common grasses and legumes for pasture. It is highly productive of pasture and can be grazed almost all year, because the soil does not become soft and wet as in the lower areas.

The potential for most urban uses is low because of steep slopes and susceptibility to hillside slippage. Capability unit VIe-1; woodland group 2r.

Gilpin Series

The Gilpin series consists of moderately deep, loamy, well drained soils. These soils are on short hillsides of the more dissected areas of the Cumberland Plateau. They are about 20 to 40 inches deep to siltstone and shale bedrock. Slopes range from 12 to 40 percent.

In a representative profile the surface layer is yellowish brown silt loam about 8 inches thick. The subsoil is yellowish brown, friable shaly silty clay loam and shaly silt loam. Bedrock is at a depth of about 32 inches.

Permeability is moderate. Available water capacity is medium. The soil is strongly acid or very strongly acid throughout except in the surface layer in limed areas.

The Gilpin soils are largely in hardwood forest. A few small areas are cleared and used for pasture and garden crops.

Representative profile of Gilpin silt loam, 12 to 20 percent slopes:

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

A2—2 to 8 inches; yellowish brown (10YR 5/4) silt loam; weak fine granular structure; very friable; many roots, strongly acid; clear smooth boundary.

B1—8 to 13 inches; yellowish brown (10YR 5/6) shaly silt loam; weak fine and medium subangular blocky structure; friable; common roots; about 15 percent by volume shale and siltstone fragments; very strongly acid; gradual wavy boundary.

B2t—13 to 25 inches; yellowish brown (10YR 5/8) shaly silty clay loam; moderate fine and medium angular and subangular blocky structure; friable; few roots; thin discontinuous clay films on faces of peds; 20 percent by volume shale and siltstone fragments; very strongly acid; gradual wavy boundary.

B3—25 to 32 inches; yellowish brown (10YR 5/8) shaly silty clay loam; many medium distinct pale brown (10YR 6/3) and prominent red (2.5YR 4/8) mottles; weak medium subangular blocky structure; friable; 30 percent by volume shale and siltstone fragments; very strongly acid.

R—more than 32 inches; shale and siltstone rock.

The A horizon is 4 to 9 inches thick and is brown, dark grayish brown, or yellowish brown silt loam. The B horizon is yellowish brown or strong brown, and the fine-earth fraction is silt loam or silty clay loam. Bedrock of acid siltstone or shale is at depths of 20 to 40 inches. Amount of shale or siltstone fragments ranges from almost none to about 15 percent by volume in the A horizon and from about 10 to 25 percent in the B horizon. except for the layer just above bedrock where it ranges to 35 percent.

GpD—Gilpin silt loam, 12 to 20 percent slopes. This moderately deep, loamy soil is on short hillsides of the Cumberland Plateau. It formed in material weathered from interbedded shale and siltstone and some sandstone. The profile is the one described as representative for the series. The surface layer is yellowish brown silt loam, 5 to 8 inches thick. The subsoil is yellowish brown or strong brown, friable silty clay loam containing a moderate amount of shale and siltstone fragments. Bedrock is at depths between 20 and 40 inches.

Included with this soil in mapping were small areas of brown loamy soil that is about 12 to 20 inches deep to sandstone bedrock. Also included were ledges of outcrops of bedrock, especially near the tops of slopes.

Nearly all the acreage of this soil is wooded. The soil gives fair response to management, especially lime and fertilizer. Because of the strong slopes and the moderate depth to rock, the soil has low potential for row crops. It could produce such crops as pasture and, possibly, small grain. These two features, slope and soil depth, limit its potential for urban uses. The soil is not deep enough for septic tank filter fields. Road construction requires cutting, filling, and removal of shale and siltstone rock. Capability unit IVe-1; woodland group 3o.

GpE—Gilpin silt loam, 20 to 40 percent slopes. This steep, moderately deep, loamy soil is on hillsides in deeply dissected areas of the Cumberland Plateau. It is 20 to 40 inches deep to shale and siltstone bedrock. This soil has a surface layer of brown silt loam and a subsoil of yellowish brown or strong brown, friable shaly silty clay loam or shaly silt loam.

Included with this soil in mapping were a few small areas of loamy soils that are 10 to 20 inches deep to sandstone bedrock. Also included were a few areas that have outcrops of bedrock.

This soil has low potential for farming and for urban uses. Its potential is limited by steep slope and

depth to rock. It has medium potential for pine and hardwood trees, for wildlife, and for extensive recreation. Capability unit VIe-1; woodland group 3r.

Greendale Series

The Greendale series consists of deep, loamy, nearly level, well drained soils in long, narrow areas along drainageways and in saucer-shaped depressions. They are on the uplands adjacent to the Christian and Waynesboro soils. Slopes are 0 to 2 percent.

In a representative profile the soil, to a depth of 45 inches, is dark brown to dark yellowish brown friable silt loam. Below this depth and to a depth of 68 inches is strong brown cherty silt loam.

Permeability is moderate. The available water capacity is high. Greendale soils are easy to work, and crops respond extremely well to good management. The soil is medium acid or strongly acid throughout except in the surface layer in limed areas. Some of the areas are occasionally flooded for very brief periods, mostly during winter and spring.

Greendale soils are used for corn, vegetables, tobacco, hay, and pasture. They are among the most productive soils in White and Van Buren Counties.

Representative profile of Greendale silt loam:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; few chert fragments; strongly acid; clear smooth boundary.

B2—8 to 26 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; few chert fragments; strongly acid; abrupt smooth boundary.

A1b—26 to 36 inches; dark brown (7.5YR 3/2) silt loam; moderate medium granular structure; friable; few chert fragments; strongly acid; gradual smooth boundary.

B21b—36 to 45 inches; dark yellowish brown (10YR 4/4) silt loam; few fine and medium strong brown and pale brown mottles; weak fine granular structure; friable; 10 percent chert fragments by volume; strongly acid; gradual smooth boundary.

B22—45 to 68 inches; strong brown (7.5YR 5/6) cherty silt loam; weak medium subangular blocky structure; friable; 15 percent chert fragments by volume; strongly acid.

The A horizon is brown silt loam or loam. The B horizon is dark yellowish brown, brown, or yellowish brown silt loam or loam. Depth to bedrock is more than 8 feet. The soil material is 2 to 19 percent chert fragments by volume.

Gr—Greendale silt loam. This soil is in 2- to 7-acre tracts on bottom land of the Highland Rim. It is a deep, well drained, nearly level, friable, loamy soil.

Included with this soil in mapping were a few small areas where the subsoil is reddish brown silt loam. Also included were a few very small areas where there are numerous fragments of chert.

This soil is easy to work and well suited to row crops, pasture, and hay. If proper management is used, the soil is suitable for cultivated crops every year. It has very high potential for farming.

The occasional and very brief flooding of some areas is only a slight limitation for crops, but overflow may be a severe limitation for uses such as homesites and roads. Capability unit I-1; woodland group 2o.

Guthrie Series

The Guthrie series consists of deep, poorly drained, gray soils. These soils are on flat or depressional areas of the Highland Rim. They formed in silty material which is presumed to be loess. Slopes are 0 to 2 percent.

In a representative profile the surface layer is grayish brown silt loam about 7 inches thick. Below this to a depth of 2 feet is gray, friable silt loam with yellowish and brownish mottles. A fragipan of grayish mottled dense and brittle silt loam and silty clay loam extends downward to a depth of 65 inches or more.

Permeability is slow. Available water capacity is medium. The water table is near the surface in winter and early in spring. The soil is strongly acid or very strongly acid throughout, except in the surface layer in limed areas. These soils give fair response to proper management.

Most areas are used for pasture, but a few areas have been drained and are used for silage, corn, and hay.

Representative profile of Guthrie silt loam:

Ap—0 to 7 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

B1g—7 to 14 inches; gray (10YR 6/1) silt loam; common fine and medium faint light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable; common roots; strongly acid; gradual smooth boundary.

B2g—14 to 30 inches; gray (10YR 6/1) silt loam; common fine and medium faint light yellowish brown (10YR 6/4) mottles and distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; friable; few roots; very strongly acid; gradual smooth boundary.

Bx1—30 to 42 inches; gray (10YR 6/1) silt loam; many medium distinct brownish yellow (10YR 6/6) and faint pale brown (10YR 6/3) and prominent yellowish red (5YR 4/6) mottles; weak medium platy parting to weak medium subangular blocky structure; brittle; firm; few roots; very strongly acid; gradual irregular boundary.

Bx2—42 to 52 inches; mottled, gray (10YR 6/1) pale brown (10YR 6/3) and yellowish red (5YR 4/6) silt loam; moderate thick platy structure parting to moderate medium subangular blocky; brittle; hard; a few vertical veins or streaks of gray silty clay 2 to 4 mm wide extending through horizon; few thin patchy clay films on peds and in pores; very strongly acid; gradual irregular boundary.

Bx3—52 to 65 inches; mottled gray (10YR 6/1) yellowish brown (10YR 5/6) dark gray (10YR 4/1) and yellowish red (5YR 4/6) silty clay loam; weak medium subangular blocky structure grading toward massive; firm, brittle; thick clay films; veins of dark gray silty clay as much as ½ inch wide; few chert fragments; very strongly acid.

The AP horizon is grayish brown, gray, or brown silt loam, 6 to 10 inches thick. Depth to the top of the fragipan ranges from 20 to 35 inches. Depth to limestone bedrock is more than 8 feet. The Bg horizon is mottled gray silt loam. The Bx horizon is dominantly gray, mottled silt loam or silty clay loam.

Gu — Guthrie silt loam. This gray, poorly drained, nearly level or slightly depressional soil is in areas of the Highland Rim (fig. 9). This soil has a fragipan. Slopes are 0 to 2 percent. Seasonal ponding is common in many areas.

Figure 9.—Guthrie silt loam in tall fescue. Waynesboro soil is on the hill in the background.

Included with this soil in mapping were a few areas of a poorly drained soil that is clayey in the lower part of the subsoil and does not contain a fragipan. Also included were a few small areas of slightly better drained soils.

This soil has medium potential for farming. It is poorly suited to crops that do not tolerate wet rooting zones or ponded conditions during the winter and early part of spring. Where adequate surface drainage is provided, the soil has fair potential for pasture, hay, soybeans, and late summer silage crops. It has severe limitations for urban uses because of wetness. Major and expensive drainage work is generally required for urban use, and some areas are very difficult to drain because of lack of outlets. Capability unit IVw-1; woodland group 2w.

Hamblen Series

The Hamblen series consists of loamy, moderately well drained soils. These soils are on bottom land along the creeks and branches in the eastern part of the Highland Rim. They formed in recent sediment washed from soils underlain by limestone, shale, and siltstone. Slopes are 0 to 2 percent.

In a representative profile the surface layer is brown silt loam about 8 inches thick. Between depths of 8 and 24 inches is brown friable silt loam mottled in the lower part with shades of gray. Between depths of 24 and 60 inches or more is grayish brown and light brownish gray, mottled friable silt loam.

Permeability is moderate. The available water capacity is high. These soils are easy to work and respond very favorably to good management, but they are subject to occasional very brief flooding. The soil is slightly acid, medium acid, or neutral.

The Hamblen soils are used for pasture, hay, and small acreages of corn and soybeans.

Representative profile of Hamblen silt loam:

Ap—0 to 8 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many roots; slightly acid; clear smooth boundary.

B2—8 to 17 inches; brown (7.5YR 4/4) silt loam; weak medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

B3—17 to 24 inches; brown (10YR 5/3) silt loam, few medium distinct gray (10YR 6/1) mottles; weak medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

C1—24 to 30 inches; grayish brown (10YR 5/2) silt loam; common medium distinct gray (10YR 6/1) and yellowish brown (10YR 5/6) mottles; massive; friable; medium acid; gradual smooth boundary.

C2—30 to 60 inches; light brownish gray (2.5Y 6/2) silt loam; many medium distinct yellowish brown (10YR 5/6) and dark brown (10YR 3/3) mottles; massive; friable; slightly acid.

The A horizon is brown, yellowish brown, dark yellowish brown, or dark grayish brown silt loam or loam, 5 to 11 inches thick. The B horizon is brown, dark yellowish brown, or yellowish brown silt loam or loam. It is mottled in shades of gray to a depth of 20 inches. Depth to bedrock is more than 6 feet.

Ha—Hamblen silt loam. This moderately well drained loamy soil is on bottom lands of the creeks and their small tributaries. Slopes are 0 to 2 percent.

Included with this soil in mapping were a few small areas of poorly drained soils. Also included were narrow strips of well drained soils adjacent to stream channels. Other areas included are those that have a surface layer of brown fine sandy loam 5 to 8 inches thick.

This soil has high potential for crops such as corn, hay, soybeans, and pasture. It can be row cropped every year. The soil is very productive when used for farming, but occasional flooding causes serious problems for other uses. Flooding occurs mostly in winter and early in spring and generally lasts only a few hours because the streams are fast-flowing and the floodwaters recede rapidly into the stream channels. Capability unit IIw-1; woodland group 2w.

Hartsells Series

The Hartsells series consists of moderately deep, loamy, and well drained soils. These soils are on broad, gently rolling areas of the Cumberland Plateau. They formed in material weathered mainy from level-bedded acid sandstone. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is brown loam about 6 inches thick. The subsoil, which extends to bedrock, is yellowish brown friable loam and clay loam. Sandstone bedrock is at a depth of 34 inches.

Permeability is moderate. The available water capacity is medium. Natural fertility is very low. These soils are easy to work, and crops respond well to proper management. The soil is strongly acid or very strongly acid except in the surface layer in limed areas.

Much of the area is used for corn, tobacco, vegetables, hay, and pasture. A sizable acreage is in Fall Creek Falls State Park.

Representative profile of Hartsells loam, 5 to 12 percent slopes:

A1—0 to 1 inch; dark grayish brown (10YR 4/2) loam; weak fine granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

A2—1 to 6 inches; brown (10YR 5/3) loam; weak fine granular structure friable; many roots; strongly acid; abrupt smooth boundary.

B1—6 to 14 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common roots; strongly acid; gradual smooth boundary.

B21t—14 to 22 inches; yellowish brown (10YR 5/6) loam; moderate fine and medium subangular blocky structure; friable; common roots; few thin patchy clay films; strongly acid; gradual smooth boundary.

B22t—22 to 31 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable; few thin clay films; few small roots; strongly acid; abrupt smooth boundary.

B3—31 to 34 inches; yellowish brown (10YR 5/4) sandy loam; very weak fine granular structure; very friable; small pockets of soft weathered sandstone rock; strongly acid; abrupt wavy boundary.

R—34 inches; sandstone rock.

The A horizon is yellowish brown, brown, or pale brown loam or fine sandy loam. In wooded areas the material in the upper 1 to 2 inches of the surface layer is grayish brown or dark grayish brown. The B horizon is yellowish brown, strong brown, or brown sandy clay loam, loam, sandy loam, or clay loam. The upper few inches of material in the B horizon is fine sandy loam, and the lower few inches is sandy loam. Depth to sandstone bedrock is 20 to 40 inches.

HsB—Hartsells loam, 2 to 5 percent slopes. This loamy, moderately deep, gently sloping, well drained soil is on the Cumberland Plateau. The surface layer is brown loam 5 to 8 inches thick. The subsoil is yellowish brown friable loam and clay loam that extends to sandstone bedrock at depths between 20 and 40 inches.

Included with this soil in mapping were a few areas of soils that have a dark brown surface layer. Also included were a few small areas of soils that are silt loam to a depth of about 2 feet. In a few areas the soil is less than 20 inches deep to sandstone rock.

Hartsells loam is easy to work, and crops respond well to proper management. It is a desirable soil for many uses. It has fairly high potential for farming. Corn grows as well, or better, in this soil as in any other soil in the State. The main limitations for farming are the very low natural fertility and, to a lesser extent, the moderate depth to rock. The latter limitation is the main one for urban uses such as roads, streets, and building sites. The thickness of the soil is not adequate for proper functioning of septic tank filter fields. Deep foundations commonly require removal of hard sandstone rock. The favorable climate and nearness to mountain gorges and streams add to its high value for recreational uses. Capability unit IIe-2; woodland group 4o.

HsC—Hartsells loam, 5 to 12 percent slopes. This loamy, moderately deep, sloping soil is on the Cumberland Plateau. It has the profile described as representative of the series. The surface layer is brown loam about 6 to 8 inches thick. In a few places the soil has been eroded and is yellowish brown clay loam. The subsoil is yellowish brown friable loam and clay loam that extends to sandstone bedrock at a depth between 20 and 40 inches.

Included with this soil in mapping were a few small areas of loamy soil that has bedrock at a depth between 10 and 20 inches. Also included were a few areas of soils that are deeper than 40 inches to bedrock. In a few areas slopes are as much as 20 percent.

This soil has medium potential for row crops and small grain. Corn, vegetables, and the other commonly grown row crops grow well in cropping systems that help to maintain the soil, such as 3 to 4 year systems, stripcropping systems, and systems that require minimum tillage practices. The potential of this soil is limited by strong slopes and, to a lesser degree, moderate depth to rock. The soil has high potential for grasses and legumes used for hay and pasture.

The main limitation for urban uses is the moderate depth to rock. Soil depth is not adequate for proper

functioning of septic tank filter fields. In places foundation or road construction require removal of hard sandstone rock. The favorable climate, forest vegetation, and nearness to mountain gorges with permanent streams add to the value for recreational uses. Capability unit IIIe-2; woodland group 4o.

Jefferson Series

The Jefferson series consists of deep, loamy, well drained soils. These soils are on benches, fans, and foot slopes. They formed in material that moved down from the higher slopes of the sandstone and siltstone mountains. Slopes range from 5 to 35 percent.

In a representative profile the surface layer is brown loam 6 inches thick. The upper 2 inches of the surface layer is stained dark because of its content of organic matter. The subsoil is yellowish brown friable clay loam and loam that extends to a depth of about 62 inches. Below 62 inches is friable loam that has many sandstone fragments.

Permeability is moderately rapid. The available water capacity is high. These soils are naturally low in fertility, but crops give excellent response to liming, fertilization, and other good management practices. The soil is very strongly acid or strongly acid except in the surface layer in limed areas.

Jefferson soils are used for tobacco, hay, corn, and pasture. Much of the acreage of steeper soils is in pine and hardwood forest or is reverting to forest.

Representative profile of Jefferson loam, 12 to 20 percent slopes:

A1—0 to 2 inches; very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; very friable; clear smooth boundary.

A2—2 to 6 inches; brown (10YR 5/3) loam; moderate fine and medium granular structure; very friable; 10 percent by volume sandstone fragments 1 to 3 inches across; strongly acid; gradual smooth boundary.

B1—6 to 12 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; 10 percent by volume sandstone fragments 1 to 3 inches across; strongly acid; gradual smooth boundary.

B21t—12 to 24 inches; yellowish brown (10YR 5/4) clay loam; moderate medium subangular blocky structure; friable; thin clay films on faces of peds; 10 percent by volume sandstone fragments 1 to 3 inches across; strongly acid; gradual smooth boundary.

B22t—24 to 40 inches; yellowish brown (10YR 5/6) clay loam; moderate medium subangular blocky structure; friable; thin patchy clay films on faces of peds; 15 percent by volume sandstone fragments 1 to 3 inches across; strongly acid; gradual wavy boundary.

B3—40 to 62 inches; yellowish brown (10YR 5/6) loam, common medium distinct mottles of brown (10YR 5/3); weak medium subangular blocky structure; friable; 15 percent by volume sandstone fragments 1 to 3 inches across; strongly acid; gradual wavy boundary.

C—62 to 70 inches; yellowish brown (10YR 5/4) gravelly loam; massive; friable; 30 percent by volume sandstone fragments 1 to 4 inches across; very strongly acid.

The Ap or A2 horizon is brown, pale brown, or dark grayish brown loam, or fine sandy loam (rarely the latter). It is 4 to 10 inches thick. The B horizon is yellowish brown or strong brown loam, clay loam, or sandy clay loam. In the A, B1, and B2 horizons sandstone fragments are 10 to 15 percent by volume. In a few places sandstone fragments are as much as 30 percent by volume. The sandstone fragments are 15 to 40 percent by volume in the B3 and C horizons. Depth to bedrock is 4 to 8 or more feet.

JfC — Jefferson loam, 5 to 12 percent slopes. This deep, loamy, well drained soil is on foot slopes and benches below hillsides. The surface layer is brown loam about 5 to 10 inches thick. The subsoil is strong brown or yellowish brown, friable clay loam or loam to a depth of 4 or more feet. Jefferson soils commonly have a few fragments of sandstone on the surface and in the soil.

Included with this soil in mapping were a few areas of a soil that contains numerous cobbles. Also included were a few areas where the subsoil is red.

This soil has medium potential for row crops. Its potential is limited by slopes, by the small size of most areas, and in places by the steep slopes of adjacent soils. Row crops such as corn and soybeans will grow well if they are not planted too frequently. This soil has high potential for small grain, hay crops, and pasture. All common grasses and legumes are well suited.

The potential for most urban uses is high. Slope is the only significant limitation, and it can be easily overcome by good design, layout, and installation procedures. Capability unit IIIe-1; woodland group 3o.

JfD — Jefferson loam, 12 to 20 percent slopes. This deep, well drained, loamy, moderately steep soil is on benches and foot slopes. It has the profile described as representative of the series. The surface layer is brown loam, and the subsoil is yellowish brown friable loam and clay loam. Bedrock is at a depth of 4 to 8 feet or more.

Included with this soil in mapping were a few small areas of soils that are less than 40 inches deep to bedrock. Also included were small areas of less steep soils on small benches between drainageways and a few steep banks, mostly in areas that were undercut by migrating streams. In a few areas the surface layer is more than 15 percent sandstone fragments by volume.

This soil has low potential for row crops. Its potential is limited mainly by slopes. Good production can be expected of row crops grown occasionally in systems that maintain the soil, such as 4- or 5-year cropping systems. Cultivated crops can be grown more often in stripcropping systems or in management programs that stress minimum tillage practices. The soil has medium potential for hay and small grain and high potential for grass and legume pasture.

The potential of this soil for urban uses is medium to low. Special design and management is required to overcome the strong slopes. Hillside slippage is a high risk if cuts for roads and foundations are made in the slopes. Capability unit IVe-1; woodland group 3o.

JfE — Jefferson loam, 20 to 35 percent slopes. This deep, loamy soil is on the lower parts of mountain slopes. It formed in material that rolled downslope from mountainsides underlain by sandstone and siltstone. The surface layer is brown loam, 4 to 8 inches thick. The subsoil is yellowish brown, friable clay loam

or loam a few feet thick. A few fragments of sandstone are on the surface and scattered throughout the soil. Depth to rock is about 4 to 8 feet or more.

Included with this soil in mapping were small areas where slopes are 35 to 45 percent. Also included were a few small areas of soil 20 to 40 inches deep to rock.

This soil has low potential for row crops, hay, and small grain because of the steep slopes. It has medium to high potential for pasture. It produces all common grasses and legumes, such as tall fescue, orchardgrass, and white clover. The slopes and susceptibility to hillside slippage are severe limitations for urban uses. If possible, highway construction should be avoided. Capability unit VIe-1; woodland group 3r.

Lonewood Series

The Lonewood series consists of deep, gently sloping and sloping, loamy, well drained soils. These soils are on the broad smooth areas of the Cumberland Plateau. They formed in residuum weathered mainly from shale, siltstone, and some sandstone. Slopes are 2 to 12 percent.

In a representative profile the surface layer is brown silt loam 10 inches thick. The subsoil, to a depth of 35 inches, is yellowish brown, mostly friable silt loam. Below this, to a depth of 60 inches, the subsoil is strong brown and yellowish red, firm silty clay loam and clay loam. Shale rock is at a depth of 65 inches.

Permeability is moderate. Available water capacity is high. These soils are easy to work, and crops respond well to management. The soil is strongly acid or very strongly acid except in the surface layer in limed areas.

Lonewood soils are dominantly in cutover hardwood forest. Cleared areas are used mainly for pasture, hay, and vegetable crops.

Representative profile of Lonewood silt loam, 2 to 5 percent slopes:

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

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

B1—10 to 16 inches; yellowish brown (10YR 5/4) silt loam; weak medium granular and fine subangular blocky structure; friable; common roots; very strongly acid; gradual smooth boundary.

B21t—16 to 21 inches; yellowish brown (10YR 5/4) silt loam; weak medium subangular blocky structure; friable; common roots; few fine dark brown concretions; thin discontinuous clay films on faces of some peds; very strongly acid; gradual smooth boundary.

B22t—21 to 31 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; few fine dark brown concretions; thin discontinuous clay films on faces of some peds; very strongly acid; clear smooth boundary.

B23t—31 to 35 inches; yellowish brown (10YR 5/6) silt loam; common medium faint strong brown (7.5YR 5/6) light yellowish brown (10YR 6/4) and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm, slightly brittle in some parts; few roots; few fine dark brown concretions; thin discontinuous clay films on faces of some peds; very strongly acid; clear smooth boundary.

B24t—35 to 49 inches; strong brown (7.5YR 5/6) silty clay loam; few medium distinct pale brown (10YR 6/3) and light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; firm, clay films on faces of peds; very strongly acid; gradual smooth boundary.

B25t—49 to 60 inches; yellowish red (5YR 4/6) clay loam; common medium distinct strong brown (7.5YR 5/6) and brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; firm, few small fragments of shale and sandstone; clay films on faces of peds; very strongly acid; gradual wavy boundary.

C—60 to 65 inches; coarsely mottled light yellowish brown (10YR 6/4) strong brown (7.5YR 5/6) and reddish brown (5YR 5/4) shaly clay loam; rock structure; firm, about 60 to 70 percent by volume soft and hard shale fragments; very strongly acid.

R—65 inches; hard shale rock.

The A horizon is 5 to 12 inches thick. It most commonly is silt loam or loam. The B horizon is yellowish brown or strong brown silt loam, loam, clay loam, or silty clay loam, The lower part of the B horizon is yellowish red clay loam. Depth to shale, siltstone, or sandstone rock is 3½ to 6 feet.

In mapping unit LwC the subsoil is slightly redder than that in the defined range for the series, but this difference does not alter the usefulness or behavior of the soil.

LoB—Lonewood silt loam, 2 to 5 percent slopes. This deep, loamy, well drained soil is on broad smooth tracts of the Cumberland Plateau. These tracts range from about 3 to as much as 50 acres in size. The soil has the profile described as representative of the series. The surface layer is brown silt loam 6 to 12 inches thick. The subsoil is yellowish brown and loamy in the upper part and reddish and more clayey in the lower part. In many places it is loamy all the way down to the underlying rock. Depth to bedrock is 3½ to 6 feet.

Included with this soil in mapping were a few areas where the soil is less than 40 inches deep to bedrock. Also included were a few areas where a discontinuous fragipan is at a depth of 25 to 30 inches.

This soil has high potential for farming and for urban uses. The mild slope is a slight limitation for some uses but it can be easily managed. All plants suited to the climate grow well. Corn grows as well, or better, in this soil as in any soil in the State. Large areas of this soil are held by companies for timber production and recreational purposes. Capability unit IIe-2; woodland group 3o.

LoC—Lonewood silt loam, 5 to 12 percent slopes. This well drained, sloping loamy soil is deep to rock. It is in moderately large size tracts on the broad areas of the Cumberland Plateau. The surface layer is yellowish brown friable silt loam. It is 5 to 12 inches thick. In many areas the subsoil is yellowish loamy material to the depth of bedrock. In a few areas it is reddish clay at a depth of about 3 feet below the surface. Depth to rock is 3½ to 6 feet.

Included with this soil in mapping were a few areas of soils that have a subsoil of yellowish brown shaly silt loam. Depth to bedrock is less than 40 inches. Also included were a few areas where rock is deeper than 6 feet and a few areas where a discontinuous fragipan is at a depth between 25 to 30 inches.

This soil has high potential for urban and most farm uses except intensive row cropping. Its potential is

slightly limited by slopes. Cultivated crops will grow well in 3- or 4-year cropping systems and perhaps even better if stripcropping systems or minimum tillage practices are used. Capability unit IIIe-2; woodland group 3o.

LwC—Lonewood loam, 3 to 12 percent slopes. This deep, loamy, well drained soil is in tracts of 2 to 20 acres on the Cumberland Plateau. The surface layer is brown loam 5 to 10 inches thick. The subsoil is yellowish red friable loam and clay loam that extends to bedrock at a depth of 3½ to 6 feet.

Included with this soil in mapping were a few areas of soils that are less than 40 inches deep to bedrock. Also included are a few small areas of soils that are as much as 7 or 8 feet deep to rock.

This soil has high potential for most urban and agricultural uses, except for intensive row cropping. Its potential is slightly limited by slope. High yields of cultivated crops can be grown in 3- or 4-year cropping systems and perhaps more often by using stripcropping systems and minimum tillage practices. Capability unit IIIe-2; woodland group 3o.

Melvin Series

The Melvin series consists of deep, poorly drained soils on the flood plains of the low, flat areas away from the stream channels. These soils formed in loamy sediment deposited by these streams. Slopes are 0 to 2 percent.

In a representative profile the surface layer is dark gray silt loam about 7 inches thick. Below the surface layer the soil is gray, mottled silty clay loam and silt loam to a depth of 60 inches.

Permeability is moderate. Available water capacity is high. The soil is slightly acid or neutral. These soils are subject to occasional brief flooding, mostly in winter and spring. The water table rises within a few inches of the surface during rainy seasons. These soils are difficult to work because of wetness, but they show good response to drainage and other management.

Melvin soils are used mostly for pasture and hay.

Representative profile of Melvin silt loam:

Ap—0 to 7 inches; dark gray (10YR 4/1) silt loam; weak fine and medium granular structure; friable; many roots with brown stains around them; slightly acid; clear smooth boundary.

B21g—7 to 17 inches; gray (10YR 5/1) silt loam; few fine faint pale brown (10YR 6/3) and distinct brownish yellow (10YR 6/6) mottles; weak medium and coarse subangular blocky structure; friable; common roots with brown stains around them; slightly acid; gradual smooth boundary.

B22g—17 to 32 inches; gray (10YR 5/1) silty clay loam; many medium faint dark gray (10YR 4/1) and distinct brownish yellow (10YR 6/6) and strong brown (7.5YR 5/6) mottles; weak medium and coarse subangular blocky structure; friable; slightly acid; clear smooth boundary.

C1g—32 to 36 inches; gray (10YR 5/1) silt loam; weak coarse subangular blocky structure; friable; few pebbles; slightly acid; clear smooth boundary.

C2g—36 to 60 inches; gray (10YR 5/1) silty clay loam, many medium distinct pale yellow (2.5Y 7/4) strong brown (7.5YR 5/8) and prominent yellowish red (5YR 5/8) mottles; weak coarse subangular blocky structure; friable; few pebbles; slightly acid; gradual wavy boundary.

The Ap horizon is dark gray, dark grayish brown, or gray silt loam, or silty clay loam. It is 5 to 9 inches thick. The B horizon is dominantly gray silt loam or silty clay loam mottled in shades of gray, brown, and yellow. In places the Cg horizon contains a small amount of gravel. The Cg horizon is silt loam or silty clay loam and (in places) silty clay, sandy clay, or clay in the lower part. Depth to limestone bedrock exceeds 6 feet.

Me—Melvin silt loam. This nearly level, poorly drained soil is on flood plains. It is in slight depressional areas away from the channel and near the base of steeper slopes, where it receives runoff and seepage. The water table is at or near the surface in winter and early in spring.

The surface layer is dark gray silt loam 5 to 9 inches thick. The subsoil is gray friable silt loam and silty clay loam that is mottled in shades of brown, red, and yellow.

This soil has medium potential for farming and low potential for urban uses. Wetness and flooding are the main limitations, and they can be overcome only by major flood control and drainage measures. Crops that can withstand wetness, such as tall fescue, and crops that can be planted late after the water table drops, such as soybeans, can be grown without installation of major drainage systems. Capability unit IIIw-1; woodland group 2w.

Minvale Series

The Minvale series consists of deep, loamy, and well drained soils. These soils are on benches, foot slopes, and fans below steeper soils that formed in material weathered from cherty limestone. The Minvale soils formed in material that washed or rolled from the steeper uplands. Slopes range from 5 to 20 percent.

In a representative profile the surface layer is brown cherty silt loam about 7 inches thick. The subsoil, to a depth of 13 inches, is strong brown, friable cherty silt loam. Between depths of 13 and 52 inches, it is yellowish red, friable cherty silty clay loam which is underlain by firm cherty clay that extends to a depth of 68 inches. Some fragments of chert are on the surface and in the soil.

Available water capacity is high. Permeability is moderate. These soils are easy to work, and crops respond very favorably to proper management. The soil is strongly acid or very strongly acid throughout except for the surface layer in limed areas.

The Minvale soils are used for tobacco, corn, small grain, hay, and pasture. A few areas are in small farm woodlots.

Representative profile of Minvale cherty silt loam, 5 to 12 percent slopes:

Ap—0 to 7 inches; brown (10YR 5/3) cherty silt loam; moderate medium granular structure; friable; many roots; 15 percent by volume chert fragments up to 2 inches in diameter; medium acid; clear smooth boundary.

B1—7 to 13 inches; strong brown (7.5YR 5/6) cherty silt loam; moderate fine and medium subangular blocky structure; friable; 15 percent by volume chert frag-

ments up to 2 inches in diameter; many roots; strongly acid; clear smooth boundary.

B21t—13 to 25 inches; yellowish red (5YR 5/8) cherty silty clay loam; moderate medium subangular blocky structure; friable; thin discontinuous clay films; 15 percent by volume chert fragments up to 2 inches in diameter; few roots; strongly acid; gradual smooth boundary.

B22t—25 to 52 inches; yellowish red (5YR 5/8) cherty silty clay loam; few fine faint mottles of strong brown; moderate medium subangular blocky structure; friable; thin discontinuous clay films; 20 percent by volume chert fragments up to 3 inches in diameter; strongly acid; gradual smooth boundary.

B23t—52 to 68 inches; yellowish red (5YR 5/8) cherty clay; common medium distinct strong brown (7.5YR 5/6), red (2.5YR 4/6), and pale brown (10YR 6/3) mottles; moderate medium and coarse subangular blocky structure; firm; thin discontinuous clay films; 15 percent by volume chert fragments up to 3 inches in diameter; strongly acid.

The Ap horizon is brown, dark grayish brown, or yellowish brown cherty silt loam or cherty loam. It is 6 to 10 inches thick. In the B2t horizon color ranges from red to reddish brown. Depth to limestone bedrock exceeds 8 feet. Chert content ranges from 10 to 20 percent in the A horizon and from 15 to 25 percent in the B horizon.

MnC—Minvale cherty silt loam, 5 to 12 percent slopes. This deep, loamy, well drained sloping soil is on benches and foot slopes. It formed in material that moved downslope from soils formed in residuum from cherty limestone. It has the profile described as representative of the series. The surface layer is brown cherty silt loam, 5 to 10 inches thick. The subsoil is dominantly yellowish red, friable cherty silty clay loam several feet thick.

Included with this soil in mapping were a few small areas of soils that have a surface layer of dark brown cherty silt loam. Also included were a few areas of soils that have yellowish red cherty clay or cherty silty clay immediatey below the surface layer.

This soil has medium potential for row crops and high potential for small grain, hay, and pasture. Its potential for cultivated crops is limited by slope. Row crops can be grown with good to excellent results in systems that maintain the soil, such as 3- or 4-year cropping systems. They can be grown with these results even more often in stripcropping systems or by using minimum tillage practices.

The soil has high potential for urban uses. Slope is a limitation for some uses, such as intensive recreation. The chert fragments are troublesome, but they do not seriously interfere with the use of the soil. Capability unit IIIe-1; woodland group 3o.

MnD—Minvale cherty silt loam, 12 to 20 percent slopes. This moderately steep, deep, loamy, well drained soil is on benches and foot slopes. It formed in material that washed or rolled downslope from soils that are underlain by cherty limestone.

The surface layer is brown cherty silt loam, 5 to 9 inches thick. The yellowish red subsoil of friable cherty silty clay loam is several feet thick. Angular chert fragments are about 10 to 25 percent by voume. In a very few places where the soil is severely eroded, the surface layer is yellowish red cherty silty clay loam.

Included with this soil in mapping were a few small areas of soils that have a surface layer of dark brown cherty silt loam. Also included were small areas of soils that have yellowish red cherty clay or cherty silty clay in the upper part of the subsoil.

This soil is limited in its use by slopes. Its potential is low for row crops, medium to high for small grain, hay, and pasture; and medium to low for urban uses. Any of the common row crops grow well, but they can be grown only every 4 to 6 years. More often row cropping requires conservation measures such as stripcropping systems and minimum tillage practices.

Slopes are a severe limitation to most urban uses, and special design and installation procedures are required to overcome this limitation. Hillside slippage is also a high risk if cuts for roads or foundations are made in this soil. Capability unit IVe-1; woodland group 3o.

Mountview Series

The Mountview series consists of deep, well drained, yellowish, loamy soils. These soils are on gently rolling uplands of the Highland Rim. They formed in a layer, 2 to 3 feet thick, of loess underlain by many feet of red cherty clay or clay. Slopes range from 2 to 12 percent.

In a representative profile the surface layer is brown silt loam 7 inches thick. The subsoil, to a depth of 30 inches, is yellowish brown and strong brown, friable silt loam and silty clay loam. Between depths of 30 and 65 inches is yellowish red firm clay.

Mountview soils are strongly acid or very strongly acid except in the surface layer in limed areas. Permeability is moderate. The available water capacity is high. These soils are easy to work, and crops give excellent response to proper management.

These soils are used for a wide variety of crops, including corn, tobacco, small grain, hay, and pasture.

Representative profile of Mountview silt loam, 2 to 5 percent slopes:

Ap—0 to 7 inches; brown (10YR 5/3) silt loam; weak fine granular structure; very friable; strongly acid; clear smooth boundary.

B1—7 to 11 inches; yellowish brown (10YR 5/4) silt loam; weak fine subangular blocky structure; friable; very strongly acid; clear smooth boundary.

B21t—11 to 24 inches; yellowish brown (10YR 5/8) silty clay loam; moderate fine and medium subangular blocky structure; friable; patchy clay films; very strongly acid; clear smooth boundary.

B22t—24 to 30 inches; strong brown (7.5YR 5/6) silty clay loam; few medium faint mottles of yellowish brown (10YR 5/6) and yellowish red (5YR 5/6); moderate and fine angular and subangular blocky structure; friable; patchy clay films; few small chert fragments; very strongly acid; gradual wavy boundary.

IIB23t—30 to 48 inches; yellowish red (5YR 4/8) clay, marginal to silty clay loam; common medium distinct mottles of yellowish brown (10YR 5/6) and pale brown (10YR 6/3); moderate to strong medium angular blocky structure; firm; common clay films; common small chert fragments; very strongly acid; gradual smooth boundary.

IIB24t—48 to 65 inches; yellowish red (5YR 4/6) clay; common medium distinct mottles of light yellowish

brown (10YR 6/4) and few fine faint mottles of yellowish brown; moderate medium subangular blocky structure; firm, continuous clay films; few chert fragments; very strongly acid.

The Ap horizon is brown silt loam, and is 4 to 9 inches thick. The B2 horizon is yellowish brown or strong brown silt loam or silty clay loam. The IIB horizon is yellowish red or red clay, silty clay, or silty clay loam. Chert fragments range from a few to about 25 percent by volume in this horizon. Size of chert fragments is less than 1 inch to about 4 inches across. Depth to limestone bedrock is more than 8 feet.

MoB—Mountview silt loam, 2 to 5 percent slopes. This gently sloping, deep, loamy, well drained soil is in 3- to 15-acre tracts on the Highland Rim. It has the profile described as representative of the series. The surface layer is brown silt loam 5 to 10 inches thick. The subsoil is yellowish brown or strong brown, friable silt loam or silty clay loam that grades to yellowish red firm clay at a depth of about 30 inches.

Included with this soil in mapping were a few areas where soils have a fragipan at a depth of 25 to 30 inches below the surface. Also included in parts of a few mapped areas are areas where slopes are less than 2 percent. A few areas have a subsoil that is red to dark red clay loam in the lower part.

The potential of this soil for farming and for urban uses is limited mainly by the small size and irregular shape of most of the areas. Also, it normally is adjacent to soils that have stronger slopes. Otherwise, the soil has slight or no limitations for a wide range of uses. It is potentially productive of all plants adapted to the local climate. Capability unit IIe-1; woodland group 3o.

MoC—Mountview silt loam, 5 to 12 percent slopes. This deep, sloping loamy, well drained soil is on short hillsides that parallel the drainageways on the Highland Rim. The surface layer is brown silt loam 4 to 8 inches thick. The upper 20 to 25 inches of the subsoil is strong brown or yellowish brown, friable silt loam or silty clay loam. The lower part, many feet thick, is reddish firm clay that has few to many fragments of chert.

Included with this soil in mapping were a few areas of soils that have a fragipan at a depth of 20 to 30 inches. Also included in parts of a few mapped areas are areas where slopes are more than 12 percent and a few areas where reddish clay is at a depth of about 15 inches.

This soil has medium potential for row crops. Its potential is limited mainly by slopes. Row crops, such as corn and soybeans, can be grown occasionally, and good results can be obtained. This soil has high potential for small grain, hay, and pasture. All common grasses and legumes grow well.

The potential for most urban uses is high. Slopes are the only significant limitation, and this limitation can be easily overcome by good design, layout, and installation procedures. Capability unit IIIe-1; woodland group 3o.

Nella Series

The Nella series consists of deep, well drained, loamy, cobbly soils. These soils are on the foot slopes of mountains. They formed in old colluvial deposits that have moved down these mountainsides and settled on the foot slopes. Slopes range from about 5 to 45 percent.

In a representative profile the surface layer is brown cobbly loam about 8 inches thick. The subsoil to a depth of 70 inches is chiefly yellowish red and red, friable cobbly clay loam. It is about 20 percent by volume sandstone cobbles.

Permeability is moderate. Available water capacity is medium. These soils respond well to management. The soil is strongly acid or very strongly acid, except in the surface layer in limed areas.

About two-thirds of the Nella soils are in hardwood forest. The cleared part is used for pasture, hay, and small acreages of tobacco, corn, and small grain.

Representative profile of Nella cobbly loam, 5 to 20 percent slopes:

A1—0 to 1 inch; dark grayish brown (10YR 4/2) loam; weak medium and fine granular structure; very friable; many roots; common angular fragments of sandstone on soil surface; strongly acid; abrupt smooth boundary.

A2—1 to 8 inches; brown (10YR 5/3) cobbly loam; weak medium and fine granular structure; very friable; many roots; about 20 percent by volume angular pebbles and cobbles up to 4 inches across; strongly acid; clear smooth boundary.

B1—8 to 14 inches; strong brown (7.5YR 5/6) cobbly loam; weak medium and fine subangular blocky structure; many roots; about 20 percent by volume angular pebbles and cobbles of sandstone up to 4 inches across; strongly acid; clear smooth boundary.

B21t—14 to 24 inches; yellowish red (5YR 4/6) cobbly clay loam; moderate medium subangular blocky structure; friable; common roots; about 15 percent by volume angular pebbles and cobbles of sandstone up to 5 inches across; discontinuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—24 to 36 inches; yellowish red (5YR 5/6) cobbly clay loam; few fine and medium distinct red (2.5YR 4/6) and yellowish brown (10YR 5/4) mottles; moderate, medium subangular blocky structure; friable; few fine roots; about 20 percent by volume angular pebbles and cobbles of sandstone up to 5 inches across; discontinuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—36 to 50 inches; yellowish red (5YR 5/6) cobbly clay loam; common medium distinct red (2.5YR 4/6) dark red (2.5YR 3/6) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; friable; few fine roots; about 25 percent by volume angular pebbles and cobbles of sandstone up to 5 inches across; discontinuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B24t—50 to 70 inches; red (2.5YR 5/6) cobbly clay loam; many medium and fine distinct dark red (2.5YR 3/6) and strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; friable; few fine roots; about 25 percent by volume angular pebbles and cobbles of sandstone as much as 6 inches across; discontinuous clay films on faces of peds; very strongly acid.

The A horizon is brown or yellowish brown cobbly loam 5 to 10 inches thick. The B horizon is mainly yellowish red and red cobbly clay loam that ranges to dark red and to cobbly clay below a depth of about 3 feet. Content of sandstone fragments in each horizon ranges from about 15 to 35 percent by volume. Sandstone or limestone bedrock is at depths greater than 6 feet. In most places the bedrock is limestone.

NeD—Nella cobbly loam, 5 to 20 percent slopes. This deep, loamy, well drained soil is on foot slopes

of the Cumberland Plateau Escarpment and outlier mountains. It has the profile described as representative of the series. The surface layer is brown cobbly loam 5 to 10 inches thick. The subsoil is mainly yellowish red cobbly clay loam several feet thick.

Included with this soil in mapping were a few areas of similar soils that have a yellowish brown or strong brown subsoil. Also included were a few areas where the soil is less than 15 percent by volume cobbles and some areas where slopes are 20 to 30 percent.

This soil has low potential for row crops and urban uses. It has medium potential for hay. Its highest potential, other than forestry, is for pasture. Potential is limited by slopes and, to a lesser extent, by the numerous cobbles on the surface and in the soil. These limitations, especially slopes, are difficult to overcome. Where cuts are made in the slopes, the likelihood of landslides is high, and slides are difficult to prevent even if design and installation practices are good. Capability unit VIe-1; woodland group 3x.

NeE—Nella cobbly loam, 20 to 45 percent slopes. This deep, loamy, well drained, steep soil is on foot slopes of mountains. It has a 5- to 10-inch thick surface layer of brown cobbly loam. The subsoil is chiefly yellowish red, friable cobbly clay loam. It is several feet thick. The cobbles are mostly sandstone and range mosty from 2 to 7 inches across.

Included with this soil in mapping were a few areas of soils that have a strong brown or yellowish brown subsoil. Also included were a few areas where sandstone or shale bedrock is at a depth of 10 to 20 inches. In some areas slopes are 10 to 20 percent.

This soil has low potential for farming and for urban uses. Its potential is limited by steep slope and cobbles. It has high potential for forestry and for extensive recreation. Because of susceptibility to hillside slippage, road construction should be avoided on this soil. Capability unit VIIe-1; woodland group 3x.

Figure 10.—Hard sandstone rock is the parent materal for the Ramsey soils.

Ramsey Series

The Ramsey series consists of loamy somewhat excessively drained soils that are less than 20 inches deep to sandstone rock (fig. 10). These soils are on the Cumberland Plateau at elevations of 1,500 to 2,000 feet. Slopes range from 5 to 75 percent.

In a representative profile the surface layer is brown loam and is about 5 inches thick. The subsoil is yellowish brown friable and very friable loam. Sandstone bedrock is at a depth of 18 inches.

These soils are strongly acid or very strongly acid. Available water capacity is low. Permeability is rapid.

Ramsey soils are mostly in pine and mixed hardwood forest.

Representative profile of Ramsey loam, 5 to 20 percent slopes:

A1—0 to 1 inch; very dark grayish brown (10YR 3/2) loam; weak medium granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

A2—1 to 5 inches; brown (10YR 4/3) loam; weak medium granular structure; very friable; many roots; about 10 percent by volume fragments of sandstone; strongly acid; clear smooth boundary.

B2—5 to 12 inches; yellowish brown (10YR 5/4) loam; weak fine subangular blocky structure; friable; common roots; 15 percent by volume fragments of sandstone; strongly acid; clear smooth boundary.

B3—12 to 18 inches; yellowish brown (10YR 5/4) loam; weak fine and medium subangular blocky structure; very friable; common roots; 25 percent by volume fragments of sandstone; strongly acid.

R—18 inches; hard sandstone bedrock.

Depth to sandstone bedrock ranges from 8 to 20 inches. Each horizon contains few to many fragments of sandstone. In many places a Ramsey soil is in small patches among outcrops of sandstone. In the C horizon some of the soil material is yellowish brown loam to loamy sand that contains many sandstone fragments.

RaD—Ramsey loam, 5 to 20 percent slopes. This shallow, loamy soil is on ridgetops and short side slopes of the Cumberland Plateau. It has the profile described as representative of the series. The surface layer is brown or yellowish brown friable loam to the depth of bedrock, which is from 8 to 20 inches.

Included with this soil in mapping were small areas of soils that are 20 to 40 inches deep to rock. Also included were a few small areas that have rock outcrops

on the surface. These outcrops are mostly near the slope breaks.

This soil has low potential for farming and for urban uses. Its potential is limited by strong slopes and by depth to rock. It has a medium potential for trees such as loblolly and Virginia pines. Capability unit VIIe-1; woodland group 4d.

RaE—Ramsey loam, 20 to 40 percent slopes. This steep, shallow soil is on the tops and upper side slopes of high mountains. The soil is brown or yellowish brown, friable or very friable loam to bedrock, which is at a depth of 8 to 20 inches. In places sandstone fragments are on the surface and in the soil. Also, outcrops of sandstone bedrock are present in places.

Included with this soil in mapping were small areas of soil that is 20 to 40 inches deep to rock. In some areas slopes are more than 40 percent.

This soil has low potential for farming and urban uses. Its potential is limited by steep slope and shallow depth to sandstone rock. It has medium potential for forestry and extensive recreation. Some of this area is near or adjacent to scenic mountain gorges, which enhance its value for recreational purposes. Capability unit VIIe-1; woodland group 4d.

RcD—Ramsey-Rock outcrop complex, 5 to 20 percent slopes. This complex is on ridgetops and short side slopes of the Cumberland Plateau. It consists of small patches of brown loamy soil 8 to 20 inches deep that is scattered among outcrops of sandstone bedrock. About 10 to 25 percent of the area is bedrock outcrops, which are mainly in the form of narrow, discontinuous ledges at the top and bottom of slopes. Relatively few outcrops are in the middle of slopes.

Included with this complex in mapping were a few areas where there are no bedrock outcrops. Also included are a few small areas of short sandstone bluffs.

The potential of this area is limited largely to forestry, extensive recreation, and wildlife habitat. Its potential is limited by shallow depth to rock, outcrops of bedrock, and slopes. Capability unit VIIs-1; woodland group 5x.

RcE—Ramsey-Rock outcrop complex, 20 to 50 percent slopes. This steep complex is on long slopes of the Cumberland Plateau. It consists of patches of brown loamy soil 8 to 20 inches deep that is among outcrops of sandstone. About 10 to 25 percent of the surface area is sandstone outcrops. The rockiest part is along the tops of slopes where short, discontinuous sandstone cliffs are common. In many places fragments of sandstone are common on the surface, and they are scattered throughout the soil.

Included with this soil in mapping were small areas of a soil that is 3 to 5 feet or more to bedrock. This soil is commonly found on the lower parts of slopes.

This soil is largely in forest or wildlife habitat. Its potential is limited by steep slopes, rock outcrops, and shallow depth to rock. It is near or adjacent to scenic mountain gorges, which enhances its potential for recreational uses such as parks and hunting. The mountain gorges commonly have streams of clear, cool water which add to potential for wildlife habitat and recreational areas. Capability unit VIIs-1; woodland group 5x.

Rock Outcrop

RoF—Rock outcrop-Ramsey complex, 35 to 75 percent slopes. This complex of soil and outcrops contains massive, narrow sandstone cliffs that extend almost vertically downward to form escarpments and benches between the Cumberland Plateau and the lower foothills. The small amount of soil between the rocks is brown loam a few inches deep. This land support very sparse vegetation of mountain laurel and oaks. It has little value for farming. Some of the more scenic overlooks are on this land as well as some waterfalls, such as the one at Fall Creek Falls State Park. In a few areas building stone is quarried from some of the thin-bedded sandstone formations. Capability unit VIIs-1; woodland group 5x.

Sequatchie Series

The Sequatchie series consists of deep, loamy, well drained soils. They are in mountain coves and on low terraces of rivers, generally a few feet higher than the first bottoms. Slopes are 0 to 3 percent.

In a representative profile the surface layer is dark brown loam about 10 inches thick. The subsoil is brown and yellowish brown friable clay loam and loam that extends to a depth of about 50 inches. Between depths of 50 and 68 inches is yellowish brown, friable fine sandy loam.

Permeability is moderate. Available water capacity is high. These soils are strongly acid throughout except for the surface layer in limed areas. The Sequatchie soils are very easy to work, and crops respond very favorable to proper management.

The Sequatchie soils are used for tobacco, corn, small grain, hay, and pasture.

Representative profile of Sequatchie loam:

Ap—0 to 10 inches; dark brown (10YR 3/3) loam; weak fine and medium granular structure; friable; many roots; strongly acid; clear smooth boundary.

B21t—10 to 17 inches; brown (7.5YR 4/4) clay loam; weak fine and medium subangular blocky structure; friable; many roots; discontinuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—17 to 25 inches; brown (7.5YR 4/4) clay loam; few fine faint brown mottles; weak fine and medium subangular blocky structure; friable; common roots; discontinuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B31—25 to 33 inches; brown (7.5YR 4/4) loam; common medium faint yellowish brown (10YR 5/4) mottles; weak fine and medium subangular blocky structure; friable; few roots; strongly acid; gradual smooth boundary.

B32—33 to 50 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct brown (10YR 4/3) mottles; weak fine and medium subangular blocky structure; friable; strongly acid; gradual smooth boundary.

C1—50 to 56 inches; yellowish brown (10YR 5/6) fine sandy loam; common medium distinct brown (10YR 5/3) mottles; massive; friable; strongly acid; gradual smooth boundary.

C2—56 to 68 inches; yellowish brown (10YR 5/4) fine sandy loam; common medium faint pale brown (10YR 6/3) mottles; massive; friable; thin strata of loamy sand; strongly acid.

Depth to bedrock is 6 feet or more. The A horizon is 6 to 12 inches thick. It is dark brown or very dark grayish

brown fine sandy loam or loam. The B horizon is brown, strong brown, yellowish brown, or dark yellowish brown loam or clay loam which in places has thin subhorizons of material that is coarser textured. The C horizon is brown or yellowish brown, loam, fine sandy loam, or loamy sand mottled in shades of gray, brown, or yellow. Content of gravel and other coarse fragments is 0 to 15 percent by volume in the A and B horizons and as much as 35 percent in the C horizon.

Sa—Sequatchie loam. This deep, nearly level, gently sloping, well drained, loamy soil is in mountain coves and on low terraces. Much of it is along the Calfkiller River in White County, the Rocky River in Van Buren County, and the Caney Fork River which is the boundary between the counties.

The surface layer is dark brown friable loam 5 to 12 inches thick. The subsoil is mostly brown friable loam or clay loam, but in places it is fine sandy loam. In places the soil has a few pebbles and cobbles on the surface and throughout the profile.

Included with this soil in mapping were small areas of soils that have gray mottles at a depth of about 20 inches. In some spots the soil is more than 15 percent by volume gravel or cobbles throughout the profile. Also included were small areas that have slopes of more than 3 percent.

Sequatchie loam has high potential for farming. Row crops can be grown every year. Some areas are flooded for an hour or two during exceptionally heavy rainfall. The soil needs to be checked for overflow before placing it to uses other than for crops. Capability unit I-1; woodland group 2o.

Sewanee Series

The Sewanee series consists of deep, moderately well drained, loamy soils. The soils are on flood plains of the Cumberland Plateau. They formed in sediment washed mainly from soils underlain by sandstone and shale. Slopes are 0 to 2 percent.

In a representative profile the surface layer is brown loam about 8 inches thick. Below this, to a depth of 27 inches, the subsoil is brown friable loam mottled in shades of gray. Between depths of 27 and 34 inches, the subsoil is brown, yellowish brown, and light brownish gray, mottled loam. Below the subsoil is light brownish gray loam that contains a small amount of gravel. This layer extends to a depth of 50 inches. Sandstone is at a depth of 50 inches.

Sewanee soils are occasionally flooded during very brief periods late in winter and early in spring. These soils are strongly acid except for the surface layer in limed areas. Available water capacity is high. Permeability is moderate.

These soils are used for corn, hay, and pasture. Some very narrow areas along intermittent drainageways are wooded.

Representative profile of Sewanee loam:

Ap—0 to 8 inches; brown (10YR 4/3) loam; few fine faint dark grayish brown mottles; weak fine and medium granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

B21—8 to 20 inches; brown (10YR 4/3) loam; common fine and medium faint light brownish gray (10YR 6/2) and pale brown (10YR 6/3) mottles; weak medium subangular blocky and weak fine granular structure; friable; many roots; strongly acid; abrupt smooth boundary.

B22—20 to 27 inches; brown (10YR 5/3) loam; common fine and medium faint mottles of yellowish brown (10YR 5/4) and light brownish gray (10YR 6/2) and distinct mottles of brown (7.5YR 4/4); weak medium subangular blocky structure; friable; common roots; strongly acid; clear smooth boundary.

B3—27 to 34 inches; mottled brown (7.5YR 4/4), yellowish brown (10YR 5/4), and light brownish gray (10YR 6/2) loam; weak medium subangular blocky structure; friable; few roots; strongly acid; clear smooth boundary.

C—34 to 50 inches; light brownish gray (10YR 6/2) loam; common fine faint mottles of yellowish brown and pale brown; massive; friable; strongly acid; a few sandstone pebbles.

R—50 inches; hard sandstone rock.

The A and B horizons are mainly silt loam and loam. The A horizon is brown or dark grayish brown, 5 to 10 inches thick. The B horizon is brown or yellowish brown and has mottles of gray and brown. Depth to bedrock ranges from 40 inches to 6 feet.

Se—Sewanee loam. This nearly level, deep, moderately well drained, loamy soil is in long, narrow areas along creeks and branches of the Cumberland Plateau. Slopes are less than 2 percent.

Included with this soil in mapping were a few spots where the surface layer is sandy loam and gravelly sandy loam. Also included are a few areas of soils that have no gray mottles above a depth of 20 inches. Other areas have soils that are gray just beneath the plow layer.

The occasional brief flooding and the high water table during parts of the winter and spring seasons are limitations to farming as well as to other uses. The small size and narrow elongated shape of most areas also affects use, especially since most areas are sandwiched between upland slopes that are poorly suited to cultivated crops. Because of these features this soil probably has no more than medium potential for crops, even if better drainage and protection from overflow were provided. Most row crops grow quite well, however, and all commonly grown grasses and legumes for hay and pasture also can be grown on this soil. Capability unit IIw-1; woodland group 2w.

Staser Series

The Staser series consists of deep, loamy, well drained, dark soils on bottom land along rivers and creeks. Slopes are 0 to 2 percent.

In a representative profile the upper 36 inches is dark brown, friable silt loam. Between depths of 36 and 65 inches the subsoil is brown, friable silt loam.

These highly productive soils are subject to occasional, very brief flooding. Permeability is moderate. Available water capacity is high. These soils are very easy to work, and crops respond extremely well to proper management. The soil material is slightly acid or neutral throughout.

Staser soils are used for corn, small grain, hay, silage, and pasture.

Representative profile of Staser silt loam:

Ap—0 to 8 inches; dark brown (7.5YR 3/2) silt loam;

weak fine granular structure; very friable; many roots; slightly acid; clear smooth boundary.

A12—8 to 23 inches; dark brown (7.5YR 3/2) silt loam; weak fine and medium subangular blocky structure; friable; many roots; slightly acid; gradual smooth boundary.

A13—23 to 36 inches; dark brown (7.5YR 3/2) silt loam; weak fine subangular blocky structure; friable; few fine roots; slightly acid; gradual smooth boundary.

B2—36 to 65 inches; brown (7.5YR 4/4) silt loam; weak fine and medium subangular blocky structure; friable; slightly acid; gradual smooth boundary.

The dark brown or very dark grayish brown A horizon is 2 to 3½ feet thick. It is silt loam, loam, and, in a few places, fine sandy loam. The B horizon is dark yellowish brown or brown silt loam or loam with thin subhorizons of coarser textured material. Depth to bedrock, most commonly limestone, exceeds 6 feet.

Ss—Staser silt loam. This deep, nearly level, well drained, dark soil is on the bottom lands of creeks and rivers. It is subject to occasional, very brief periods of flooding, mostly in winter and early spring. Flooding generally lasts for only an hour or two because the water moves rapidly down the streams.

Included with this soil in mapping were some small areas of soils that have dark brown surface layers less than 10 inches deep. Also included were a few small strips of moderately well drained soils.

This soil has high potential for farming. It is one of the most productive soils in White and Van Buren Counties. The occasional flooding does not seriously interfere with farming, but it is a severe limitation to urban uses such as homesites and roads. The high value of this soil for crops should be considered before putting it to other uses. Capability unit I-1; woodland group 2o.

Taft Series

The Taft series consists of deep, somewhat poorly drained soils that have a fragipan. They are mostly on the Highland Rim in large depressions. Slopes are 0 to 2 percent.

In a representative profile the 6-inch surface layer is brown silt loam. The upper part of the subsoil down to the fragipan at a depth of 26 inches is brownish and yellowish silt loam profusely mottled in shades of gray. The fragipan is firm, brittle gray silt loam and silty clay loam with yellowish and brownish mottles. It extends to a depth of more than 5 feet.

Permeability is slow. Available water capacity is medium. These soils are easy to work in summer and early in fall when the perched water table is several feet below the surface. In winter and early in spring the water table is within about 1 foot of the surface layer and some ponding occurs. The Taft soils respond fairly well to surface drainage and other management practices. The soil is strongly acid or very strongly acid, except for the surface layer in limed areas.

Taft soils are used for pasture, hay, and where drained, corn and silage. A few areas are in hardwood forest.

Representative profile of Taft silt loam:

Ap—0 to 6 inches; brown (10YR 5/3) silt loam; common fine faint mottles of light brownish gray; moderate medium granular structure; very friable; strongly acid; clear smooth boundary.

B21—6 to 14 inches; light yellowish brown (2.5Y 6/4) silt loam; many coarse faint mottles of light brownish gray (2.5Y 6/2) and a few fine distinct mottles of olive yellow; weak medium subangular and angular blocky structure; friable; strongly acid; clear smooth boundary.

B22—14 to 26 inches; mottled light brownish gray (2.5Y 6/2), olive yellow (2.5Y 6/6), and light gray (2.5Y 7/2) silt loam; weak medium angular and subangular blocky structure; friable; strongly acid; clear wavy boundary.

A'2 and B'x1—26 to 32 inches; mottled gray (N6), light brownish gray (2.5YR 6/2), and light yellowish brown 2.5Y 6/4) silt loam; weak medium platy parting to weak medium angular and subangular blocky structure; friable; brittle in some parts; few dark concretions; very strongly acid; clear wavy boundary.

B'x2—32 to 45 inches; gray (N6) silty clay loam; common medium distinct mottles of light yellowish brown (2.5Y 6/4) and common medium distinct mottles of olive yellow (2.5Y 6/6); weak thick platy parting to moderate fine and medium angular and subangular blocky structure; brittle, firm; clay flows in pockets; few small dark concretions; very strongly acid; gradual wavy boundary.

B'x3—45 to 53 inches; gray (N6) silty clay loam; common medium distinct mottles of yellowish brown (10YR 5/4); weak thick platy parting to moderate fine and medium angular and subangular blocky structure; firm, brittle; clay flows in cracks, pores, and old root channels; discontinuous clay films; very strongly acid; gradual wavy boundary.

B'x4—53 to 63 inches; gray (N5) silty clay loam; common coarse prominent mottles of strong brown (7.5YR 5/6) and a few faint distinct mottles of pale brown; weak thick platy parting to moderate medium angular and subangular blocky structure; firm, brittle; discontinuous clay films on some faces of peds; clay flows in old root channels; few small chert fragments; very strongly acid.

Depth to the top of the fragipan ranges from 20 to 30 inches. Thickness of the fragipan generally is more than 2 feet. Depth to limestone bedrock is more than 8 feet.

Ta—Taft silt loam. This nearly level, somewhat poorly drained soil has a fragipan in the lower part of the subsoil. It is in large depressional areas of the Highland Rim.

Included with this soil in mapping were a few pockets of poorly drained soils and a few patches of moderately well drained soils.

This soil has medium potential for farming. Major drainage work is required to grow a wide range of crops. Drainage work is not feasible for many individual owners because water outlets are not available. Without improved drainage, water tolerant crops, such as tall fescue, and crops that can be planted late, such as soybeans, are better suited than others. Wetness is a severe limitation to urban uses, and it is doubtful whether this limitation could be overcome. The slow permeability of the soil combined with the lack of water outlets makes this soil difficult to drain. Capability unit IIIw-2; woodland group 3w.

Talbott Series

The Talbott series consists of moderately deep, well drained soils that have a plastic, clay subsoil. These soils are gently sloping to steep on low-lying hills on the

eastern edge of the Highland Rim. They formed in limestone residuum. Slopes range from 5 to 50 percent.

In a representative profile the surface layer is brown silt loam about 5 inches thick. The subsoil is yellowish red, plastic, clay mottled in the lower part in shades of red, brown, and yellow. Limestone bedrock is at a depth of 36 inches.

Permeability is moderately slow. The available water capacity is medium to low. The Talbott soils are fairly easy to work except where they have been severely eroded. In these places the present surface layer consists of clayey subsoil material. The soil is strongly acid except in the surface layer in limed areas and also in a thin layer just above the limestone bedrock, where it ranges to mildly alkaline.

Talbott soils are used mainly for hay and pasture. Many rocky and steep areas are in woodland.

Representative profile of Talbott silt loam, 5 to 12 percent slopes, eroded:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam; moderate medium granular structure; friable; few fine roots; strongly acid; clear smooth boundary.

B21t—5 to 12 inches; yellowish red (5YR 4/6) clay; moderate to strong medium subangular blocky parting to fine subangular blocky structure; firm, plastic; discontinuous clay films; few fine black concretions; strongly acid; gradual smooth boundary.

B22t—12 to 20 inches; yellowish red (5YR 5/6) clay; strong medium subangular blocky structure; continuous clay films; firm, plastic; few fine black concretions; strongly acid; gradual smooth boundary.

B23t—20 to 28 inches; yellowish red (5YR 5/6) clay; moderate medium subangular blocky structure; firm, plastic; continuous clay films; strongly acid; gradual smooth boundary.

B24t—28 to 34 inches; yellowish red (5YR 4/6) clay; common medium distinct mottles of dark reddish brown (5YR 3/4); moderate medium subangular blocky structure; continuous clay films; firm, plastic; few black concretions; strongly acid; clear smooth boundary.

B3—34 to 36 inches; dark reddish brown (5YR 3/3) clay; common medium faint mottles of reddish brown (5YR 5/4); moderate fine subangular blocky structure; firm; many small pieces of partly weathered limestone; neutral.

R—36 inches; limestone rock.

The Ap horizon is 4 to 7 inches thick. It is brown, yellowish brown, strong brown, or yellowish red silt loam, silty clay loam, or clay. The upper part of the B horizon is yellowish red or red, and the lower part ranges from yellowish red to dark reddish brown. The B horizon is firm, plastic clay. Depth to limestone bedrock ranges from 20 to 40 inches.

TbC2—Talbott silt loam, 5 to 12 percent slopes, eroded. This soil is well drained. Areas of this soil are 3 to 10 acres in size. It has the profile described as representative of the series. The surface layer is brown silt loam 4 to 7 inches thick, and the subsoil is yellowish red, plastic clay that extends to bedrock which is at a depth of 20 to 40 inches. Numerous spots of eroded soils in most mapped areas have a surface layer of strong brown or yellowish red silty clay loam or clay.

Included with this soil in mapping were small spots of a soil in depressions. This included soil is brown, friable silt loam to a depth of 30 inches or more. Also included were small areas of soils that have slopes of 2 to 5 percent, a few small areas of soils that have slopes of 12 to 20 percent, and some areas of soils that are much deeper than 40 inches to bedrock. There are scattered outcrops of limestone.

This soil has low potential for row crops. Its potential is limited by slope, a clayey subsoil of moderately slow permeability, rapid runoff, and medium or low available water capacity. These features and also moderate shrink-swell potential and low strength severely limit this soil for urban uses. This soil has medium potential for small grain, hay crops, and pasture. Capability unit IVe-2; woodland group 3c.

TcD — Talbott silty clay loam, 5 to 20 percent slopes, rocky areas. This soil is well drained. It has a reddish, plastic, clay subsoil. Areas are 3 to 10 acres in size and are mainly along the eastern edge of the Highland Rim. Scattered outcrops of limestone make up about 2 to 10 percent of each mapped area. Thickness of the soil to limestone rock generally ranges from 20 to about 40 inches. Some areas, however, have tongues of reddish clay that extend to depths of several feet.

This soil has low potential for row crops. Its potential is limited by slope; a clayey, plastic subsoil of moderately slow permeabiity; high runoff; medium to low available water capacity; and outcrops of limestone rock. These features and also moderate shrink-swell potential and low strength severely limit this soil for urban uses. This soil has medium potential for small grain, hay, and pasture. Capability unit VIe-2; woodland group 4x.

TcE—Talbott silty clay loam, 20 to 50 percent slopes, rocky areas. This steep soil is on hillsides on the eastern edge of the Highland Rim. It has a reddish, plastic, clay subsoil. Scattered outcrops of limestone rock cover about 5 to 10 percent of each mapped area. Depth of the soil ranges from 20 to about 40 inches except where tongues of reddish clay extend 5 feet deep or more in solution channels of the limestone.

This soil has low potential for farming and for urban uses. Its potential is limited by steep slope, outcrops of rock, and clayey subsoil of moderately slow permeability. It has medium potential for forestry and extensive recreation. Capability unit VIIs-1; woodland group 4x.

TrD—Talbott-Rock outcrop complex, 5 to 20 percent slopes. This complex of soil and rock outcrops is mainly on foot slopes and benches of the Cumberland Plateau Escarpment. It is also on the slopes of outlier mountains, such as Goulden Mountain.

From 10 to 40 percent of each area is made up of limestone outcrops. The soil between the rocks consists of strips and patches of reddish, fine-textured soil ranging in most places from 20 to 40 inches deep to rock. In some places, however, tongues of reddish clay extend to a depth of 5 feet or more. This land supports sparse stands of trees, dominantly eastern red cedar.

This complex has low potential for farming and for urban uses. Its potential is limited mainly by limestone outcrops. The clayey soil material, low available water capacity, and slope are further limitations. Some areas are used for native pasture, but the potential for pasture is low because the outcrops make establishing and maintaining pasture extremely difficult. Some of the

rock is used for agricultural lime and some is used for road-building material. For uses such as roadways, cuts must be made in limestone rock. The eastern redcedar in this unit is valuable for fenceposts and lumber. Capability unit VIIs-1; woodland group 5x.

TrF—Talbott-Rock outcrop complex, 20 to 50 percent slopes. This complex of soil and limestone outcrops is mainly on the lower parts of the Cumberland Plateau Escarpment and on the sides of outlier mountains that have been detached from the main range of the Cumberlands through long ages of geologic erosion. It is also on steep side slopes along the Caney Fork River and Calfkiller River. In a few places, it is actually a bluff 50 to 200 feet high.

Each area consists of 10 to 50 percent limestone outcrops. Patches and tongues of reddish, clayey, plastic soil are among the rocks. Some of the rocks extend 2 to 4 feet above the surface. This complex supports sparce stands of trees (fig. 11).

This unit has low potential for most uses. The eastern redcedar is valuable for lumber and fenceposts. Trees grow slowly because of the clayey soil, depth to rock, and low available water capacity. Some of the rock is used for agricultural lime, and some is used for road-building material. Capability unit VIIs-1; woodland group 5x.

Tilsit Series

The Tilsit series consists of moderately well drained loamy soils that have a fragipan beginning at a depth of about 2 feet. These soils are on the Cumberland Plateau. Slopes are 2 to 5 percent.

In a representative profile the surface layer is brown silt loam about 5 inches thick. The subsoil to the fragipan, at a depth of 24 inches, is brown and yellowish brown, friable silt loam. The fragipan, which extends to a depth of 56 inches, is light yellowish brown mottled with shades of gray, yellow, and brown. It is silty clay loam and silt loam that is firm and brittle. Between

Figure 11.—The rockier parts of the Talbott-Rock Outcrop complex support sparse vegetation.

depths of 56 and 62 inches is firm silty clay loam mottled in shades of gray and brown. Bedrock is at a depth of 62 inches.

The Tilsit soils are strongly acid or very strongly acid, except in the surface layer in limed areas. Permability is moderate down to the fragipan, and it is slow in the fragipan. Available water capacity is medium.

Tilsit soils are used for corn, soybeans, pasture, and hay. Many areas are in hardwood forest.

Representative profile of Tilsit silt loam, 2 to 5 percent slopes:

A1—0 to 1 inch; very dark gray (10YR 3/1) silt loam with some brown (10YR 4/3) silt loam mixed in; weak medium granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

A2—1 to 5 inches; brown (10YR 5/3) silt loam; moderate medium granular structure; very friable; common roots; strongly acid; abrupt smooth boundary.

B1—5 to 11 inches; brown (10YR 5/3) silt loam; weak medium subangular blocky structure; friable; common roots; very strongly acid; gradual smooth boundary.

B21—11 to 17 inches; yellowish brown (10YR 5/4) silt loam; moderate medium subangular blocky structure; friable; common roots; very strongly acid; gradual smooth boundary.

B22t—17 to 24 inches; yellowish brown (10YR 5/6) silt loam; moderate medium subangular blocky structure; friable; common roots; discontinuous clay films; very strongly acid; clear smooth boundary.

Bx1—24 to 32 inches; light yellowish brown (2.5Y 6/4) silt loam; common medium distinct mottles of gray (10YR 6/1) and brownish yellow (10YR 6/6); moderate medium subangular blocky structure; firm, brittle; discontinuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bx2—32 to 40 inches; mottled light yellowish brown (2.5Y 5/4) gray (10YR 6/1) and brownish yellow (10YR 6/6) silty clay loam; massive with some weak fine and medium subangular blocky structure; firm, brittle; discontinuous clay films; few small shale and siltstone fragments; very strongly acid; gradual smooth boundary.

Bx3—40 to 56 inches; light yellowish brown (10YR 6/4) silty clay loam; many medium distinct mottles of light gray (10YR 6/1) pale brown (10YR 6/3) and strong brown (7.5YR 5/8); massive; firm, brittle; few small shale and siltstone fragments; very strongly acid; gradual wavy boundary.

C—56 to 62 inches; mottled light gray (10YR 7/1), pale brown (10YR 6/3), and strong brown (7.5YR 5/8) silty clay loam; massive with relic rock structure; firm; about 5 to 10 percent by volume siltstone and shale fragments; very strongly acid; clear smooth boundary.

R—62 inches; siltstone rock.

The Ap horizon is brown or dark grayish brown silt loam or loam, 5 to 8 inches thick. Depth to the fragipan ranges from 18 to 28 inches. Depth to bedrock is 3½ to 6 feet. Coarse fragments ¼ inch to 3 inches in size make up 2 to 10 percent of the volume of the A and B horizons and 10 to 35 percent of the volume of the C horizon. The B horizon is silt loam or silty clay loam. The Bx horizon is dominantly silty clay loam but ranges to silt loam. The C horizon is silty clay loam, clay loam or (rarely) silty clay.

TtB—Tilsit silt loam, 2 to 5 percent slopes. This moderately well drained, loamy soil has a fragipan. This soil is on the Cumberland Plateau.

Included with this soil in mapping were small pockets of a somewhat poorly drained soil. Also included, on narrow ridgetops, are soils that are well drained and have no fragipan.

This soil has high potential for farming. Good to excellent growth of all common crops can be obtained. The slow permeability of the fragipan is a severe limitation for onsite sewage disposal. This limitation can be partly overcome by expansion of field lines and installation of dual field line systems. Capability unit IIe-3; woodland group 3o.

Udorthents

Um — Udorthents-Mine pits complex. This complex consists of areas that have been strip mined for coal. The mine pits are 6 to 30 or more feet deep. Between the mine pits are high heaps of material excavated from the mines. The excavated material varies considerably. The upper part is largely lowgrade coal and shaly material. This material came out last in the excavation process and was spread unevenly over material that was largely sandstone and shale fragments mixed with variable amounts of fine-earth material. Common features of the excavated material are the large amount of fragments (more than 50 percent), the relatively small amount of fine-earth material, and the extreme acidity. Individual areas vary in size from 2 to 200 or more acres. Some areas have been planted in pine trees, but survival of the pine trees is low. One area near Piney School in Van Buren County is being used for a sanitary landfill for both White and Van Buren Counties. Some pits contain several feet of water. Capability unit VIIs-2; woodland group 5x.

Waynesboro Series

The Waynesboro series consists of deep, well drained soils. These soils are on old high terraces of the Highland Rim. Slopes range from 2 to 35 percent.

In a representative profile the surface layer is brown loam about 6 inches thick. The subsoil, to a depth of 70 inches, is yellowish red and red, friable clay loam in the upper part and dark red friable clay in the lower part.

The Waynesboro soils are strongly acid or very strongly acid throughout, except for the surface layer in limed areas. Permeability is moderate. Available water capacity is high.

Most of the acreage has been cleared and is used for crops and pasture; only the steepest slopes are wooded.

Representative profile of Waynesboro loam, 2 to 5 percent slopes:

Ap—0 to 6 inches; brown (7.5YR 4/4) loam; weak fine and medium granular structure; very friable; many roots; strongly acid; abrupt smooth boundary.

B1—6 to 13 inches; yellowish red (5YR 4/6) clay loam; moderate fine and medium subangular blocky structure; friable; many roots; strongly acid; gradual smooth boundary.

B21t—13 to 24 inches; red (2.5YR 4/6) clay loam; moderate fine and medium subangular blocky structure; friable; discontinuous clay films; common roots; strongly acid; gradual smooth boundary.

B22t—24 to 38 inches; dark red (2.5YR 3/6) clay; few fine distinct strong brown mottles in lower part of horizon; moderate fine and medium subangular blocky structure; friable; continuous clay films; few roots;

few pebbles ¼ to 1 inch in diameter; strongly acid; gradual smooth boundary.

B23t—38 to 55 inches; dark red (2.5YR 3/6) clay; few medium distinct yellowish red (5YR 5/6) mottles; weak fine and medium subangular blocky structure; friable; continuous clay films; few pebbles ¼ to 1 inch in diameter; strongly acid; gradual smooth boundary.

B24t—55 to 70 inches; dark red (10YR 3/6) clay; common medium distinct yellowish red (5YR 5/6) mottles; weak fine and medium angular and subangular blocky structure; friable; discontinuous clay films; few pebbles ¼ inch to 2 inches in diameter; strongly acid.

Depth to bedrock is more than 8 feet. The A horizon, 5 to 10 inches thick, is brown or yellowish brown loam. In areas where the soil is severely eroded, the A horizon is yellowish red or red clay loam. Content of cobbles or gravel in each layer is less than 15 percent by volume.

WaB—Waynesboro loam, 2 to 5 percent slopes. This deep, well drained soil is in 3- to 10-acre tracts on old high terraces of the Highland Rim. It has a profile described as representative of the series. The surface layer is brown loam, 5 to 10 inches thick. The subsoil, several feet thick, is yellowish red or red clay loam in the upper part and dark red friable clay in the lower part.

Included with this soil in mapping were a few small areas where the soil is more than 15 percent gravel or cobbles. Also included are a few areas that have slopes of 5 to 12 percent. Some tracts contain areas of soils that have a dark red surface layer. Also included are a few areas of soils that have a yellowish brown subsoil.

This soil has medium potential for cultivated crops. Its potential for this use is slightly limited by the mild slopes, the small size and irregular shape of the areas, and their location atop low hills. The soil has high potential for small grain, hay, and pasture. Its potential for urban uses is high. There are no significant limitations. Capability unit IIe-1; woodland group 3o.

WaC—Waynesboro loam, 5 to 12 percent slopes. This deep, well drained soil is in tracts of 3 to 20 acres on old high terrace lands of the Highland Rim. The surface layer is brown loam, 5 to 8 inches thick. The upper 16 to 20 inches of the subsoil is yellowish red and red, friable clay loam, underlain by several feet of dark red friable clay. In some areas there are occasional spots of eroded soil that has a surface layer of reddish clay loam.

Included with this soil in mapping are a few areas where slopes are 2 to 5 percent. Also included are a few small areas that contain numerous cobbles and gravel.

This soil has medium potential for row crops. Its potential is limited mainly by slopes. If row crops are grown more often than about every 3 years, conservation measures, such as stripcropping systems or minimum tillage practices, are needed. The potential for small grain, hay, and pasture is high. It is also high for urban uses such as residential building. Slopes are the main limitations for urban uses, but this limitation is not ordinarily serious enough to require special design. Capability unit IIIe-1; woodland group 3o.

WaD—Waynesboro loam, 12 to 20 percent slopes. This deep, well drained soil is in areas of 3 to 10 acres on short hillsides. Some areas of it form the rims around limestone sinks. The surface layer is brown loam 5 to 10 inches thick. The upper part of the subsoil is yellowish red or red, friable clay loam, and the lower part is red or dark red, friable clay. The soil is more than 8 feet deep to bedrock.

Included with this soil in mapping were a few small areas where slopes are less than 12 and more than 20 percent. Some tracts contain small areas where numerous cobbles or pebbles are throughout the profile. Also, in some of the areas there are frequent spots of eroded soil and patches where the surface layer is reddish clay loam.

Because of strong slopes, this soil has low potential for row crops. Although all common row crops grow well, the soil is too sloping for frequent cultivation. Some areas are deeply pitted by limestone sinks, and they are difficult to farm except for pasture. All common grasses and legumes for hay and pasture grow well, and the potential for these uses is high. This soil has low to medium potential for urban uses. Its potential for these uses is limited by slopes and, in places, by limestone sinks. Capability unit IVe-1; woodland group 3o.

WaE2 — Waynesboro loam, 20 to 35 percent slopes, eroded. This deep, steep, well drained soil is on hillsides and in tracts of 3 to 10 acres in size. In places it surrounds deep limestone sinks. The surface layer is brown loam 5 to 9 inches thick. The upper part of the subsoil is yellowish red, friable clay loam, and the lower part is dark red or red, friable clay many feet thick.

Included with this soil in mapping were small areas where slopes are less than 20 and more than 35 percent. In a few small areas a notable amount of gravel or cobbles is on the surface and throughout the soil. Some tracts contain small areas of soils that have a subsoil of yellowish red, plastic clay. Also, in most areas there are frequent patches of eroded soil that has a surface layer of reddish clay loam.

This soil is limited in use mainly by steep slopes. Because of this, it has low potential for row crops and medium potential for pasture. Slopes are a severe limitation for urban uses. Some areas are deeply pitted by limestone sinks, and these are difficult to manage except possibly for pasture or forestry. Capability unit VIe-1; woodland group 3r.

WbC3—Waynesboro clay loam, 5 to 12 percent slopes, severely eroded. This deep, well drained soil is in areas of 3 to 10 acres on low-lying hills of the Highland Rim. Erosion has removed most of the original surface layer. The present surface layer, 4 to 6 inches thick, consists mostly of former subsoil material and is yellowish red friable clay loam that ranges to loam in spots where the soil is less eroded. The subsoil, many feet thick, is yellowish red friable clay loam in the upper foot or two and dark red friable clay below. In places there are a few cobbles and pebbles on the surface and in the soil. A few shallow gullies are in several of the areas.

Included with this soil in mapping were small areas where numerous pebbles or cobbles are present, a few

areas where slopes are 2 to 5 percent, and a few areas where slopes are 12 to 20 percent.

This soil has medium or low potential for row crops. If these crops are grown more often than every 3 or 4 years, stripping systems or minimum tillage practices are needed to prevent excessive erosion. The potential for small grain, hay, and pasture is high. All of the commonly grown grasses and legumes for hay and pasture grow well.

The potential for urban uses is high. Slopes are the only significant limitation, and this limitation can ordinarily be handled with proper management and without special design techniques. Capability unit IVe-1; woodland group 4c.

WbD3—Waynesboro clay loam, 12 to 20 percent slopes, severely eroded. This deep, well drained, moderately steep soil is in areas 3 to 10 acres in size. Erosion has removed most of the original surface layer. The present surface layer, consisting mostly of former subsoil material, is yellowish red clay loam. The subsoil is yellowish red or red, friable clay loam in the upper part and red or dark red, friable clay in the lower part. A few cobbles and pebbles are on the surface and in the soil in places.

Included with this soil in mapping were small areas of soils with numerous cobbles or pebbles throughout and small areas of soils where slopes are less than 12 and more than 20 percent.

The strong slopes and clay loam surface layer are the main reasons for management by users. Except for these two features, the soil has favorable physical properties. It has low potential for row crops and high potential for hay and pasture. The strong slopes and limestone sinks, in places, are moderate to severe limitations for urban uses. These limitations can be overcome by proper design of lot layout and by installing disposal systems to carry runoff water. Capability unit VIe-1; woodland group 4c.

Welchland Series

The Welchland series consists of deep, nearly level to gently sloping, well drained, loamy soils on low terraces along streams and in mountain coves. Some areas are flooded occasionally. Slopes range from 0 to 3 percent.

In a representative profile the surface layer is dark brown cobbly loam 9 inches thick. The subsoil, to a depth of 46 inches, is brown and strong brown very friable cobbly loam. Between depths of 46 and 60 inches, the subsoil is strong brown cobbly sandy loam. Cobbles and pebbles make up about 25 percent by volume of the surface layer and subsoil. They are mainly sandstone.

Permeability is moderately rapid. The available water capacity is low to medium. Welchland soils are difficult to work because of the cobbly surface layer. They give only fair response to proper management. The soils are strongly acid or very strongly acid except for the surface layer in limed areas.

Welchland soils are used mostly for pasture.

Representative profile of Welchland cobbly loam:

Ap—0 to 9 inches; dark brown (10YR 3/3) cobbly loam; weak fine granular structure; very friable; many roots; 25 percent by volume sandstone pebbles and cobbles up to 6 inches in diameter; medium acid; clear smooth boundary.

B1—9 to 17 inches; brown (7.5YR 4/4) cobbly loam; weak medium subangular blocky structure; very friable; common roots; 20 percent by volume sandstone pebbles and cobbles up to 6 inches in diameter; strongly acid; gradual wavy boundary.

B2t—17 to 38 inches; brown (7.5YR 4/4) cobbly loam; weak medium subangular blocky structure; very friable; common roots; discontinuous clay films on faces of peds; 30 percent by volume sandstone pebbles and cobbles up to 5 inches in diameter; strongly acid; gradual wavy boundary.

B3—38 to 46 inches; strong brown (7.5YR 5/6) cobbly loam; weak fine subangular blocky structure; very friable; 35 percent by volume sandstone pebbles and cobbles up to 6 inches in diameter; strongly acid; gradual wavy boundary.

C—46 to 60 inches; strong brown (7.5YR 5/6) cobbly sandy loam; massive; very friable; 45 percent by volume sandstone pebbles and cobbles up to 6 inches in diameter; strongly acid.

The A horizon is dark brown or very dark grayish brown cobbly loam or cobbly sandy loam. The B horizon is reddish brown, brown, or strong brown cobbly loam, cobbly clay loam, or cobbly sandy clay loam. It has thin subhorizons of cobbly sandy loam. The C horizon, in addition to the colors given for the B horizon, includes yellowish brown. It is cobbly loam, cobbly sandy loam, or (rarely) cobbly loamy sand. Depth to limestone bedrock is more than 6 feet. The amount of pebbles, cobbles, and stones average 15 to 30 percent by volume in the A horizon, 15 to 35 percent in the B horizon, and 20 to 60 percent in the C horizon. The rock fragments are mainly sandstone and the dominant size range is 2 to 6 inches in diameter. Some, however, are as large as 10 or 12 inches in diameter.

We—Welchland cobbly loam. This dark brown, loamy, nearly level to gently sloping, well drained soil is in mountain coves and along streams that flow out of the mountains. The surface layer is dark brown cobbly loam. The subsoil is chiefly brown and strong brown, friable cobbly loam. This soil has many cobbles and pebbles on the surface and throughout the profile.

Included with this soil in mapping were small patches that are nearly free of cobbles.

This soil has low to medium potential for farming. Even if the cobbles were removed, as they have been in some places, row crop production is only fairly good because of the limitation caused by available water capacity. Row crops can be grown every year because the soil is not likely to erode. Some areas of this soil become flooded during unusually high rainfall. Before putting this soil to uses other than crops, it should be checked for overflow. Capability unit IIs-1; woodland group 3x.

Use and Management of the Soils

This section describes the use and management of the soils for crops and for pasture, for woodland, and for wildlife habitat. It also discusses uses of soils for engineering purposes.

Use of the Soils for Crops and Pasture[3]

The soils of White and Van Buren Counties are used mainly for farming. Use of the soils for recreational purposes, however, has steadily increased in the Cumberland Plateau Region. The largest acreages are used for pasture and hay. Small acreages are in corn, small grain, tobacco, and vegetables. In the following paragraphs the capability grouping used by the Soil Conservation Service is explained, the management by capability units is described and estimated yields of the principal crops in these counties are given.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management.

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

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

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

Class I soils have few limitations that restrict their uses.

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, that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture or range, woodland, or wildlife habitat. (There are no class V soils in White and Van Buren Counties.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or to esthetic purposes. (There are no class VIII soils in White and Van Buren Counties.)

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained. The letter *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.) The letter *s* shows that the soil is limited mainly because it is shallow, droughty, or stony. The letter *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture or range, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-2 or IIIe-2. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation as defined in the previous paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

Suggestions for the use and management of the soils of White and Van Buren Counties by capability unit are given in the following pages. Specific statements are not made concerning the use of fertilizer, desirable varieties and mixtures of seeds, or favorable dates for planting. Up-to-date information is published by the Tennessee Agricultural Experiment Station and the Extension Service. Personnel of the local office of the Soil Conservation Service and the Extension Service can furnish information helpful in interpreting this information.

The capability unit designation for each soil in the survey area is given in the "Guide to Mapping Units" at the back of this survey.

[3] CLARENCE H. JENT JR., agronomist, Soil Conservation Service, assisted in writing this section.

CAPABILITY UNIT I-1

This unit consists of deep, nearly level to gently sloping, friable and very friable loam and silt loam that has a subsoil of friable or very friable, silt loam, loam, or clay loam. These soils are on bottom land or along drainageways on low terraces. Some of these soils are subject to flooding. The available water capacity is high. Roots penetrate to a depth of 4 feet or more. Fertility is moderate to high. The response to management is excellent.

These soils are well suited to crops and can be farmed intensively. They are easy to work. They are generally not used for pasture, but their high available water capacity makes them especially well suited to supplemental summer pasture. All the common crops can be grown. Alfalfa ordinarily does not survive as long on these soils as on the reddish upland soils. Nearly all the acreage is cultivated. Much of it is used for corn and hay. Small acreages are used for tobacco.

The soils in this unit can be row cropped every year because they are not subject to erosion. Plowing under large amounts of residue replenishes the supply of organic matter and preserves tilth. Fertilization is important.

CAPABILITY UNIT IIe-1

This unit consists of deep, well drained, gently sloping loam and silt loam that is moderately permeable. The root zone is thick and is easily penetrated by air, water, and roots. The available water capacity is high.

These soils are among the best in the country for farming. If adequately limed, fertilized, and otherwise well managed, they are suited to all commonly grown crops. The response to management is good.

These soils are suitable for moderately intensive use. They can be used for row crops as much as 50 percent of the time, but not for more than 2 years in succession. They should not be cultivated every year. They can be conserved and kept productive by means of a suitable cropping system, adequate fertilization, and good water management.

Contour cultivation is effective in controlling erosion. On long hillsides, the hazard of erosion can be reduced by terracing or contour stripcropping. Diversions protect areas that receive excess runoff from steep slopes. Natural draws provide excellent sites for sodded waterways.

CAPABILITY UNIT IIe-2

This unit consists of well drained, gently sloping loams and silt loams. Depth to sandstone or shale bedrock is 20 to 65 inches. The root zone is easily penetrated by air, roots, and water. The available water capacity is medium to high.

If adequately limed, fertilized, and otherwise well managed, these soils are productive of all crops suited to the climate. Crops respond extremely well to management. Some of the highest corn yields in the State have been obtained on the soils of this unit.

These soils are suitable for moderately intensive use. They can be used for row crops as much as 50 percent of the time, but not for more than 2 years in succession. They should not be cultivated every year. They can be conserved and kept productive by means of a suitable cropping system, adequate fertilization, and good water management. Since the natural fertility of these soils is extremely low, liming and fertilization are necessary for satisfactory yields of all crops.

Contour cultivation is effective in controlling erosion. On long hillsides the hazard of erosion can be reduced by terracing and stripcropping. Diversions protect areas that receive excess runoff from steep slopes. Natural draws provide excellent sites for sodded waterways.

CAPABLITY UNIT IIe-3

This unit consists of moderately well drained, nearly level to gently sloping silt loams. These soils have a fragipan at a depth of about 24 inches. Roots, air, and water penetrate easily as far down as the fragipan. During periods of heavy rainfall, the 4-to 6-inch surface layer just above the fragipan is waterlogged. During prolonged dry periods, the soils dry out and do not supply sufficient moisture for most crops.

These soils are easy to work. If fertilized and otherwise well managed, they are moderately well suited to all commonly grown crops. They are well suited to soybeans and small grain; to tall fescue, white clover, and annual lespedeza; and to sericea lespedeza for hay and pasture. Their suitability for corn and tobacco varies considerably from year to year, depending on the amount of rainfall. Tobacco should be grown only on areas that have enough slope to provide surface drainage. Alfalfa ordinarily does not last more than 2 or 3 years because of the fragipan and the seasonal wetness in the layer just above the fragipan. These limitations can be overcome in part by selecting plants that tolerate both excess water and drought.

A suitable cropping system, adequate fertilization, and good water management practices reduce runoff and help to control erosion. A short cropping system is best. Row crops can be grown as much as 50 percent of the time but for no more than 2 years in succession. If minimum tillage practices are used, row crops can be grown continuously. Contour cultivation, terraces, contour stripcropping, residue management, and winter cover crops are all effective in erosion control. Residue and winter cover crops also help preserve tilth. Diversion ditches and vegetated draws are effective in carrying excess runoff. Carefully controlled grazing prevents damage from trampling.

CAPABILITY UNIT IIs-1

The only soil in this unit is Welchland cobbly loam. This soil is deep, loamy, well drained, and nearly level to gently sloping. It is on the low terraces of creeks and in mountain coves. Many sandstone cobbles are on the surface and throughout the soil. These cobbles interfere with tillage and reduce the available water capacity to medium or low.

This soil is moderately suited to row crops, such as corn, soybeans, and tobacco. Unless rainfall is plentiful and well distributed, yields are greatly reduced in some years because of the limited available water capacity.

Even though yields are quite variable from year to year, row crops can be grown every year because there is little hazard of erosion. Small grain is well suited because it grows and matures when moisture is plentiful. This soil is well suited to pasture and hay except that the cobbles are a nuisance in preparing a seedbed and mowing. Tall fescue, common bermudagrass, midland bermudagrass, and lespedeza are suited.

Some of the lowest areas adjacent to creeks are susceptible to very brief periods of flooding. Damage from flooding and sedimentation can be reduced by straightening, clearing, and snagging the stream channels. Diversions are needed in some areas that are adjacent to steep mountainsides to protect the soil against runoff from these slopes.

CAPABILITY UNIT IIw-1

This unit consists of moderately well drained, nearly level silt loams and loams on first bottoms. Most areas of these soils are occasionaly flooded for very brief periods. Flooding occurs mostly in winter and early in spring. Planting dates are sometimes delayed because of excess moisture. The available water capacity is high. Response to management is good.

These soils are well suited to soybeans, grain sorghum, tall fescue, white clover, and lespedeza. They are well suited to supplemental summer pasture of plants such as the pearl millets or sudan-sorghum hybrids. Corn grows well, but planting may be delayed because of wetness. Small grain and soybeans can be grown in areas where surface drainage is good and where ponding or flooding is not severe.

These soils can be row cropped every year, because they are not subject to erosion. In many places a system of drainage ditches and diversion ditches improves surface and internal drainage of these soils. Plowing under large amounts of residue replenishes the supply of organic matter and preserves tilth.

CAPABILITY UNIT IIIe-1

This unit consists of deep, friable, well drained, sloping loam and silt loams on uplands and terraces. These soils are easily penetrated by air, water, and roots. The surface layer is easy to work. The available water capacity is high. Response to management is good.

If fertilized and otherwise well managed, these soils are suited to many crops, including corn, tobacco, small grain, lespedeza, white clover, alfalfa, orchardgrass, and tall fescue. They are well suited to most commercial nursery species.

Erosion control is the main concern. A suitable cropping system, adequate fertilization, and other good management techniques are needed.

A suitable cropping system is a row crop followed by a small grain, then pasture or hay for 2 or more years or a row crop followed by alfalfa for 4 years. These rotations work well in stripcropping systems. The use of no-tillage cropping systems allows these soils to be row cropped more often.

Vetch, crimson clover, or small grain are effective winter cover and green-manure crops because they replenish the supply of organic matter and protect the soils against erosion. Plowing under crop residue helps to control erosion and preserve tilth. Diversions, stripcropping, terracing, and contour cultivation also are effective in erosion control. In many places natural draws provide excellent sites for grassed waterways.

CAPABILITY UNIT IIIe-2

This unit consists of well drained, gently sloping and sloping loams and silt loams on uplands. These soils are moderately deep and deep. (Depth to sandstone or shale rock is 20 to 60 inches.) These soils are easily penetrated by air, water, and roots. The surface layer is easy to work. The available water capacity is medium to high. These soils have very low natural fertility. Response to fertilization and other good management is extremely good.

Some tracts are in large holdings that are used to produce forest products and to provide recreational sites.

If fertilized and otherwise well managed, these soils are suited to many crops, including corn, small grain, soybeans, tobacco, lespedeza, white clover, alfalfa, orchardgrass, and tall fescue.

A suitable cropping system is a row crop followed by a small grain followed by pasture or hay for 2 or more years or a row crop followed by alfalfa for 4 years. These rotations work well in strips.

Vetch, crimson clover, or small grain are effective winter cover and green-manure crops because they replenish the supply of organic matter and help protect the soil against erosion. Plowing under crop residue helps to control erosion and preserve tilth. Diversions, stripcropping, terracing and contour cultivation also are effective in erosion control. In many places natural draws provide excellent sites for sod waterways.

CAPABILITY UNIT IIIw-1

This unit consists of poorly drained silt loams in bottoms. Most of the areas are subject to short periods of flooding or ponding, and they stay wet until late in spring.

Wetness in these soils is caused by a high water table, seepage from adjacent slopes, and flooding. As a result, planting of crops is delayed from a few days to several weeks in spring. During summer the soils dry out and plant roots are able to penetrate the previously waterlogged soil. The roots grow too slowly, however, to benefit from the drying and are ordinarily limited to the upper 20 inches of the soil.

Grain sorghum, soybeans, and annual lespedeza are suited to these soils. Water-tolerant pasture plants such as tall fescue and white and alsike clover also are suited. The grazing season is limited to late in spring, throughout summer, and early in fall.

Improved drainage can expand the use of these soils. If these soils are adequately drained, corn, grain sorghum, soybeans, and other row crops can be grown every year. Harvest in the fall, however, is sometimes hindered by excessive wetness. When suitable outlets are available, a system of open ditches will remove surface water and lower the water table. Tile drains

are also effective. Tilling these soils within a narrow area of moisture content is important because it prevents hard clods from forming as the soil dries. Flooding along small drainageways can often be reduced by alining stream channels and by clearing, shaping, and establishing perennial plants on the streambanks.

These soils can be used continuously for crops, and erosion is not a serious concern. Adequate fertilization insures that fairly large amounts of crop residues are available for return to the soil so that good tilth is maintained.

CAPABILITY UNIT IIIw-2

The only soil in this unit is Taft silt loam. This soil is somewhat poorly drained and nearly level. It has a fragipan at a depth of about 2 feet. The fragipan is poorly aerated; it is slowly permeable to air and water, and it restricts the growth of roots. The upper part of the subsoil is friable silt loam. The fragipan is dense silt loam or silty clay loam.

This soil is easy to work, but it is saturated in winter and spring and in places is ponded for short periods. In summer and fall, it generally dries out and is somewhat droughty. The response to management is good.

Wetness is the main limitation to use of this soil for crops. It often delays tillage in spring and harvest in fall. It can be overcome by selecting water-tolerant crops and by using open ditches to remove surface water from pockets and low areas where suitable outlets are available. Tile drainage is generally not effective because of slow internal water movement.

Under natural drainage, crop failures are common. Under supplemental drainage, corn, grain sorghum, and soybeans are fairly well suited to this soil. Tall fescue, common bermudagrass, white clover, and annual lespedeza are suitable hay and pasture plants. Deep-rooted legumes, such as alfalfa, are poorly suited. The soil is easily damaged by overgrazing when it is dry and by trampling when it is wet.

Row crops can be grown every year because this soil is nearly level and is not likely to erode. Large amounts of fertilizer should be applied and stalks and stubble should be plowed under to replenish the supply of organic matter and to preserve tilth.

CAPABILITY UNIT IVe-1

This unit consists of deep, moderately deep, well drained soils that have a loamy surface layer and loamy or clayey subsoil. Slopes for most of the soils are 12 to 20 percent, but in places slopes are 5 to 20 percent.

These soils are deep or moderately deep to the root zone. Available water capacity is medium to high. These soils are easily penetrated by air, water, and roots. The surface layer is easy to work. In a few places the surface layer has a moderate amount of chert fragments, but this does not significantly hinder cultivation or other uses of the soil.

Crops respond well to additions of fertilizer and lime and to other management practices. Corn, tobacco, alfalfa, tall fescue, orchardgrass, red clover, white clover and lespedeza can be grown on these soils. The soils are well suited to improved pasture. They can be grazed whenever forage is available throughout the year, because they do not become wet and soft during the winter months.

Erosion control is the main management concern. Soil and water losses can be reduced by using a suitable cropping system, proper fertilization, and such good water-management practices as contour cultivation, stripcropping, and the use of diversions and grassed waterways.

A suitable cropping system is one that includes a row crop one-fourth of the time and grasses and legumes the rest of the time. Where these soils are used more intensively, soil loss and runoff are greatly reduced if a minimum tillage system is used with the residue from a close-growing crop provided for surface mulch. Natural draws, seeded or in sod, provide for the safe removal of runoff water.

CAPABILITY UNIT IVe-2

This unit consists of deep and moderately deep, well drained, sloping silt loams or cherty silt loams. These soils have a thin loamy surface layer and a clayey subsoil. Permeability is moderately slow. Available water capacity is medium. The thin, loamy surface layer is fairly easy to work, and the response to management is good.

These soils are moderately to poorly suited to corn, tobacco, and other row crops. Small grain is well suited, because ample moisture is available during its growing season. These soils should not be cultivated more than 1 year out of each 4- to 6-year period.

These soils will grow most grasses and legumes for hay and pasture. With good management, tall fescue, bermudagrass, white clover, annual lespedeza, and sericea lespedeza grow fairly well. Alfalfa can be grown, but good stands are somewhat difficult to establish and maintain. The results of analyses of soil tests should always be used to determine lime and fertilizer needs.

Water management practices are very important on these soils. Diversions, stripcropping, and contour cultivation are effective systems and practices for cultivated crops. Small grain or other winter annual crops should be planted after any row crop that is grown on these soils, because ground cover must be provided until perennial plants are reestablished.

Tillage operations should be performed within narrow areas of moisture conditions. Soil tilth can be improved by plowing cover crops under to return crop residue to the soil.

CAPABILITY UNIT IVw-1

The only soil in this unit is Guthrie silt loam. This nearly level or depressional soil is on uplands. It has a fragipan at a depth of about 30 inches that limits growth of roots and the movement of air and water. Surface runoff is slow, and in many places ponding is common. The soil is generally saturated in winter and spring and is dry during prolonged periods in summer and fall. The response to lime and fertilizer is generally good.

In most areas this soil is poorly suited to row crops.

If adequately drained, it is suited to soybeans or other summer annuals that can be planted late in spring and harvested early in fall. In places waterlogging delays or prevents harvesting and the use of heavy machinery.

This soil is well suited to water-tolerant permanent pasture. It is suited to tall fescue, reed canarygrass, white clover, and annual lespedeza. This soil is easily worked if it contains the proper amount of moisture. It is not subject to erosion. Where suitable outlets are available, excess water on the surface can be removed by open ditches. Subsurface (tile) drainage is usually ineffective.

CAPABILITY UNIT VIe-1

This unit consists of deep and moderately deep, well drained soils. Slopes range from sloping to steep, but most of these soils are moderately steep and steep. They have a loamy surface layer and a loamy and clayey subsoil. The available water capacity is medium to high. Except for the small proportion of areas where there are cobbles, the surface layer is easy to work and its response to management is good.

These soils are poorly suited to crops that require tillage because slopes are strong and erosion is a hazard or, in a few areas, cobbles are on the surface. They are well suited to permanent pasture and hay. Orchardgrass, tall fescue, common bermudagrass, white clover, red clover, and annual lespedeza are among the commonly grown grasses and legumes.

Controlling runoff to reduce erosion is the main management concern. Well fertilized grasses and legumes provide hay and pasture and reduce runoff and erosion, unless the areas are overgrazed or mowed too closely. Better protection against runoff and erosion is provided by planting a grass-legume mixture than by planting only legumes. Grazing is possible in winter because the soils do not become too wet or soft for extended periods.

These soils should be plowed only to reseed pasture or hay. Pasture or hay should be established or renovated in alternate contour strips to reduce erosion. Many areas revert to locust and other woody plants if brush and weed control measures are not used.

CAPABILITY UNIT VIe-2

This unit consists of deep and moderately deep, well drained soils. These soils have a thin, loamy surface layer and a clayey subsoil. Slopes range from sloping to steep, but these soils are dominantly moderately steep and steep. Some of the soils have a moderate amount of chert fragments in the surface layer. In a few areas there are outcrops of limestone. Available water capacity is medium to low. Permeability is moderately slow.

These soils are highly susceptible to erosion and consequently are poorly suited to crops that require tillage. Runoff is medium or rapid because of the strong slopes and the moderately slow permeability of the clayey subsoil. Selected crops, especially small grain, can be grown occasionally in some of the areas of less sloping soils, but special practices and very careful management is needed to control erosion.

These soils are suited to permanent pasture, hay, or trees. If fertilized and otherwise well managed, they are suited to tall fescue, common bermudagrass, bluegrass, white clover, and lespedeza. Growth is generally fast in spring but is slower in summer and fall because of lack of moisture.

Ordinarily, good seedbeds are difficult to prepare and good stands are difficult to establish and maintain, especially in the areas of more eroded soil. In a few places seedbeds are difficult to prepare because of limestone outcrops. Pasture and hay should be established or renovated in alternate contour strips to control erosion and to reduce the risk of heavy losses during adverse weather conditions. Grazing should be carefully controlled during dry periods.

CAPABILITY UNIT VIIe-1

This unit consists of dominantly steep soils. In a few places there are soils that are sloping to moderately steep. These are on the crest of ridges and on short hillsides where the depth to rock is less than 20 inches. Available water capacity is low to medium in soils of this unit. Few to many fragments of sandstone and shale are throughout the soils.

These soils are suited to trees, mainly loblolly pine, yellow-poplar, red oak, and white oak. Most areas provide good food and cover for wildlife. The few cleared areas generally need to be reforested. Facts about the use of these soils for growing trees can be found in the section "Woodland Management and Productivity."

CAPABILITY UNIT VIIs-1

This unit consists of dominantly steep, cherty, stony or rocky soils. Available water capacity is low to medium. In all areas the soils are too steep and too rocky or stony to cultivate.

These soils are mostly in forest. Cleared areas need to be reforested. Facts about use of these soils for growing trees can be found in the section "Woodland Management and Productivity."

CAPABILITY UNIT VIIs-2

Only the Udorthents-Mine pits complex is in this unit. It is made up of areas that have been strip mined for coal. These areas consist of a series of long, deep pits, some as much as 30 and more feet deep, and high uneven heaps of spoil material between the pits. The bottoms of the pits are on sandstone rock. In some of the pits, water is several feet deep throughout the year. The spoil material consists of a mixture of soil material and rock fragments. The fragments are shale, coal, and sandstone. They make up more than half of the material. The soil material is extremely acid and droughty.

Pine seedlings have been planted in some of the spoil area. Survival of these seedlings is low because of extreme acidity, stoniness, high surface temperatures in summer, heaving of seedlings, slippage of steep side slopes, and droughtiness. Researchers are continuing to find a way to reclaim this land and return it to a desirable use.

Estimated yields

Table 6 shows estimated yields per acre of principal crops grown on soils of these counties under two levels of management. The yields in columns A are those to be expected under prevailing, or common, management; those in columns B are yields to be expected under improved management. Under prevailing management, yields generally are 30 to 40 percent lower than those obtained under improved management.

The yields in columns B are based on test yields

TABLE 6.—*Estimated average yield per acre of principal crops under two levels of management*

[Yields in columns A are those obtained under common management; those in columns B are to be expected under a high level of management. Absence of yield indicates crop is not suited to the soil or is not commonly grown in it]

Soil series and mapping units	Corn		Tobacco		Wheat		Alfalfa		Soybeans		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Lbs*	*Lbs*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days*[1]	*Cow-acre-days*[1]
Allen:												
AeC	48	75	1,800	2,300	34	51	2.1	3.3	23	35	135	195
AeD	46	68	1,700	2,100	30	46	2.1	3.1			135	180
AeE											125	170
AnD3	32	50	1,450	1,600	24	36	1.7	2.4			90	150
Atkins: At	35	50							22	30	80	135
Bewleyville:												
BeB	58	92	2,100	2,400	36	54	2.3	3.4	27	40	115	195
BeC	55	85	1,950	2,250	34	52	2.2	3.3	21	36	115	195
Bodine: BdF											55	90
Bonair: Bn	42	68							20	33	105	180
Bouldin: BoF												
Christian:												
ChC2	42	60	1,650	1,850	32	47	2.0	2.9	17	21	120	165
ChD2	40	55	1,500	1,700	30	44	1.9	2.6			110	165
CnC2	40	56	1,600	1,750	32	44	2.0	2.5	16	20	125	165
CnD2	32	52	1,400	1,650	28	41	1.8	2.4			105	150
CnE2											95	135
CsD3					20	33	1.4	1.9			75	110
Curtistown: CuB	75	115	2,100	2,400	38	54	2.6	3.8	28	43	150	225
Decatur:												
DeB	56	82	1,850	2,100	38	54	2.7	4.0	23	32	150	195
DeC2	53	75	1,850	1,950	36	51	2.4	3.8	21	27	150	210
Dickson: DkB	52	78	1,650	1,850	38	52	1.6	2.1	24	34	110	180
Emory: Em	78	120	2,000	2,300	37	50	2.3	3.0	32	44	120	225
Etowah:												
EtB	72	110	2,100	2,400	38	54	2.3	3.5	26	42	140	225
EtC	65	90	2,000	2,300	36	53	2.2	3.4	24	37	140	210
EtD	58	82	1,750	1,950	35	50	2.0	3.2	20	32	125	195
EwC	52	82	1,900	2,100	34	49	2.1	3.0	22	32	115	195
EwD	48	70	1,850	1,950	31	45	2.0	2.8	19	27	110	180
EwE											105	180
Gilpin:												
GpD	42	65	1,700	1,900	30	45	2.0	3.0			120	180
GpE											105	165
Greendale: Gr	70	115	1,700	2,300	35	50	1.6	2.7	30	44	130	210
Guthrie: Gu	33	48							23	34	95	155
Hamblen: Ha	70	105			30	42	1.8	2.6	30	45	150	215
Hartsells:												
HsB	55	90	1,900	2,200	34	52	1.8	3.2	24	37	115	195
HsC	48	78	1,700	2,000	32	48	1.7	3.1	23	30	110	180

TABLE 6.—*Estimated average yield per acre of principal crops under two levels of management*—Continued

Soil series and mapping units	Corn		Tobacco		Wheat		Alfalfa		Soybeans		Pasture	
	A	B	A	B	A	B	A	B	A	B	A	B
	Bu	*Bu*	*Lbs*	*Lbs*	*Bu*	*Bu*	*Tons*	*Tons*	*Tons*	*Tons*	*Cow-acre-days*[1]	*Cow-acre-days*[1]
Jefferson:												
JfC	48	78	2,000	2,300	36	52	2.1	3.1	25	35	110	180
JfD	47	68	1,850	2,100	33	49	2.0	2.9	19	27	100	165
JfE											90	150
Lonewood:												
LoB	58	90	1,950	2,300	37	53	2.0	3.3	28	40	120	210
LoC	53	82	1,850	2,200	35	51	2.0	3.2	26	36	115	200
LwC	53	82	1,850	2,200	35	51	2.0	3.2	26	36	115	200
Melvin: Me	35	55							23	32	110	165
Minvale:												
MnC	48	72	1,800	2,000	34	48	2.0	3.0	22	28	110	190
MnD	44	64	1,650	1,800	33	46	2.0	2.9	18	24	105	180
Mountview:												
MoB	54	88	2,100	2,400	37	54	2.0	3.3	28	40	125	210
MoC	52	80	2,000	2,250	35	50	2.0	3.2	26	36	120	195
Nella:												
NeD	42	56	1,750	1,900	26	35	1.9	2.4			90	150
NeE											80	140
Ramsey:												
RaD											55	90
RaE											35	60
RcD											35	60
RcE												
Rock outcrop: RoF												
Sequatchie: Sa	75	110	2,000	2,300	38	54	1.9	3.1	30	42	120	210
Sewanee: Se	50	75			26	38	1.6	2.4	27	38	115	200
Staser: Ss	75	120	2,000	2,200	34	48	2.0	2.9	32	46	130	225
Taft: Ta	42	60			22	28			24	34	105	175
Talbott:												
TbC2	38	48	1,300	1,500	30	44	1.9	2.6			90	135
TcD											50	70
TcE												
TrD											40	60
TrF												
Tilsit: TtB	50	78	1,550	1,700	34	50	1.5	2.0	24	33	100	165
Udorthents: Um												
Waynesboro:												
WaB	58	84	2,000	2,300	40	54	2.2	3.5	24	33	120	195
WaC	54	78	1,900	2,150	40	52	2.1	3.5	22	29	110	180
WaD	47	72	1,750	1,950	37	50	2.0	3.2	20	24	100	165
WaE2											95	150
WbC3	40	58	1,450	1,600	29	42	1.9	2.7	14	19	100	160
WbD3					25	37	1.5	2.5			95	140
Welchland: We	47	70	1,350	1,600	32	44	1.4	2.0	12	16	100	165

[1]Cow-acre-days is a term used to express the carrying capacity of pasture. It is the number of animal units (one cow, one steer, one horse, one mule, five sheep, or seven hogs) carried per acre multiplied by the number of days the pasture is grazed during a single grazing season without injury to the sod. For example, an acre of pasture that provides 30 days of grazing for two cows has a carrying capacity of 60 cow-acre-days.

taken from farms in a cooperative study of soil productivity and management and on the knowledge of agronomists and soil scientists who have had experience with crops and soils in White and Van Buren Counties. They are averages of long-term yields where irrigation is not used.

The yields from the tests were adjusted to reflect the combined effects of slope, weather, and level of management. Where yields from tests were not available, yields were estimated from tests on similar soils. The hazard of overflow for soils on bottom land was disregarded in making yield estimates, because the effects of flooding must be considered locally by those familiar with the characteristics of the various streams.

To obtain the yields in columns B, the farmer fertilizes and limes each crop according to needs indicated by soil tests and by past cropping and fertilization; selects adapted, high-yielding varieties of crops; prepares the seedbed adequately; plants or seeds by suitable methods at the appropriate time and rate; inoculates legumes; uses shallow cultivation if row crops are grown; controls weeds, insects, and diseases; uses a cropping system suggested in the section "Management by Capability Units," or a similar cropping system; and conserves soil and water by establishing waterways, cultivating on the contour, terracing or contour stripcropping, and protecting pasture from overgrazing.

Specific up-to-date information on rates of seeding or planting and fertilizing that are required to obtain the yields in columns B can be obtained from the local offices of the Agricultural Extension Service or Soil Conservation District.

Woodland Management and Productivity[4]

Originally, White and Van Buren Counties were mainly wooded. Now, trees cover about 6- percent of these counties (*7*).

Good stands of commercial trees are provided in the woodlands of these counties. Needle-leaved tree species occur most frequently on the ridges, eroded areas, rocky areas, and on the Cumberland Plateau. Broad-leaved trees generally predominate in the coves, toe slopes, and on the bottoms along the rivers and creeks.

The value of the wood products is substantial, though it is considerably below its potential. Other values include wildlife, recreation, natural beauty, and conservation of soil and water.

Table 7 contains information useful to woodland owners or managers planning use of soils for wood crops. Mapping unit symbols for those soils suitable for wood crops are listed alphabetically by soil name, and the ordination symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the symbol, an Arabic numeral, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a lowercase letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates no significant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the order in which the letters are listed above—x, w, o, d, c, f, and r.

In table 7 the soils are also rated for a number of factors to be considered in management. The ratings of slight, moderate, and severe are used to indicate the degree of major soil limitations.

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

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

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

Considered in the ratings of windthrow hazard are characteristics of the soil that affect the development of tree roots and the ability of soil to hold trees firmly. A rating of *slight* indicates that trees in wooded areas are not expected to be blown down by commonly occurring winds; a rating of *moderate*, that some trees are blown down during periods of excessive soil wetness and strong winds; and a rating of *severe*, that many trees are blown down during periods of excessive soil wetness and moderate or strong winds.

Ratings of plant competition indicate the degree of which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from

[4] CHARLES M. HENNINGER, woodland conservationist, Soil Conservation Service, assisted in the preparation of this section.

TABLE 7.—*Woodland management and productivity*

[Absence of an entry in a column means the information was not available]

Soil name and mapping unit	Ordination symbol	Management concerns					Potential productivity		
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	Trees to plant
Allen:									
AeC, AeD	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar	90	Yellow-poplar, black walnut, shortleaf pine, white pine, loblolly pine.
							Southern red oak	70	
							Shortleaf pine	70	
AeE	3r	Moderate	Moderate	Slight	Slight	Moderate	White pine	80	
							Loblolly pine	80	
AnD3	4c	Moderate	Severe	Severe	Slight	Slight	Southern red oak	60	Loblolly pine, Virginia pine, white pine.
							Shortleaf pine	60	
							Virginia pine	60	
							White pine	70	
							Loblolly pine	70	
Atkins: At	2w	Slight	Severe	Severe	Slight	Severe	Loblolly pine	90	Loblolly pine, sweetgum.
							Sweetgum	90	
							Southern red oak	80	
							Red maple		
							Sycamore		
Bewleyville: BeB, BeC	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar	95	Yellow-poplar, black walnut, shortleaf pine, loblolly pine.
							Southern red oak	70	
							Shortleaf pine	70	
							Eastern redcedar	55	
							Loblolly pine	80	
Bodine: BdF	4f	Moderate	Severe	Moderate	Slight	Slight	Virginia pine	60	Virginia pine, shortleaf pine, eastern redcedar.
							Shortleaf pine	60	
							Chestnut oak	55	
							Scarlet oak	55	
							Eastern redcedar	40	
Bonair: Bn	2w	Slight	Severe	Severe	Slight	Severe	Southern red oak	80	Loblolly pine, sweetgum.
							Sweetgum	90	
							Loblolly pine	90	
							Red maple		
Bouldin: BoF	3x	Moderate	Severe	Slight	Slight	Moderate	Yellow-poplar	90	Too stony to plant.
							Northern red oak	70	
							White oak	70	Manage by natural regeneration.
							Shortleaf pine	70	
							White pine	80	
Christian:									
ChC2, ChD2	3o	Slight	Slight	Slight	Slight	Moderate	Shortleaf pine	70	Loblolly pine, shortleaf pine, Virginia pine, white pine.
							Southern red oak	70	
CnC2, CnD2, CnE2	3r	Slight	Moderate	Slight	Slight	Moderate	Virginia pine	70	
							White pine	80	
							Loblolly pine	80	
CsD3	4c	Slight	Severe	Severe	Slight	Slight	Shortleaf pine	60	Loblolly pine, Virginia pine, white pine.
							Virginia pine	60	
							Loblolly pine	70	

Curtistown: CuB	2o	Slight	Slight	Slight	Slight	Severe	Yellow-poplar Northern red oak White pine Shortleaf pine Loblolly pine	100 80 90 80 90	Yellow-poplar, black walnut, loblolly pine, white pine.
Decatur: DeB, DeC2	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar Shortleaf pine White pine Southern red oak Loblolly pine	90 70 80 70 80	Yellow-poplar, black walnut, loblolly pine, white pine.
Dickson: DkB	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar Shortleaf pine Southern red oak White oak Loblolly pine	90 70 70 70 80	Yellow-poplar, shortleaf pine, loblolly pine.
Emory: Em	2o	Slight	Slight	Slight	Slight	Severe	Yellow-poplar Northern red oak Sweetgum Loblolly pine Black walnut	100 80 90 90 ---	Yellow-poplar, black walnut, loblolly pine.
Etowah:									
EtB, EtC, EtD, EwC, EwD	2o	Slight	Slight	Slight	Slight	Severe	Yellow-poplar Northern red oak Loblolly pine Shortleaf pine Black walnut White ash	100 80 90 80 --- ---	Yellow-poplar, black walnut, loblolly pine.
EwE	2r	Moderate	Moderate	Slight	Slight	Severe			
Gilpin:									
GpD	3o	Slight	Slight	Slight	Slight	Moderate	Shortleaf pine Virginia pine White pine Southern red oak Loblolly pine	70 70 80 70 80	Shortleaf pine, Virginia pine, white pine, loblolly pine.
GpE	3r	Moderate	Moderate	Slight	Slight	Moderate			
Greendale: Gr	2o	Slight	Slight	Slight	Slight	Severe	Yellow-poplar Southern red oak Sweetgum Loblolly pine Black walnut	100 80 90 90 ---	Yellow-poplar, black walnut, loblolly pine.
Guthrie: Gu	2w	Slight	Severe	Severe	Slight	Severe	Willow oak White oak Sweetgum Loblolly pine Yellow-poplar	90 80 90 90 100	Sweetgum, loblolly pine.
Hamblen: Ha	2w	Slight	Moderate	Slight	Slight	Severe	Yellow-poplar White oak Sweetgum Loblolly pine	100 80 90 90	Yellow-poplar, loblolly pine.
Hartsells: HsB, HsC	4o	Slight	Slight	Slight	Slight	Slight	Shortleaf pine Virginia pine Black oak White pine Loblolly pine	60 60 60 70 70	Loblolly pine, shortleaf pine, Virginia pine, white pine.
Jefferson:									
JfC, JfD	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar Shortleaf pine Southern red oak Virginia pine Loblolly pine	90 70 70 70 80	Yellow-poplar, black walnut, loblolly pine, white pine, shortleaf pine.
JfE	3r	Moderate	Moderate	Slight	Slight	Moderate			

TABLE 7.—*Woodland management and productivity*—Continued

Soil name and mapping unit	Ordination symbol	Management concerns					Potential productivity		
		Erosion hazard	Equipment limitation	Seedling mortality	Windthrow hazard	Plant competition	Important trees	Site index	Trees to plant
Lonewood: LoB, LoC, LwC	3o	Slight	Slight	Slight	Slight	Moderate	Shortleaf pine Virginia pine Southern red oak Loblolly pine White pine	70 70 70 80 80	Shortleaf pine, white pine, loblolly pine, Virginia pine.
Melvin: Me	2w	Slight	Severe	Severe	Slight	Severe	Yellow-poplar Water oak Sweetgum Loblolly pine Cottonwood	90 90 90 90 100	Loblolly pine, sweetgum, cottonwood.
Minvale: MnC, MnD	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar Southern red oak Shortleaf pine Virginia pine Loblolly pine	90 70 70 70 80	Yellow-poplar, black walnut, shortleaf pine, loblolly pine.
Mountview: MoB, MoC	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar Southern red oak Shortleaf pine Virginia pine Loblolly pine	90 70 70 70 80	Shortleaf pine, loblolly pine, Virginia pine.
Nella: NeD, NeE	3x	Moderate	Moderate	Slight	Slight	Moderate	Yellow-poplar Southern red oak Shortleaf pine White pine Loblolly pine	90 70 70 80 80	Yellow-poplar, black walnut, shortleaf pine, white pine, loblolly pine.
Ramsey: RaD, RaE	4d	Moderate	Moderate	Moderate	Moderate	Slight	Shortleaf pine Black oak Virginia pine White pine Loblolly pine	60 60 60 70 70	Shortleaf pine, Virginia pine, white pine, loblolly pine.
RcD, RcE	5x	Moderate	Severe	Moderate	Moderate	Slight	Shortleaf pine Black oak Virginia pine White pine Loblolly pine	50 50 50 60 60	Shortleaf pine, Virginia pine, white pine, loblolly pine.
Rock outcrop: RoF	5x	Moderate	Severe	Moderate	Moderate	Slight	Shortleaf pine Virginia pine Chestnut oak Scarlet oak	50 50 50 50	Shortleaf pine, Virginia pine, loblolly pine.
Sequatchie: Sa	2o	Slight	Slight	Slight	Slight	Severe	Yellow-poplar Shortleaf pine White pine Loblolly pine	100 80 90 90	Yellow-poplar, white pine, loblolly pine
Sewanee: Se	2w	Slight	Moderate	Slight	Slight	Severe	Yellow-poplar Southern red oak Shortleaf pine Sweetgum Loblolly pine	100 80 80 90 90	Yellow-poplar, cottonwood, white pine, loblolly pine.

Staser: Ss	2o	Slight	Slight	Slight	Slight	Severe	Yellow-poplar Northern red oak White pine Loblolly pine Black walnut	100 80 90 90	Yellow-poplar, black walnut white pine, loblolly pine.
Taft: Ta	3w	Slight	Moderate	Moderate	Slight	Moderate	Yellow-poplar Southern red oak Sweetgum Shortleaf pine Loblolly pine	90 70 80 70 85	Loblolly pine.
Talbott: TbC2	3c	Slight	Slight	Moderate	Slight	Moderate	Southern red oak Shortleaf pine Virginia pine Loblolly pine Eastern redcedar	65 65 70 80 45	Loblolly pine, Virginia pine, eastern redcedar.
TcD, TcE	4x	Slight	Severe	Severe	Moderate	Slight	Southern red oak Shortleaf pine Virginia pine Loblolly pine Eastern redcedar	60 60 60 70 35	Loblolly pine, Virginia pine, eastern redcedar.
TrD, TrF	5x	Moderate	Severe	Severe	Moderate	Slight	Shortleaf pine Virginia pine Eastern redcedar Black oak Loblolly pine	50 50 35 50 60	Loblolly pine, Virginia pine, eastern redcedar.
Tilsit: TtB	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar Southern red oak Shortleaf pine Virginia pine Loblolly pine	90 70 70 70 80	Shortleaf pine, Virginia pine, loblolly pine, white pine.
Udorthents: Um	5x	Severe	Severe	Severe	Moderate	Slight	Virginia pine Shortleaf pine		Virginia pine, black locust, loblolly pine.
Waynesboro: WaB, WaC, WaD	3o	Slight	Slight	Slight	Slight	Moderate	Yellow-poplar Southern red oak Shortleaf pine Loblolly pine White pine	90 70 70 80 80	Yellow-poplar, black walnut, white pine, loblolly pine, shortleaf pine.
WaE2	3r	Moderate	Moderate	Slight	Slight	Moderate			
WbC3, WbD3	4c	Moderate	Severe	Moderate	Slight	Slight	Southern red oak Shortleaf pine Virginia pine White pine Loblolly pine	60 60 60 70 70	Loblolly pine, Virginia pine.
Welchland: We	3x	Slight	Moderate	Moderate	Slight	Moderate	Yellow-poplar Southern red oak Shortleaf pine White pine Loblolly pine	90 70 70 80 80	Loblolly pine, shortleaf pine, white pine.

other plants; a rating of *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; and a rating of *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The potential productivity of merchantable trees on a soil is expressed as a site index. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands.

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

Wildlife Habitat[5]

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the development of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, inadequate, or inaccessible, wildlife will either be scarce or will not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by properly managing the existing plant cover, and by fostering the natural establishment of desirable plants.

In table 8 the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in—

1. Planning the use of parks, wildlife refuges, nature study areas, and other developments for wildlife.
2. Selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat.
3. Determining the intensity of management needed for each element of the habitat.
4. Determining areas that are suitable for acquisition to manage for wildlife.

The potential of the soil is rated *good, fair, poor,* or *very poor.* A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention are required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. Examples are corn, sorghum, wheat, oats, barley, millet, buckwheat, cowpeas, soybeans, and sunflowers. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

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

Wild herbaceous plants are native or naturally established herbaceous grasses and forbs, including weeds, that provide food and cover for wildlife. Examples are bluestem, indiangrass, goldenrod, beggarweed, pokeweed, partridgepea, fescue, and gramas. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, persimmon, sassafras, sumac, hickory, hazelnut, black walnut, blackberry, grape, blackhaw, viburnum, blueberry, bayberry, and briers. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated good are Russian-olive, autum-olive, and crabapple. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness.

Coniferous plants are cone-bearing trees, shrubs or ground cover that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Examples are pine, spruce, hemlock, fir, yew, cedar, and juniper. Major soil properties that affect the growth of coniferous plants are depth of the root zone, available water capacity, and wetness.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, ex-

[5] WILLIAM J. MELVIN, biologist, Soil Conservation Service, assisted in preparing this section.

clusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Examples of wetland plants are smartweed, wild millet, rushes, sedges, reeds, cordgrass, and cattail. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, slope, and surface stoniness.

Shallow water areas are bodies of surface water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control devices in marshes or streams. Examples are muskrat marshes, waterfowl feeding areas, wildlife watering developments, beaver and other wildlife ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Open land habitat consists of croplands, pastures, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The kinds of wildlife attracted to these areas include bobwhite quail, pheasant, meadowlark, field sparrow, killdeer, cottontail rabbit, red fox, and woodchuck.

Woodland habitat consists of hardwood or conifers or a mixture of both, with associated grasses, legumes, and wild herbaceous plants. Example of wildlife attracted to this habitat are wild turkey, ruffed grouse, woodcock, thrushes, vireos, woodpeckers, tree squirrels, gray fox, raccoon, deer, elk, and black bear.

Wetland habitat consists of water-tolerant plants in open, marsh, or swampy shallow water areas. Examples of wildlife attracted to this habitat are ducks, geese, heron, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Engineering[6]

This section provides information about the use of soils for building sites, sanitary facilities, construction materials, and water management. Among those who can benefit from this section are engineers, landowners, community decision makers and planners, town and city managers, land developers, builders, contractors, farmers, and ranchers.

The ratings in tables in this section are based on test data and estimated data in the "Soil Properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by the soil survey and used in determining the ratings in this section are grain-size distribution, liquid limit, plasticity index, soil reaction, depth to and hardness of bedrock within 5 to 6 feet of the surface, soil wetness characteristics, depth to a seasonal water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

Based on the information assembled about soil properties, ranges of values may be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values may be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering work. The ranges of values can be used to select potential residential, commercial, industrial, and recreational areas; make preliminary estimates pertinent to construction in a particular area; evaluate alternate routes for roads, streets, highways, pipelines, and underground cables; evaluate alternate sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; plan detailed onsite investigations of soils and geology; find sources of gravel, sand, clay, and topsoil; plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 to 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations and testing.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, ratings of the degree and kind of limitations for building site development; table 10 presents similar information for sanitary facilities. The suitability of the soils as a source of construction materials is presented in table 11, and characteristics and limitations of the soils that affect water management are presented in table 12.

The information in the tables, along with the soil

[6] BOBBY G. MOORE, civil engineer, SCS, assisted in the preparation of this section.

TABLE 8.—*Wildlife habitat potentials*

Soil name and map symbol	Potentials for habitat elements—							Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Open land wildlife	Woodland wildlife	Wetland wildlife
Allen:										
AeC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
AeD	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
AeE, AnD3	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Atkins: At	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Good.
Bewleyville:										
BeB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
BeC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Bodine: BdF	Very poor	Poor	Fair	Fair	Fair	Very poor	Very poor	Poor	Fair	Very poor.
Bonair: Bn	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Fair	Fair.
Bouldin: BoF	Very poor	Very poor	Fair	Good	Good	Very poor	Very poor	Poor	Fair	Very poor.
Christian:										
ChC2, CnC2	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
ChD2, CnD2	Poor	Good	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
CnE2, CsD3	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
Curtistown: CuB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
Decatur:										
DeB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
DeC2	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Dickson: DkB	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Emory: Em	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Etowah:										
EtB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
EtC, EwC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
EtD, EwD	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
EwE	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Gilpin:										
GpD	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
GpE	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Greendale: Gr	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Guthrie: Gu	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Hamblen: Ha	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Hartsells:										
HsB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
HsC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Jefferson:										
JfC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
JfD	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
JfE	Very poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.

Lonewood:										
LoB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
LoC, LwC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Melvin: Me	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
Minvale:										
MnC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
MnD	Fair	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Mountview:										
MoB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
MoC	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
Nella:										
NeD	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
NeE	Poor	Poor	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Ramsey:										
RaD	Poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor.
RaE, RcD, RcE, RoF	Very poor	Poor	Fair	Poor	Poor	Very poor	Very poor	Poor	Poor	Very poor.
Sequatchie: Sa	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Sawanee: Se	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Staser: Ss	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Taft: Ta	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
Talbott:										
TbC2	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
TcD, TcE, TrD, TrF	Very poor	Poor	Good	Good	Good	Very poor	Very poor	Poor	Good	Very poor.
Tilsit: TtB	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Udorthents: Um	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Waynesboro:										
WaB	Good	Good	Good	Good	Good	Poor	Very poor	Good	Good	Very poor.
WaC, WaD, WbC3	Fair	Good	Good	Good	Good	Very poor	Very poor	Good	Good	Very poor.
WaE2, WbD3	Poor	Fair	Good	Good	Good	Very poor	Very poor	Fair	Good	Very poor.
Welchland: We	Fair	Fair	Good	Good	Good	Poor	Very poor	Fair	Good	Very poor.

TABLE 9.—*Building site development*

["Shrink-swell" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbols	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Allen:					
AeC	Slight	Slight	Slight	Moderate: slope	Slight.
AeD, AnD3	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
AeE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Atkins: At	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.
Bewleyville:					
BeB	Slight	Slight	Slight	Slight	Moderate: low strength.
BeC	Slight	Slight	Slight	Moderate: slope	Moderate: low strength.
Bodine: BdF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Bonair: Bn	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Bouldin: BoF	Severe: slope; large stones.	Severe: slope; large stones.	Severe: slope; large stones.	Severe: slope; large stones.	Severe: slope; large stones.
Christian:					
ChC2, CnC2	Severe: too clayey	Moderate: low strength.	Moderate: low strength.	Moderate: slope; low strength.	Moderate: low strength.
ChD2, CnD2, CsD3	Severe: too clayey	Moderate: slope; low strength.	Moderate: slope; low strength.	Severe: slope	Moderate: low strength; slope.
CnE2	Severe: too clayey; slope.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Curtistown: CuB	Slight	Slight	Slight	Slight	Moderate: low strength.
Decatur: DeB, DeC2	Moderate: too clayey.	Slight	Slight	Moderate: low strength; slope.	Moderate: low strength; slope.
Dickson: DkB	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness; low strength.	Moderate: low strength.
Emory: Em	Slight; severe if flooding occurs.	Moderate: low strength; severe if flooding occurs.	Moderate: low strength; severe if flooding occurs.	Moderate: low strength; severe if flooding occurs.	Moderate: low strength; severe if flooding occurs.
Etowah:					
EtB	Slight	Slight	Slight	Slight	Slight.
EtC, EwC	Slight	Slight	Slight	Moderate: slope	Slight.
EtD, EwD	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
EwE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Gilpin:					
GpD	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: slope	Moderate: slope.
GpE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Greendale: Gr	Slight; severe if flooding occurs.	Slight; severe if flooding occurs.	Slight; severe if flooding occurs.	Slight; severe if flooding occurs.	Moderate: low strength; severe if flooding occurs.
Guthrie: Gu	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Hamblen: Ha	Severe: wetness; floods.	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Hartsells: HsB, HsC	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Jefferson:					
JfC	Slight	Slight	Moderate: depth to rock.	Moderate: slope	Slight.
JfD	Moderate: slope	Moderate: slope	Moderate: slope; depth to rock.	Severe: slope	Moderate: slope.
JfE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.

TABLE 9.—*Building site development*—Continued

Soil name and map symbols	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Lonewood:					
LoB	Slight	Slight	Moderate: depth to rock.	Slight	Moderate: low strength.
LoC, LwC	Slight	Slight	Moderate: depth to rock.	Moderate: slope	Moderate: low strength.
Melvin: Me	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.
Minvale:					
MnC	Slight	Slight	Slight	Moderate: slope	Moderate: low strength.
MnD	Moderate: slope	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope; low strength.
Mountview:					
MoB	Slight	Slight	Slight	Slight	Moderate: low strength.
MoC	Slight	Slight	Slight	Moderate: slope	Moderate: low strength.
Nella:					
NeD	Moderate: slope; small stones.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
NeE	Severe: slope; small stones.	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Ramsey: RaD, RaE, RcD, RcE, RoF.	Severe: slope; depth to rock.	Severe: slope; depth to rock.	Severe: slope; depth to rock.	Severe: slope; depth to rock.	Severe: slope; depth to rock.
Sequatchie: Sa	Slight; severe if flooding occurs.	Slight; severe if flooding occurs.	Slight; severe if flooding occurs.	Slight; severe if flooding occurs.	Slight; severe if flooding occurs.
Sewanee: Se	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Staser: Ss	Moderate: floods	Severe: floods	Severe: floods	Severe: floods	Severe: floods.
Taft: Ta	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Talbott:					
TbC2	Severe: too clayey; depth to rock.	Moderate: shrink-swell; depth to rock.	Severe: depth to rock.	Moderate: slope; shrink-swell; depth to rock.	Severe: low strength.
TcD, TcE, TrD, TrF	Severe: too clayey; depth to rock; slope.	Severe: slope	Severe: slope; depth to rock.	Severe: slope	Severe: low strength.
Tilsit: TtB	Moderate: wetness	Moderate: wetness	Severe: wetness	Moderate: wetness; low strength.	Moderate: low strength.
Udorthents: Um.					
Waynesboro:					
WaB	Moderate: too clayey.	Slight	Slight	Slight	Moderate: low strength.
WaC, WbC3	Moderate: too clayey.	Slight	Slight	Moderate: slope	Moderate: low strength.
WaD, WbD3	Moderate: slope; too clayey.	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope; low strength.
WaE2	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Welchland: We	Moderate: small stones; severe if flooding occurs.	Moderate: small stones; severe if flooding occurs.	Moderate: small stones; severe if flooding occurs.	Moderate: small stones; severe if flooding occurs.	Slight; severe if flooding occurs.

map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used by scientists may differ somewhat in meaning from similar terms used by engineers. The Glossary at the back of this survey defines many of these special terms.

TABLE 10.—*Sanitary facilities*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbols	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Allen:					
AeC	Slight	Severe: slope	Slight	Slight	Good.
AeD, AnD3	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Fair: slope.
AeE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Atkins: At	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Poor: wetness.
Bewleyville:					
BeB	Slight	Moderate: seepage; slope.	Slight	Slight	Good.
BeC	Slight	Severe: slope	Slight	Slight	Good.
Bodine: BdF	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Bonair: Bn	Severe: floods	Severe: floods; wetness.	Severe: floods	Severe: floods	Poor: floods.
Bouldin: BoF	Severe: slope; large stones.	Severe: slope; large stones.	Severe: slope; large stones.	Severe: slope; large stones.	Poor: slope; large stones.
Christian:					
ChC2, CnC2	Severe: percs slowly	Severe: slope	Severe: too clayey	Slight	Fair: too clayey.
ChD2, CnD2, CsD3	Severe: percs slowly	Severe: slope	Severe: too clayey	Moderate: slope	Fair: slope; too clayey.
CnE2	Severe: percs slowly; slope.	Severe: slope	Severe: too clayey	Severe: slope	Poor: slope.
Curtistown: CuB	Slight	Moderate: slope; seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
Decatur:					
DeB	Slight	Moderate: seepage; slope.	Severe: too clayey	Slight	Poor: thin layer; too clayey.
DeC2	Slight	Severe: slope	Severe: too clayey	Moderate: slope	Poor: thin layer; too clayey.
Dickson: DkB	Severe: percs slowly	Slight	Moderate: wetness	Moderate: wetness	Good.
Emory: Em	Slight; severe if flooding occurs.	Moderate: seepage	Severe: wetness; floods.	Slight; severe if flooding occurs.	Good.
Etowah:					
EtB	Slight	Moderate: slope; seepage.	Slight	Slight	Fair: too clayey.
EtC, EwC	Slight	Severe: slope; seepage.	Slight	Slight	Fair: too clayey.
EtD, EwD	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Fair: too clayey.
EwE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Gilpin:					
GpD	Severe: depth to rock.	Severe: slope	Severe: depth to rock.	Moderate: slope	Fair: thin layer.
GpE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Greendale: Gr	Slight; severe if flooding occurs.	Moderate: seepage	Severe: wetness; seepage.	Slight; severe if flooding occurs.	Good.
Guthrie: Gu	Severe: percs slowly; wetness.	Slight	Severe: wetness	Severe: wetness	Poor: wetness.
Hamblen: Ha	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Severe: wetness; floods.	Good.
Hartsells: HsB, HsC	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.
Jefferson:					
JfC	Slight	Severe: slope; seepage.	Moderate: depth to rock.	Slight	Good.
JfD	Moderate: slope	Severe: slope; seepage.	Moderate: slope	Moderate: slope	Fair: slope.
JfE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.

TABLE 10.—*Sanitary facilities*—Continued

Soil name and map symbols	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Lonewood:					
LoB	Moderate: depth to rock.	Moderate: depth to rock; slope.	Moderate: depth to rock.	Slight	Good.
LoC, LwC	Moderate: depth to rock.	Severe: slope	Moderate: depth to rock.	Slight	Good: slope.
Melvin: Me	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Severe: floods; wetness.	Poor: wetness.
Minvale:					
MnC	Slight	Severe: slope; seepage.	Slight	Slight	Good.
MnD	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Fair: slope.
Mountview:					
MoB	Slight	Moderate: slope	Slight	Slight	Good.
MoC	Slight	Severe: slope	Slight	Slight	Good.
Nella:					
NeD	Moderate: slope	Severe: slope	Moderate: slope	Moderate: slope	Fair: slope.
NeE	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Ramsey: RaD, RaE, RcD, RcE, RoF.	Severe: depth to rock; slope.	Severe: depth to rock; slope.	Severe: slope; depth to rock.	Severe: slope	Poor: slope; thin layer; rock outcrops.
Sequatchie: Sa	Slight; severe if flooding occurs.	Severe: seepage	Moderate: seepage	Moderate: seepage	Good.
Sewanee: Se	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Poor: floods.
Staser: Ss	Severe: floods	Severe: floods	Severe: floods	Severe: floods	Good.
Taft: Ta	Severe: percs slowly; wetness.	Slight	Severe: wetness	Severe: wetness	Poor: wetness.
Talbott:					
TbC2	Severe: percs slowly; depth to rock.	Severe: slope; depth to rock.	Severe: depth to rock; too clayey.	Moderate: slope	Poor: too clayey.
TcD, TcE, TrD, TrF	Severe: percs slowly; slope; depth to rock.	Severe: slope; depth to rock.	Severe: depth to rock.	Severe: slope	Poor: too clayey; slope.
Tilsit: TtB	Severe: percs slowly	Slight	Moderate: wetness	Moderate: wetness	Good.
Udorthents: Um.					
Waynesboro:					
WaB	Slight	Moderate: slope	Moderate: too clayey.	Slight	Fair: too clayey.
WaC, WbC3	Slight	Severe: slope	Moderate: too clayey.	Slight	Fair: too clayey.
WaD, WbD3	Moderate: slope	Severe: slope	Moderate: too clayey.	Moderate: slope	Fair: too clayey; slope.
WaE2	Severe: slope	Severe: slope	Severe: slope	Severe: slope	Poor: slope.
Welchland: We	Slight; severe if flooding occurs.	Severe: seepage	Severe: seepage; small stones.	Severe: seepage	Fair: small stones.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, base-

TABLE 11.—*Construction materials*

["Area reclaim" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Allen:				
AeC	Good	Unsuited	Unsuited	Fair: slope.
AeD, AnD3	Fair: slope	Unsuited	Unsuited	Poor: slope.
AeE	Poor: slope	Unsuited	Unsuited	Poor: slope.
Atkins: At	Poor: wetness	Unsuited	Unsuited	Poor: wetness.
Bewleyville: BeB, BeC	Fair: low strength	Unsuited	Unsuited	Good.
Bodine: BdF	Fair: slope	Unsuited	Fair: excess fines	Poor: small stones.
Bonair: Bn	Poor: wetness	Unsuited	Unsuited	Poor: wetness.
Bouldin: BoF	Poor: large stones; slope	Unsuited	Unsuited	Poor: large stones; slope.
Christian: ChC2, ChD2, CnC2, CnD2, CnE2, CsD3.	Poor: low strength	Unsuited	Unsuited	Poor: too clayey.
Curtistown: CuB	Fair: low strength	Unsuited	Unsuited	Good.
Decatur: DeB, DeC2	Fair: low strength	Unsuited	Unsuited	Fair: too clayey; area reclaim.
Dickson: DkB	Fair: low strength	Unsuited	Unsuited	Fair: area reclaim.
Emory: Em	Fair: low strength	Unsuited	Unsuited	Good.
Etowah:				
EtB, EtC, EwC	Fair: low strength	Unsuited	Unsuited	Good.
EtD, EwD	Fair: slope; low strength	Unsuited	Unsuited	Fair: slope.
EwE	Poor: slope; low strength	Unsuited	Unsuited	Poor: slope.
Gilpin: GpD, GpE	Poor: thin layer; slope	Unsuited	Unsuited	Poor: thin layer; slope.
Greendale: Gr	Fair: low strength	Unsuited	Unsuited	Good.
Guthrie: Gu	Poor: wetness	Unsuited	Unsuited	Poor: wetness.
Hamblen: Ha	Fair: low strength	Unsuited	Unsuited	Good.
Hartsells: HsB, HsC	Poor: area reclaim	Poor: excess fines.	Unsuited	Poor: area reclaim.
Jefferson:				
JfC	Fair: low strength	Unsuited	Unsuited	Good.
JfD	Fair: low strength; slope	Unsuited	Unsuited	Fair: slope.
JfE	Fair: slope	Unsuited	Unsuited	Poor: slope.
Lonewood: LoB, LoC, LwC	Fair: low strength	Unsuited	Unsuited	Good.
Melvin: Me	Poor: wetness; floods	Unsuited	Unsuited	Poor: wetness.
Minvale: MnC, MnD	Fair: low strength	Unsuited	Unsuited	Fair: small stones.
Mountview: MoB, MoC	Fair: low strength	Unsuited	Unsuited	Good.
Nella:				
NeD	Fair: slope	Unsuited	Unsuited	Poor: slope; small stones.
NeE	Poor: slope	Unsuited	Unsuited	Poor: slope; small stones.
Ramsey: RaD, RaE, RcD, RcE, RoF.	Poor: thin layer; area reclaim	Unsuited	Unsuited	Poor: thin layer; rock outcrops; area reclaim.
Sequatchie: Sa	Fair: low strength	Unsuited	Unsuited	Good.
Sewanee: Se	Fair: low strength	Unsuited	Unsuited	Good.
Staser: Ss	Fair: low strength	Unsuited	Unsuited	Good.
Taft: Ta	Poor: wetness	Unsuited	Unsuited	Poor: wetness.
Talbott: TbC2, TcD, TcE, TrD, TrF.	Poor: low strength	Unsuited	Unsuited	Poor: slope; too clayey; thin layer.

TABLE 11.—*Construction materials*—Continued

Soil name and map symbol	Road fill	Sand	Gravel	Topsoil
Tilsit: TtB	Fair: low strength	Unsuited	Unsuited	Fair: area reclaim.
Udorthents: Um	Good	Unsuited	Unsuited	Poor.
Waynesboro:				
WaB	Fair: low strength	Unsuited	Unsuited	Fair: too clayey; thin layer.
WaC, WbC3	Fair: low strength	Unsuited	Unsuited	Fair: slope; too clayey; thin layer.
WaD, WbD3	Fair: slope; low strength	Unsuited	Unsuited	Fair: slope; too clayey; thin layer.
WaE2	Poor: slope	Unsuited	Unsuited	Poor: slope.
Welchland: We	Good	Unsuited	Unsuited	Poor: small stones.

TABLE 12.—*Water management*

["Seepage" and other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil not evaluated]

Soil name and map symbols	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments dikes and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Allen: AeC, AeD, AeE, AnD3	Moderate: seepage.	Slight	Not needed	Slope; erodes easily.	Slope; erodes easily.	Favorable.
Atkins: At	Slight	Moderate: low strength.	Wetness; floods	Wetness; floods	Not needed	Wetness.
Bewleyville: BeB, BeC	Moderate: seepage.	Slight	Not needed	Favorable	Favorable	Favorable.
Bodine: BdF	Severe: seepage	Moderate: piping.	Not needed	Droughty; slope	Slope; erodes easily.	Slope.
Bonair: Bn	Moderate: seepage.	Moderate: piping.	Floods; wetness	Wetness	Not needed	Not needed.
Bouldin: BoF	Severe: seepage	Severe: large stones.	Not needed	Slope	Slope; large stones.	Slope; large stones.
Christian: ChC2, ChD2, CnC2, CnD2, CnE2, CsD3	Slight	Moderate: compressible.	Not needed	Slope; erodes easily.	Slope; erodes easily.	Slope.
Curtistown: CuB	Moderate: seepage.	Moderate: piping.	Not needed	Favorable	Favorable	Favorable.
Decatur: DeB, DeC2	Severe: seepage	Moderate: hard to pack; piping.	Not needed	Slope	Favorable	Favorable.
Dickson: DkB	Slight	Moderate: compressible; low strength.	Not needed	Favorable	Favorable	Favorable.
Emory: Em	Severe: seepage	Moderate: piping.	Not needed	Favorable	Favorable	Favorable.
Etowah:						
EtB, EtC, EwC	Moderate: seepage.	Slight	Not needed	Favorable	Favorable	Favorable.
EtD, EwD, EwE	Moderate: seepage.	Slight	Not needed	Slope	Slope	Slope.
Gilpin: GpD, GpE	Severe: depth to rock.	Moderate: large stones; thin layer.	Not needed	Droughty; slope	Slope; depth to rock.	Slope.

TABLE 12.—*Water management*—Continued

Soil name and map symbols	Limitations for—		Features affecting—			
	Pond reservoir areas	Embankments dikes and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Greendale: Gr	Moderate: seepage.	Slight	Not needed	Favorable	Favorable	Favorable.
Guthrie: Gu	Slight	Moderate: piping.	Percs slowly; poor outlets.	Wetness	Not needed	Not needed.
Hamblen: Ha	Moderate: seepage.	Slight	Floods	Favorable	Not needed	Favorable.
Hartsells: HsB, HsC	Severe: depth to rock.	Slight	Not needed	Favorable	Favorable	Favorable.
Jefferson:						
JfC	Moderate: seepage.	Slight	Not needed	Favorable	Favorable	Favorable.
JfD, JfE	Moderate: seepage.	Slight	Not needed	Slope	Slope	Slope.
Lonewood: LoB, LoC, LwC	Moderate: depth to rock.	Slight	Not needed	Favorable	Favorable	Favorable.
Melvin: Me	Slight	Moderate: piping.	Wetness; floods	Wetness; floods	Not needed	Wetness.
Minvale: MnC, MnD	Moderate: seepage.	Slight	Not needed	Favorable	Slope	Favorable.
Mountview: MoB, MoC	Moderate: seepage.	Slight	Not needed	Favorable	Favorable	Favorable.
Nella: NeD, NeE	Moderate: seepage.	Slight	Not needed	Slope	Slope	Slope.
Ramsey: RaD, RaE, RcD, RcE, RoF.	Severe: depth to rock.	Severe: thin layer.	Not needed	Slope; droughty; rooting depth.	Slope; depth to rock.	Slope; rock outcrops.
Sequatchie: Sa	Severe: seepage.	Slight	Not needed	Favorable	Favorable	Favorable.
Sewanee: Se	Moderate: seepage.	Moderate: low strength; piping.	Wetness; floods	Favorable	Favorable	Favorable.
Staser: Ss	Moderate: seepage.	Moderate: piping.	Not needed	Favorable	Favorable	Favorable.
Taft: Ta	Slight	Moderate: piping.	Percs slowly; poor outlets.	Wetness	Not needed	Not needed.
Talbott: TbC2, TcD, TcE, TrD, TrF.	Severe: depth to rock.	Severe: compressible.	Not needed	Erodes easily; rooting depth.	Slope; depth to rock.	Slope; rooting depth; erodes easily; rock outcrops.
Tilsit: TtB	Slight	Slight	Not needed	Favorable	Favorable	Favorable.
Udorthents: Um.						
Waynesboro: WaB, WaC, WaD, WaE2, WbC3, WbD3.	Moderate: seepage.	Slight	Not needed	Slope	Slope	Slope.
Welchland: We	Severe: seepage.	Slight	Not needed	Fast intake	Not needed	Not needed.

ments, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6

feet, unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, ordinarily difficult to excavate, is indicated.

Dwellings and small commercial buildings referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation will not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity, and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and the large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious limitation.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The AASHTO and Unified classifications of the soil and the soil texture, density, and shrink-swell potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones all affect stability and ease of excavation and were also considered in making the ratings.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that deal with the ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for these uses and for use of the soil as daily cover for landfills.

If the degree of soil limitation is indicated by the rating *slight,* soils are favorable for the specified use and limitations are minor and easily overcome; and if this degree is indicated by the rating *moderate,* soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design. A *severe* rating, however, indicates that soil properties or site features are so unfavorable or so difficult to overcome that major soil reclamation, special designs, or intensive maintenance are required.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the material in soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that effect the absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallow depth to bedrock interfere with installation of systems. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas. Also, soil erosion and soil slippage are hazards where absorption fields are installed in sloping soils.

Percolation tests are performed to determine the absorptive capacity of the soil and its suitability for septic tank absorption fields. These tests should be performed during the season when the water table is highest and the soil is at minimum absorptive capacity.

In many of the soils that have moderate or severe limitations for septic tank absorption fields, it may be possible to install special systems that lower the seasonal water table or to increase the size of the absorption field so that satisfactory performance is achieved.

Sewage lagoons are shallow ponds constructed to hold sewage while bacteria decompose the solid and liquid wastes. Lagoons have a nearly level flow area surrounded by cut slopes or embankments of compacted, nearly impervious soil material. They generally are designed so that depth of the sewage is 2 to 5 feet. Impervious soil at least 4 feet thick for the lagoon floor and sides is required to minimize seepage and contamination of local ground water. Soils that have a high content of organic matter and those that have stones and boulders are undesirable. Unless the soil has very slow permeability, contamination of local ground water is a hazard in areas where the seasonal high water table is above the level of the lagoon floor. In soils that have a seasonal high water table, seepage of ground water into the lagoon can seriously reduce its capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the location of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill is disposed solid waste, either in excavated trenches or on the surface of the soil, that is spread, compacted in layers, and covered with thin layers of soil material. Landfill areas are subject to

heavy vehicular traffic. Ease of excavation, risk of polluting ground water, and trafficability affect the suitability of a soil for this purpose. The best soils have a loamy or silty texture, have moderate or slow permeability, are deep to bedrock and a seasonal water table, are free of large stones and boulders, and are not subject to flooding. In areas where the seasonal water table is high, water seeps into the trenches and causes problems in excavating and filling the trenches. Also, seepage into the refuse increases the risk of pollution of ground water. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability that might allow noxious liquids to contaminate local ground water.

Unless otherwise stated, the ratings in table 10 apply only to soil properties and features within a depth of about 6 feet. If the trench is deeper, ratings of slight or moderate may not be valid. Site investigation is needed before a site is selected.

In the area type of sanitary landfill, refuse is placed on the surface of the soil in successive layers. The limitations caused by soil texture, depth to bedrock, and content of stones do not apply to this type of landfill. Soil wetness, however, may be a limitation because of difficulty in operating equipment.

Daily cover for sanitary landfills should be soil material that is easy to excavate and spread over the compacted fill during wet and dry weather. Soils that are loamy or silty and free of stones or boulders are better suited than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

In addition to these features, the soils selected for final cover of landfills should be suitable for growing plants. In comparison with other horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas, such as slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of road fill, sand, gravel, and topsoil is indicated in table 11 by ratings of *good, fair,* or *poor*. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction material. Each soil is evaluated to the depth observed, generally about 6 feet, and described as the survey is made.

Road fill is soil material used in embankments for roads. The ratings reflect the ease of excavating and working the material and the expected performance of the material after it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about soil properties that determine such performance is given in the descriptions of soil series.

The ratings apply to the soil profile between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within the profile. The estimated engineering properties in table 14 provide more specific information about the nature of each horizon that can help determine its suitability for road fill.

According to the Unified soil classification system, soils rated *good* have low shrink-swell potential and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as high shrink-swell potential, steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor,* regardless of the quality of the suitable material.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 14.

Topsoil is used in areas where vegetation is to be established and maintained. Its suitability is determined mainly by the ease of working and spreading the soil material, as when preparing a seedbed, for example, and by the ability of the soil material to sustain the growth of plants. Also considered is the damage that would result to the area from which the topsoil is taken.

Soils rated *good* have at least 16 inches of friable, loamy material at the surface. They are free of stones, are low in content of gravel and other coarse fragments, and have gentle slopes. They are naturally fertile or respond well to fertilization. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose, sandy or firm, loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel or stones.

Soils rated *poor* are very sandy soils; very firm, clayey soils; soils that have suitable layers less than 8 inches thick; soils that have large amounts of gravel and stones; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is much preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter. Consequently, careful preservation and use of material from these horizons is desirable.

Water management

Many soil properties and site features that affect management practices have been identified in this soil survey. In table 12 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties and site features are unfavorable for the rated use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for this use have low seepage potential, which is determined by the permeability and depth over fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and is of favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Stones and organic matter in a soil downgrade the suitability of the soil for use in embankments, dikes, and levees.

Drainage of a soil is affected by such soil properties as permeability, texture, structure, depth to fragipan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage and depth to the water table.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to intercept runoff and allow the water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity of slope and steepness, depth to bedrock or other unfavorable material, permeability, ease of establishing vegetation, and resistance to water erosion, soil blowing, slippage, and piping.

Grassed waterways are constructed to channel runoff at nonerosive velocities to outlets. Features that affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Recreation

Fall Creek Falls State Park as well as large areas owned by large companies are used for recreational purposes. Fall Creek Falls State Park has boating, swimming, golf, horseback riding, softball, group camping, and many other activities. The waterfall at Fall Creek Falls State Park is 256 feet high. It is the highest waterfall east of the Rockies. Much of the Cumberland Plateau has high potential for recreation because of the smooth hilltops, rock bluffs, and deep gorges carrying permanent streams.

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accesibility of the area, its size and shape, and its scenic quality. Other important considerations are ability of the soil to support vegetation, access to water, potential available water impoundment sites, and either access to public sewerlines or a capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited in varying degrees for recreational use, depending on the duration of the flooding and the season in which it occurs. Onsite assessment of height, duration, and frequency of flooding is essential in planning recreational facilities.

In table 13 the limitations of soils are rated as slight, moderate, or severe. *Slight* means that the soil properties are generally favorable and that the limitations are minor and easily overcome. *Moderate* means that the limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 13 can be supplemented by additional information in other parts of this survey. Especially helpful are the interpretations for septic tank absorption fields given in table 10 and the interpretations for dwellings without basements and local roads and streets given in table 9.

Camp areas require such site preparation as shaping and leveling of 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 for this use have mild slopes and are not wet nor subject to flooding during the period of use. They have few or no stones or boulders on the surface, absorb rainfall readily but remain firm, and are not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

TABLE 13.—*Recreation development*

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of entry means soil is not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Allen:				
AeC	Slight	Slight	Severe: slope	Slight.
AeD, AnD3	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
AeE	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Atkins: At	Severe: wetness; floods	Severe: wetness; floods	Severe: wetness; floods	Severe: wetness; floods.
Bewleyville:				
BeB	Slight	Slight	Moderate: slope	Slight.
BeC	Slight	Slight	Severe: slope	Slight.
Bodine: BdF	Severe: slope; small stones.	Severe: slope; small stones.	Severe: slope; small stones.	Severe: slope.
Bonair: Bn	Severe: floods; wetness	Severe: floods; wetness	Severe: floods; wetness	Severe: floods; wetness.
Bouldin: BoF	Severe: large stones; slope.	Severe: large stones; slope.	Severe: large stones; slope.	Severe: large stones; slope.
Christian:				
ChC2, CnC2	Slight	Slight	Severe: slope	Slight.
ChD2, CnD2, CsD3	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
CnE2	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Curtistown: CuB	Slight	Slight	Moderate: slope	Slight.
Decatur:				
DeB	Slight	Slight	Moderate: slope	Slight.
DeC2	Slight	Slight	Severe: slope	Slight.
Dickson: DkB	Slight	Slight	Moderate: percs slowly	Slight.
Emory: Em	Slight	Slight	Slight	Slight.
Etowah:				
EtB	Slight	Slight	Moderate: slope	Slight.
EtC, EwC	Slight	Slight	Severe: slope	Slight.
EtD, EwD	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
EwE	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Gilpin:				
GpD	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
GpE	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Greendale: Gr	Slight; severe if subject to flooding.	Slight	Slight	Slight.
Guthrie: Gu	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Hamblen: Ha	Moderate: wetness; severe if subject to flooding.	Moderate: wetness; floods.	Moderate: wetness	Slight.
Hartsells:				
HsB	Slight	Slight	Moderate: slope	Slight.
HsC	Slight	Slight	Severe: slope	Slight.
Jefferson:				
JfC	Slight	Slight	Severe: slope	Slight.
JfD	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
JfE	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Lonewood:				
LoB	Slight	Slight	Moderate: slope	Slight.
LoC, LwC	Slight	Slight	Severe: slope	Slight.
Melvin: Me	Severe: floods; wetness	Severe: wetness	Severe: floods; wetness	Severe: wetness.
Minvale:				
MnC	Slight	Slight	Severe: slope	Slight.
MnD	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.

TABLE 13.—*Recreation development*—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mountview:				
MoB	Slight	Slight	Moderate: slope	Slight.
MoC	Slight	Slight	Severe: slope	Slight.
Nella:				
NeD	Moderate: slope	Moderate: slope	Severe: slope	Moderate: slope.
NeE	Severe: slope	Severe: slope	Severe: slope	Severe: slope.
Ramsey:				
RaD	Moderate: slope	Moderate: slope	Severe: slope; depth to rock; rock outcrops.	Moderate: slope; rock outcrops.
RaE, RcD, RcE, RoF	Severe: slope; rock outcrops.	Severe: slope; rock outcrops.	Severe: slope; depth to rock; rock outcrops.	Severe: slope; rock outcrops.
Sequatchie: Sa	Slight; severe if subject to flooding.	Slight	Slight	Slight.
Sewanee: Se	Severe: floods	Moderate: floods	Moderate: floods	Slight.
Staser: Ss	Slight; severe if subject to flooding.	Slight	Slight	Slight.
Taft: Ta	Severe: wetness	Severe: wetness	Severe: wetness	Severe: wetness.
Talbott:				
TbC2	Moderate slope; percs slowly.	Moderate: slope	Severe: slope	Slight.
TcD, TcE, TrD, TrF	Severe: slope; rock outcrops.	Severe: slope; rock outcrops.	Severe: slope; rock outcrops.	Moderate: slope; rock outcrops.
Tilsit: TtB	Slight	Slight	Moderate: percs slowly; slope.	Slight.
Udorthents: Um.				
Waynesboro:				
WaB	Slight	Slight	Moderate: slope	Slight.
WaC, WbC3	Slight	Slight	Severe: slope	Slight.
WaD, WbD3	Moderate: slope	Moderate: slope	Severe: slope	Slight.
WaE2	Severe: slope	Severe: slope	Severe: slope	Moderate: slope.
Welchland: We	Moderate: small stones	Moderate: small stones	Severe: small stones	Moderate: small stones.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, not dusty when dry, not subject to flooding during the period of use, and do not have slopes or stones or boulders that will 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 nearly level and not wet or subject to flooding during the season of use. The surface is free of stones or boulders, and the surface material is firm after rains and not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over rock should be sufficient to allow necessary grading.

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

Soil properties

Extensive data about soil properties collected dur ing the soil survey are summarized in this section. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of samples selected from representative soil profiles in the field.

When he makes soil borings during field mapping, the soil scientist identifies several important soil properties. He notes, for example, the seasonal soil moisture condition, or the presence of free water and its depth in the profile. For each horizon, he notes the thickness of the soil material and its color; the texture, or the amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or natural pattern of cracks and pores in the undisturbed soil; and the consistence of soil in place under the existing soil moisture condi-

TABLE 14.—*Engineering properties and classifications*

[The symbol < means less than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Percentage larger than 3 inches	Percentage passing sieve No.—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	Inches										
Allen: AeC, AeD, AeE, AnD3.	0–12	Loam	ML, CL–ML, SM–SC, SM	A–4	0–2	90–100	80–100	75–95	40–80	14–25	2–7
	12–35	Clay loam	CL, CL–ML	A–4, A–6, A–7	0–5	85–100	80–100	75–95	50–80	22–43	5–19
	35–75	Clay loam	CL–ML, CL, SC, SM–SC	A–6, A–7, A–4	0–5	85–100	80–100	70–90	45–80	22–48	6–22
Atkins: At	0–7	Silt loam	ML, CL–ML	A–4	0	95–100	80–100	60–85	50–75	15–25	2–7
	7–48	Silt loam, silty clay loam	ML, CL–ML, CL	A–4	0	95–100	80–100	60–85	50–75	20–30	3–10
	48–60	Loam	CL, CL–ML, ML	A–4, A–6, A–7	0	95–100	80–100	65–85	55–75	20–42	3–15
Bewleyville: BeB, BeC.	0–8	Silt loam	ML, CL–ML	A–4	0	100	95–100	95–100	85–100	20–30	2–7
	8–28	Silty clay loam, silt loam	CL	A–6, A–7	0	95–100	95–100	90–100	85–100	30–45	11–22
	28–72	Clay, silty clay loam	CL, ML, CH, MH	A–6, A–7	0–5	75–100	75–100	70–95	60–95	35–65	12–32
Bodine: BdF	0–8	Cherty silt loam	CL–ML, ML, GM, SM	A–4, A–2	2–20	50–75	40–65	35–60	30–55	15–25	2–7
	8–16	Cherty silt loam	GC, GM, GM–GC	A–1, A–2	5–25	15–60	10–50	10–40	10–35	18–30	4–9
	16–60	Cherty silty clay loam	GC, GM, GW–GC	A–4, A–6, A–2	10–30	15–55	15–55	10–50	5–40	22–39	7–16
Bonair: Bn	0–9	Silt loam, loam	ML, CL–ML, CL	A–4	0	95–100	90–100	70–95	55–85	16–25	2–8
	9–45	Silt loam	CL–ML, CL	A–4, A–6	0	95–100	90–100	70–95	55–80	20–32	5–12
	45–62	Loam, fine sandy loam	CL–ML, CL, SM–SC, SC	A–4, A–6	0–5	90–100	85–100	70–90	40–80	17–32	4–12
Bouldin: BoF	0–18	Stony sandy loam, stony loam.	ML, CL–ML, SM, GM	A–2, A–4	10–40	65–85	55–70	40–65	30–55	15–25	2–7
	18–75	Stony clay loam	GC, GM	A–2, A–4, A–6	30–55	55–75	45–65	35–60	25–50	25–39	8–16
Christian: ChC2, ChD2	0–6	Silt loam	CL–ML, CL	A–4, A–6	0	95–100	95–100	90–100	70–90	20–32	5–12
	6–14	Silty clay loam	CL	A–6, A–7	0	95–100	95–100	90–100	85–95	32–43	12–18
	14–65	Clay	CL, MH, CH	A–7	0	95–100	95–100	90–100	80–95	46–60	20–28
CnC2, CnD2, CnE2, CsD3.	0–6	Cherty silt loam	CL, CL–ML	A–4, A–6	0–5	70–95	65–85	60–80	55–75	20–32	5–12
	6–14	Cherty silty clay loam	CL	A–6, A–7	0–5	75–100	65–85	65–85	60–80	32–43	12–18
	14–65	Clay	CL, MH	A–7	0–5	90–100	90–100	85–100	75–95	46–60	20–28
Curtistown: CuB	0–8	Silt loam	ML, CL–ML, CL	A–4	0	100	95–100	90–95	80–95	18–29	3–10
	8–38	Silty clay loam	CL	A–6, A–4	0	100	95–100	90–95	80–90	25–39	8–18
	38–75	Clay	CL, MH, ML	A–6, A–7	0–5	95–100	85–100	75–85	70–80	38–55	15–24
Decatur: DeB, DeC2	0–7	Silt loam	CL, ML, CL–ML	A–4, A–6	0–3	95–100	90–100	80–90	65–75	20–32	5–12
	7–13	Silty clay loam	CL, ML	A–6, A–7	0–3	95–100	90–100	85–90	75–85	42–49	10–22
	13–62	Clay	MH, ML, CL	A–7	0–3	95–100	90–100	85–90	75–80	42–49	14–23
Dickson: DkB	0–7	Silt loam	CL–ML, ML	A–4	0	100	95–100	90–100	75–95	20–28	2–7
	7–24	Silt loam	CL, CL–ML	A–4, A–6	0	100	95–100	95–100	85–95	25–38	5–17
	24–38	Silt loam	CL, CL–ML	A–4, A–6, A–7	0	95–100	90–100	85–100	80–95	27–42	7–18
	38–60	Cherty clay	MH, ML, GC, CL	A–6, A–7	0–20	70–100	60–100	55–100	45–95	35–65	12–30
Emory: Em	0–42	Silt loam	CL	A–4, A–6	0–2	95–100	90–100	85–100	80–95	25–40	7–20
	42–60	Silty clay loam	CL	A–4, A–6, A–7	0–2	90–100	75–100	70–95	65–90	25–45	9–22

Soil name and map symbols	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number					
			Unified	AASHTO	> 3 inches	4	10	40	200	0.05 mm	0.002 mm
	In				Pct						
Etowah:											
EtB, EtC, EtD	0–7	Silt loam	ML, CL, CL–ML, SM–SC	A–4	0	80–100	75–100	70–95	45–70	20–30	3–10
	7–50	Silty clay loam	ML, CL	A–4, A–6	0	80–100	75–100	70–95	65–85	25–35	10–15
	50–70	Clay	ML, MH, CL	A–6, A–7	0	80–100	75–100	70–95	65–85	39–60	15–25
EwC, EwD, EwE	0–7	Cherty silt loam	ML, CL, CL–ML, SM–SC	A–4	0–5	80–95	70–85	65–80	40–70	20–30	3–10
	7–50	Silty clay loam	ML, CL	A–4, A–6	0–5	80–100	70–100	70–95	65–85	25–35	10–15
	50–70	Clay	CL, ML, MH	A–6, A–7	0–5	80–100	75–100	70–95	65–85	39–60	15–25
Gilpin: GpD, GpE	0–8	Silt loam	ML, CL–ML	A–4	0	85–95	70–90	65–85	60–75	15–25	3–7
	8–32	Shaly silty clay loam	CL	A–4, A–6	0–5	85–100	70–90	65–85	55–75	25–39	8–16
	32	Shale bedrock.									
Greendale: Gr	0–45	Silt loam	CL–ML, ML, CL	A–4, A–6	0–2	80–100	75–100	65–90	60–90	20–35	3–12
	45–68	Cherty silt loam	CL, ML, GM–GC, GC	A–4, A–6	0–2	60–75	55–75	50–65	40–60	20–35	3–12
Guthrie: Gu	0–7	Silt loam	ML, CL–ML	A–4	0		100	90–100	85–95	18–28	2–7
	7–30	Silt loam	CL–ML, CL, ML	A–4, A–6	0		100	90–100	85–95	23–39	5–14
	30–52	Silt loam	CL, CL–ML	A–4, A–6	0	100	95–100	85–100	85–95	23–42	5–15
	52–65	Silty clay loam	ML, CL	A–4, A–6	0–5	90–100	85–100	80–100	70–95	25–50	8–25
Hamblen: Ha	0–60	Silt loam	CL, CL–ML	A–4	0–2	90–100	80–100	65–95	55–85	22–38	5–14
Hartsells: HsB, HsC	0–6	Loam	ML, SM	A–4	0–5	85–100	75–100	70–95	35–75	<20	[1]NP–3
	6–34	Loam, clay loam	CL–ML, CL, SM, ML	A–4, A–6	0–5	85–100	75–100	65–95	40–75	<35	NP–20
	34	Bedrock.									
Jefferson: JfC, JfD, JfE.	0–12	Loam, fine sandy loam	ML, CL–ML	A–4	0–2	95–100	90–100	65–95	50–80	15–25	2–7
	12–62	Clay loam, loam	CL	A–6, A–4	0–2	95–100	90–100	65–95	50–80	25–38	8–16
	62–70	Gravelly loam	CL, GC, SC	A–2, A–4, A–6	0–20	65–100	50–85	40–75	30–70	25–38	8–16
Lonewood: LoB, LoC, LwC.	0–10	Silt loam	CL–ML, ML	A–4	0	100	95–100	85–100	75–90	15–26	3–7
	10–35	Silt loam	CL	A–4, A–6	0	100	95–100	85–95	70–90	25–39	9–18
	35–60	Silty clay loam, clay loam	CL	A–6, A–7	0	95–100	85–100	75–90	65–85	29–48	10–22
	60–65	Shaly clay loam	CL, GC, SC	A–2, A–4, A–6, A–7	5–25	45–90	25–85	25–80	25–75	25–48	9–22
Melvin: Me	0–60	Silt loam, silty clay loam	CL, CL–ML, ML	A–4, A–6	0	85–100	80–100	70–100	60–95	25–40	5–20
Minvale: MnC, MnD	0–13	Cherty silt loam	ML, CL, CL–ML, GM, GC	A–4	0–5	55–80	50–75	40–70	35–60	<30	NP–10
	13–52	Cherty silty clay loam	CL, GC, CL–ML, GM–GC	A–4, A–6	0–5	55–80	50–75	40–70	35–65	20–30	5–15
	52–68	Cherty clay	CL, GC, CL–ML, GM–GC	A–4, A–6	0–5	50–75	50–75	40–70	35–65	20–30	5–15
Mountview: MoB, MoC.	0–11	Silt loam	ML, CL–ML	A–4	0	100	95–100	95–100	85–95	20–30	2–7
	11–30	Silty clay loam	CL	A–6, A–7	0	95–100	95–100	90–100	85–95	30–43	10–20
	30–65	Clay	ML, MH, CL	A–6, A–7	0–20	70–100	65–100	60–95	50–95	35–65	11–32
Nella: NeD, NeE	0–14	Cobbly loam	ML, SM, CL–ML	A–4	0–30	65–90	60–85	45–75	36–55	<30	NP–8
	14–70	Cobbly clay loam	GC, CL, SC, CL–ML	A–4, A–6	0–30	65–90	55–85	45–70	36–60	25–40	6–20
Ramsey:											
RaD, RaE, RcD, RcE, RoF.	0–18	Loam	SM, ML, CL–ML, CL	A–4	0–10	85–100	75–95	60–75	35–70	15–25	2–8
	18	Bedrock.									
Rock outcrop part of RcD, RcE, and RoF consists of sandstone rocks.											
Sequatchie: Sa	0–10	Loam	SM, ML, CL–ML	A–4	0–5	90–100	85–100	70–95	35–70	15–25	NP–10
	10–68	Loam, clay loam, fine sandy loam.	CL, SM, SC, CL–ML	A–4, A–6	0–5	90–100	85–100	70–85	55–75	20–30	5–15

TABLE 14.—*Engineering properties and classifications*—Continued

Soil name and map symbol	Depth	USDA texture	Classification		Percentage larger than 3 inches	Percentage passing sieve No.—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	Inches										
Sewanee: Se	0–50	Loam	ML, CL, CL–ML, SM, SC	A–2, A–4	0	80–100	75–100	65–95	30–65	<30	NP–10
	50	Bedrock.									
Staser: Ss	0–65	Silt loam	ML, CL, CL–ML	A–4, A–6	0	90–100	80–100	60–85	55–80	20–35	5–15
Taft: Ta	0–6	Silt loam	ML, CL–ML	A–4	0	100	95–100	90–100	75–95	18–30	2–7
	6–26	Silt loam	CL, ML, CL–ML	A–4, A–6	0	100	95–100	95–100	85–95	23–38	5–16
	26–63	Silty clay loam, silt loam	CL–ML, CL	A–4, A–6	0	95–100	90–100	85–100	80–95	23–42	5–20
Talbott: TbC2, TcD, TcE, TrD, TrF.	0–5	Silt loam	ML, CL, CL–ML	A–4, A–6, A–7	0–5	95–100	90–100	85–95	75–95	25–45	5–18
	5–36	Clay	CL, MH, CH	A–6, A–7	0–10	95–100	90–100	85–95	80–100	40–80	20–45
Rock outcrop part of TrD, TrF consists of limestone rocks.	36	Bedrock.									
Tilsit: TtB	0–5	Silt loam	CL, ML	A–4	0	100	95–100	85–95	75–90	20–28	2–7
	5–24	Silt loam	CL	A–4, A–6	0	100	95–100	85–100	80–90	26–28	9–16
	24–56	Silt loam, silty clay loam	CL	A–4, A–6	0	100	90–100	85–100	75–90	27–42	9–18
	56–62	Silty clay loam	CL, GC	A–4, A–6	2–15	65–95	55–85	45–75	40–65	27–42	9–18
Udorthents: Um.											
Waynesboro: WaB, WaC, WaD, WaE2, WbC3, WbD3.	0–6	Loam	CL–ML, ML, CL, SM	A–4	0–5	85–100	80–100	70–95	45–70	16–29	2–9
	6–24	Clay loam	ML, CL, SC	A–4, A–6, A–7	0–5	90–100	85–100	75–95	45–75	30–41	9–17
	24–70	Clay	CL, MH, ML, SC	A–6, A–4, A–7	0–5	90–100	80–100	70–95	45–75	38–68	9–28
Welchland: We	0–9	Cobbly loam	ML, SM, CL–ML, SM–SC	A–4	8–25	75–95	65–85	55–75	40–60	<25	NP–6
	9–38	Cobbly loam	CL, ML, SM, SC, GM, GC	A–4	8–25	75–90	60–85	50–75	35–60	18–29	5–10
	38–60	Cobbly loam, cobbly sandy loam.	SM, SC, GM, GC	A–2, A–4	15–40	60–90	40–80	30–65	20–55	<25	NP–6

[1]NP means nonplastic.

tions. He records the root depth of existing plants, determines soil pH, or reaction, and identifies any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to characterize key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many of the soil series are available from nearby areas.

Based on summaries of available field and laboratory data, and listed in tables in this section, are estimated ranges in engineering properties and classifications and in physical and chemical properties for each major horizon of each soil in the survey area. Also, pertinent soil and water features are presented.

Engineering properties and classifications.—Table 14 provides estimates of engineering properties and classifications for the major horizons of each soil in the survey area. These estimates are presented as ranges in values most likely to exist in areas where the soil is mapped.

Most soils have, within the upper 5 to 6 feet, horizons of contrasting properties. Information is presented for each of these contrasting horizons. Depth to the upper and lower boundaries of each horizon in a typical profile of each soil is indicated. More information about the range in depth and in properties of each horizon is given for each soil series in the section "Descriptions of the Soils."

Texture is described in table 14 in standard terms used by the United States Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms used by USDA are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (USCS) (*2*) and the American Association of State Highway and Transportation Officials Soil Classification System (AASHTO) (*1*). In table 14 soils in the survey area are classified according to both systems.

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, plasticity index, liquid limit, and content of organic matter. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example CL-ML.

The AASHTO system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified as one of seven basic groups ranging 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. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified as A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or more for the poorest. The estimated classification, without group index numbers, is given in table 14. Also in table 14 the percentage, by weight, of cobbles, or the rock fragments more than 3 inches in diameter, are estimated for each major horizon. These estimates are determined largely by observing volume percentage in the field and then converting it, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four standard sieves is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and plasticity index indicate the effect of water on the strength and consistency of soil. These indexes are used in both the USCS and the AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior.

Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

Physical and chemical properties.—Table 15 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the representative profile of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships between the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for water movement in a vertical direction when the soil is saturated. Not considered in the estimates are lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in the planning and design of drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil

TABLE 15.—*Physical and chemical properties of soils*

[Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Corrosivity	
						Steel	Concrete
	Inches	*Inches per hour*	*Inches per inch of soil*	*pH*			
Allen: AeC, AeD, AeE, AnD3	0–12	0.6–2.0	0.14–0.19	4.5–5.5	Low	Low	Moderate.
	12–35	0.6–2.0	0.15–0.18	4.5–5.5	Low	Low	Moderate.
	35–75	0.6–2.0	0.12–0.18	4.5–5.5	Low	Low	Moderate.
Atkins: At	0–7	0.6–2.0	0.14–0.22	5.1–5.5	Low	High	Moderate.
	7–48	0.6–2.0	0.14–0.18	5.1–5.5	Low	High	Moderate.
	48–60	0.6–2.0	0.08–0.18	5.1–5.5	Low	High	Moderate.
Bewleyville: BeB, BeC	0–8	0.6–2.0	0.20–0.22	4.5–5.5	Low	Moderate	Moderate.
	8–28	0.6–2.0	0.18–0.20	4.5–5.5	Low	Moderate	Moderate.
	28–72	0.6–2.0	0.12–0.17	4.5–5.5	Moderate	Moderate	Moderate.
Bodine: BdF	0–8	2.0–6.0	0.07–0.12	4.5–5.5	Low	Low	High.
	8–16	2.0–6.0	0.05–0.10	4.5–5.5	Low	Low	High.
	16–60	2.0–6.0	0.05–0.10	4.5–5.5	Low	Low	High.
Bonair: Bn	0–9	0.6–2.0	0.18–0.20	4.5–5.5	Low	High	High.
	9–45	0.6–2.0	0.17–0.20	4.5–5.5	Low	High	High.
	45–62	0.6–2.0	0.12–0.20	4.5–5.5	Low	High	High.
Bouldin: BoF	0–18	2.0–6.0	0.07–0.11	4.5–5.5	Low	Low	Moderate.
	18–75	2.0–6.0	0.07–0.11	4.5–5.5	Low	Low	Moderate.
Christian:							
ChC2, ChD2	0–6	0.6–2.0	0.18–0.22	4.5–5.5	Low	Low	High.
	6–14	0.6–2.0	0.18–0.22	4.5–5.5	Low	Low	High.
	14–65	0.2–0.6	0.11–0.15	4.5–5.5	Moderate	Low	High.
CnC2, CnD2, CnE2, CsD3	0–6	0.6–2.0	0.14–0.17	4.5–5.5	Low	Low	High.
	6–14	0.6–2.0	0.14–0.17	4.5–5.5	Low	Low	High.
	14–65	0.2–0.6	0.10–0.14	4.5–5.5	Moderate	Low	High.
Curtistown: CuB	0–8	0.6–2.0	0.18–0.22	4.5–5.5	Low	Low	Moderate.
	8–38	0.6–2.0	0.17–0.20	4.5–5.5	Low	Moderate	Moderate.
	38–75	0.6–2.0	0.14–0.16	4.5–5.5	Low	High	Moderate.
Decatur: DeB, DeC2	0–7	0.6–2.0	0.18–0.20	4.5–6.0	Low	High	Moderate.
	7–13	0.6–2.0	0.14–0.17	4.5–5.5	Moderate	High	Moderate.
	13–62	0.6–2.0	0.12–0.16	4.5–5.5	Moderate	High	Moderate.
Dickson: DkB	0–7	0.6–2.0	0.18–0.22	4.5–5.5	Low	Moderate	Moderate.
	7–24	0.6–2.0	0.18–0.20	4.5–5.5	Low	Moderate	Moderate.
	24–38	0.2–0.6	0.05–0.11	4.5–5.5	Low	Moderate	Moderate.
	38–60	0.2–0.6	0	4.4–5.5	Moderate	Moderate	Moderate.
Emory: Em	0–42	0.6–2.0	0.17–0.21	5.1–6.0	Low	Moderate	Moderate.
	42–60	0.6–2.0	0.16–0.20	5.1–6.0	Low	Moderate	Moderate.
Etowah:							
EtB, EtC, EtD	0–7	0.6–2.0	0.15–0.20	5.1–5.5	Low	Low	Moderate.
	7–50	0.6–2.0	0.16–0.20	5.1–5.5	Low	Low	Moderate.
	50–70	0.6–2.0	0.16–0.20	5.1–5.5	Low	Low	Moderate.
EwC, EwD, EwE	0–7	0.6–2.0	0.15–0.18	5.1–5.5	Low	Low	Moderate.
	7–50	0.6–2.0	0.14–0.18	5.1–5.5	Low	Low	Moderate.
	50–70	0.6–2.0	0.14–0.18	5.1–5.5	Low	Low	Moderate.
Gilpin: GpD, GpE	0–8	0.6–2.0	0.08–0.14	4.5–5.5	Low	Low	High.
	8–32	0.6–2.0	0.10–0.16	4.5–5.5	Low	Low	High.
Greendale: Gr	0–45	0.6–2.0	0.15–0.20	5.1–6.0	Low	Low	Moderate.
	45–68	0.6–2.0	0.10–0.14	5.1–6.0	Low	Low	Moderate.
Guthrie: Gu	0–7	0.6–2.0	0.20–0.22	4.5–5.5	Low	High	High.
	7–30	0.6–2.0	0.18–0.20	4.5–5.5	Low	High	High.
	30–52	0.06–0.2	0.03–0.05	4.5–5.5	Low	High	High.
	52–65	0.06–0.2	0	4.5–5.5	Low	High	High.
Hamblen: Ha	0–60	0.6–2.0	0.18–0.20	5.6–7.3	Low	Moderate	Moderate.

TABLE 15.—*Physical and chemical properties of soils*—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Corrosivity	
						Steel	Concrete
	Inches	*Inches per hour*	*Inches per inch of soil*	*pH*			
Hartsells: HsB, HsC	0–6	0.6–2.0	0.12–0.18	4.5–5.5	Low	Moderate	High.
	6–34	0.6–2.0	0.13–0.18	4.5–5.5	Low	Moderate	High.
Jefferson: JfC, JfD, JfE	0–12	2.0–6.0	0.15–0.20	4.0–5.5	Low	Low	High.
	12–62	2.0–6.0	0.12–0.18	4.0–5.5	Low	Low	High.
	62–70	0.6–2.0	0.11–0.15	4.0–5.5	Low	Low	High.
Lonewood: LoB, LoC, LwC	0–10	0.6–2.0	0.20–0.22	4.5–5.5	Low	Low	Moderate.
	10–35	0.6–2.0	0.18–0.22	4.5–5.5	Low	Low	Moderate.
	35–60	0.6–2.0	0.14–0.17	4.5–5.5	Low	Low	Moderate.
	60–65	0.6–2.0	0.05–0.11	4.5–5.5	Low	Low	Moderate.
Melvin: Me	0–60	0.6–2.0	0.18–0.22	6.1–7.3	Low	Moderate	Low.
Minvale: MnC, MnD	0–13	2.0–6.0	0.14–0.17	4.5–5.5	Low	Moderate	Low.
	13–52	0.6–2.0	0.09–0.14	4.5–5.5	Low	Moderate	Low.
	52–68	0.6–2.0	0.09–0.14	4.5–5.5	Low	Moderate	Low.
Mountview: MoB, MoC	0–11	0.6–2.0	0.18–0.22	4.5–5.5	Low	Moderate	Moderate.
	11–30	0.6–2.0	0.17–0.20	4.5–5.5	Low	Moderate	Moderate.
	30–65	0.6–2.0	0.10–0.15	4.5–5.5	Moderate	Moderate	Moderate.
Nella: NeD, NeE	0–14	0.6–2.0	0.12–0.17	4.5–5.5	Low	Low	Moderate.
	14–70	0.6–2.0	0.10–0.17	4.5–5.5	Low	Low	Moderate.
Ramsey: RaD, RaE, RcD, RcE, RoF. Rock outcrop part of RcD, RcE, and RoF consists of sandstone rock.	0–18	6.0–20	0.09–0.12	4.5–5.5	Low	Low	Moderate.
Sequatchie: Sa	0–10	0.6–2.0	0.12–0.18	5.1–5.5	Low	Low	Moderate.
	10–68	0.6–2.0	0.15–0.20	5.1–5.5	Low	Low	Moderate.
Sewanee: Se	0–50	0.6–2.0	0.14–0.20	5.1–5.5	Low	Low	Moderate.
Staser: Ss	0–65	0.6–2.0	0.18–0.22	6.1–7.3	Low	Low	Low.
Taft: Ta	0–6	0.6–2.0	0.20–0.22	4.5–5.5	Low	High	High.
	6–26	0.6–2.0	0.18–0.20	4.5–5.5	Low	High	High.
	26–63	0.06–0.2	0.03–0.07	4.5–5.5	Low	High	High.
Talbott: TbC2, TcD, TcE, TrD, TrF. Rock outcrop part of TrD and TrF consists of limestone rocks.	0–5	0.6–2.0	0.10–0.18	5.1–6.0	Moderate	Low	Moderate.
	5–36	0.2–0.6	0.10–0.14	5.1–7.8	Moderate	High	Moderate.
Tilsit: TtB	0–5	0.6–2.0	0.18–0.22	4.5–5.5	Low	Moderate	Moderate.
	5–24	0.6–2.0	0.18–0.20	4.5–5.5	Low	Moderate	Moderate.
	24–56	0.06–0.2	0.05–0.11	4.5–5.5	Low	Moderate	Moderate.
	56–62	0.2–0.6	0	4.5–5.5	Low	Moderate	Moderate.
Udorthents: Um.							
Waynesboro: WaB, WaC, WaD, WaE2, WbC3, WbD3.	0–6	0.6–2.0	0.16–0.20	4.5–5.5	Low	Moderate	Moderate.
	6–24	0.6–2.0	0.15–0.19	4.5–5.5	Low	Moderate	Moderate.
	24–70	0.6–2.0	0.12–0.16	4.5–5.5	Moderate or low.	Moderate	Moderate.
Welchland: We	0–9	2.0–6.0	0.09–0.14	4.5–5.5	Low	Low	Moderate.
	9–38	2.0–6.0	0.08–0.14	4.5–5.5	Low	Low	Moderate.
	38–60	2.0–6.0	0.05–0.11	4.5–5.5	Low	Low	Moderate.

characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as range in pH values. The range in pH of each major horizon is based on many field checks. For many soils the values have been verified by laboratory analyses. Soil reaction is important when selecting the crops and ornamental or other plants to be grown. It is also important when evaluating soil amendments for fertility and stabilization and when evaluating the corrosivity of metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others it was estimated on the basis of the kind of clay and on measurements of similar soils. Size of imposed loadings and the magnitude of changes in soil moisture content are also important factors that influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A *high* shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Corrosivity, as used in table 15, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rating of soils for corrosivity to concrete is based mainly on the sulfate content, soil texture, and acidity. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Installations of steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely within one kind of soil or within one soil horizon.

Soil and water features

Features that relate to runoff or infiltration of water, to flooding, and to grading and excavation of each soil are indicated in table 16. This information is helpful in planning land uses and engineering projects that are likely to be affected by the amount of runoff from watersheds, by flooding and seasonal high water table, and by the presence of bedrock.

Hydrologic groups are used to estimate runoff after rainfall. Soil properties that influence the minimum rate of infiltration into the bare soil after prolonged wetting are depth to a water table, water-intake rate and permeability after prolonged wetting, and depth to layers of slowly or very slowly permeable soil material.

Flooding is rated in general terms that describe the frequency, duration, and period of the year when flooding is most likely. The ratings are based partly on evidence in the soil profile of the effects of flooding. This evidence appears as thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the areas that are not subject to flooding. In addition to the evidence provided by the soil profile, local information about floodwater heights and the extent of flooding and local knowledge that relates the unique landscape position of each soil to historic floods were used when making the ratings. Most soils in low positions on the landscape where flooding is likely to occur are classified as fluvents at the suborder level or as fluventic subgroups. (See the section "Formation and Classification of the Soils").

The generalized description of flood hazards is of value in land use planning and provides a valid basis for land use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood plains at specific flood frequency levels.

The high water table is the highest level of a saturated zone more than 5 inches thick in soils for continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed during the course of ths soil survey. Indicated are the depth to the high water table; the kind of water table, whether perched, artesian, or the upper part of the ground water table; and the months of the year that the high water commonly is present. Only those saturated zones above a depth of 5 or 6 feet are indicated.

Information about the high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not to construct basements and to determine how septic tank absorption fields and other underground installations will function. Also, a high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at depths of 8 feet or less. For many soils limited ranges in depths to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and other observations during the soil mapping. The relative hardness of the bedrock as it is related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200 horsepower tractor, but hard bedrock generally requires blasting.

Formation and Classification of the Soils

The five main factors of soil formation are discussed in the first part of this section. Processes of

TABLE 16.—*Soil and water features*

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol > means more than]

Soil name and map symbols	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			*Ft*	
Allen: AeC, AeD, AeE, AnD3	B	None			>6			6->8	Hard.
Atkins: At	D	Common	Very brief	Jan.-Apr.	0-1	Apparent	Dec.-May	5->8	Hard.
Bewleyville: BeB, BeC	B	None			>6			>8	
Bodine: BdF	B	None			>6			6->8	Hard.
Bonair: Bn	D	Common	Very brief	Jan.-Apr.	0-1	Apparent	Jan.-Apr.	3½-6	Hard.
Bouldin: BoF	B	None			>6			5->8	Hard.
Christian: ChC2, ChD2, CnC2, CnD2, CnE2, CsD3	B	None			>6			4-7	Hard.
Curtistown: CuB	B	None			>6			>8	
Decatur: DeB, DeC2	B	None			>6			>8	
Dickson: DkB	C	None			2-3	Perched	Jan.-Apr.	>8	
Emory: Em	B	None to common.	Very brief	Jan.-Apr.	5-6	Apparent	Jan.-Apr.	>8	
Etowah: EtB, EtC, EtD, EwC, EwD, EwE	B	None			>6			6->8	Hard.
Gilpin: GpD, GpE	C	None			>6			1½-3½	Rippable.
Greendale: Gr	B	None to common.	Very brief	Jan.-Apr.	5-6	Apparent	Jan.-Apr.	>8	
Guthrie: Gu	D	Rare to common.	Very brief	Jan.-Apr.	½-1	Perched	Jan.-Apr.	>8	
Hamblen: Ha	C	None to common.	Very brief	Jan.-Apr.	2-3	Apparent	Jan.-Apr.	6->8	Hard.
Hartsells: HsB, HsC	B	None			>6			1½-3½	Hard.
Jefferson: JfC, JfD, JfE	B	None			>6			4-8	Hard.
Lonewood: LoB, LoC, LwC	B	None			>6			3½-6	Hard.
Melvin: Me	D	Common	Very brief	Jan.-Apr.	0-1	Apparent	Jan.-May	6->8	Hard.
Minvale: MnC, MnD	B	None			>6			>8	
Mountview: MoB, MoC	B	None			>6			>8	
Nella: NeD, NeE	B	None			>6			6->8	Hard.
Ramsey: RaD, RaE, RcD, RcE, RoF	D	None			>6			½-1½	Hard.
Sequatchie: Sa	B	None to common.	Very brief	Jan.-Apr.	>6			6->8	Hard.
Sewanee: Se	B	Common	Very brief	Dec.-Apr.	1-2	Apparent	Dec.-Apr.	3½-6	Hard.
Staser: Ss	B	Common	Very brief	Jan.-Apr.	3-4	Apparent	Jan.-Apr.	6->8	Hard.
Taft: Ta	C	None			1-2	Perched	Jan.-Apr.	>8	
Talbott: TbC2, TcD, TcE, TrD, TrF	C	None			>6			1½-3½	Hard.

TABLE 16.—*Soil and water features*—Continued

Soil name and map symbols	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			*Ft*	
Tilsit: TtB	C	None			2–3	Perched	Jan.–Apr.	3½–6	Rippable.
Udorthents: Um. Too variable to rate.									
Waynesboro: WaB, WaC, WaD, WaE2, WbC3, WbD3	B	None			>6			>8	
Welchland: We	B	None to rare.	Very brief.	Jan.–Apr.	>6	Apparent	Jan.–Apr.	6–>8	Hard.

soil formation are explained in this discussion, and the relationship of the factors to the soils of White and Van Buren Counties is presented. Following this, the current system of classifying soils is defined, and the soils of the two counties are classified according to this system.

Formation of the Soils

Soil is a natural, three-dimensional body on the earth's surface that supports 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.

The interaction of five main factors results in differences among the soils. These factors are the physical and chemical composition of the parent material; the climate during and after the accumulation of the parent material; the kind of plants and organisms living in the soil; the relief of the land and its effect on runoff; and the length of time it took the soil to form.

The effect of a factor can differ from place to place, but the interaction of all the factors determines the kind of soil that forms. In the following paragraphs the factors of soil formation are discussed as they relate to the soils in the survey area.

Parent material

Parent material is the unconsolidated mass from which soil forms. Two of the most important properties of soil parent material are its texture and its mineral composition. Both of these properties are carried over as characteristics of the soil formed in the parent material, although they may be altered somewhat as the soil ages.

The soils of White and Van Buren Counties formed in a variety of parent materials. These include residuum of limestones, shales, and sandstones; alluvium, both local and general; colluvium; and loess. Since the parent materials on the Highland Rim are so different from those on the Cumberland Plateau, it seems best to first discuss the parent materials of the Highland Rim and then those of the Cumberland Plateau and its escarpment.

The Highland Rim includes the western half of White County and the extreme northwestern edge of Van Buren County. The main kinds of materials in which the soils formed are limestone residuum, alluvium, and loess. Before further discussion, it may be well to point out that part of the thick red beds along the eastern part of the Highland Rim, commonly called alluvium, might be more correctly referred to as colluvium, for it is believed that these materials accumulated at the base of the Cumberland Plateau Escarpment as it retreated, over long ages, eastward across the Highland Rim to its present position. Undoubtedly most of these materials have been reworked by water since that time, and for consistence and convenience these materials will be referred to as alluvium.

The parent materials in the westernmost part of the Highland Rim in White County are mostly limestone residuum and loess. The limestone contains a small amount of chert and, in places, small amounts of siltstone and shale. Here the soils on the hillsides, such as Christian, formed almost entirely in clayey residuum of limestone, while those on the broader, smoother hilltops, such as Dickson and Mountview, formed in a two-story sequence consisting of 1 or 2 feet of loess underlain by several feet of clayey residuum of limestone. Near the middle of the Highland Rim part of White County, thick beds of old alluvium become apparent. These thick beds of alluviuum gave rise to deep, well drained, red soils such as Decatur, Etowah, and Waynesboro. Three kinds of parent materials stacked one on top of the other contributed to the formation of some of the soils in this vicinity. On the broad, smooth areas the sequence consisted of 1 to 2 feet of loess underlain by a few feet of old alluvium which, in turn, was underlain by several feet of clayey residuum of limestone. The Bewleyville and Curtistown soils formed in this three-story layering of materials. In most places, however, the clayey residuum is several feet down and is not considered part of the modern soil. On the hillsides in this vicinity the parent material was either alluvium or limestone residuum or old alluvium stacked on residuum. Decatur, Etowah, and Waynesboro soils formed in the old alluvium, while Christian soils formed in the residuum.

The easternmost part of the Highland Rim in White County and all of the Highland Rim part of Van Buren County consist almost entirely of thick beds of old alluvium. This area is commonly called the "red lands" or the "red belt." It stretches from the base of the Cumberland Escarpment a few miles westward on the Highland Rim. The soils that formed in this old alluvium are mainly Decatur, Etowah, and Waynesboro. On the flood plains and low terraces are Staser, Hamblen, Sequatchie, and Welchland.

The eastern limit of the Highland Rim terminates at the base of the Cumberland Escarpment. This escarpment rises nearly 1,000 feet to the level of the Cumberland Plateau or tableland. It is a steep, rough, rocky slope underlain by limestone up to the short, nearly vertical sandstone cliffs which line the extreme top of the escarpment. Two main kinds of parent materials are on this rugged slope — colluvium and residuum of limestone. The colluvium, also called "talus," contains many stones and boulders, some as much as 10 or more feet across. This colluvium, or creep, extends various distances downslope from the base of the sandstone cliff ringing the top of the escarpment. In places, particularly on east- and north-facing slopes, it extends all the way to the bottoms of the deep mountain gorges. The deep, stony Bouldin soils formed in this colluvium. Farther from the cliffs, where the colluvium is thin or not present, residuum is exposed. Many outcrops of limestone bedrock rise as high as 4 or 5 feet above the surface of the soil. Talbott soils, which formed in the clayey residuum, are reddish colored and clayey.

The parent materials on the Cumberland Plateau are somewhat more uniform than they are elsewhere in the survey area. They weathered from sandstones and shales. On some of the broad, smooth areas there is substantial evidence that about a foot of loess has been deposited on the surface. The soils that formed in the residuum of sandstone are the moderately deep Hartsells on the gently sloping and sloping areas of the landscape and the shallow Ramsey soils on the hillsides. Formed in the residuum of shales are the moderately deep Gilpin soils. The Lonewood soils formed in the places where there appears to be about a foot of loess mixed in the upper part of the residuum weathered from either shale or sandstone.

Climate

The climate of White and Van Buren Counties is characterized by mild winters, warm summers, and abundant rainfall. This is presumed to be the type of climate in which the soils formed. The climate is relatively uniform over the Highland Rim and over the Cumberland Plateau areas. The Cumberland Plateau, however, receives slightly more rainfall, and the average annual temperature is about 3° to 4° F less than it is on the Highland Rim.

Chemical weathering is hastened by the warm temperatures, and large amounts of water moving through the soil removes dissolved or suspended materials. Water is essential for both chemical and biological weathering. Plant remains recompose rapidly, and organic acids hasten development of clay minerals and the removal of carbonates. As a result of the temperate climate in White and Van Buren Counties, leaching is rather intense, and soluble and colloidal materials move downward in the soil. Weathering and translocation of materials are almost continuous because the soil is frozen for only short periods, and then to depths of only 4 to 5 inches.

The soils in White and Van Buren Counties, except the younger ones on bottom lands and on escarpments, reflect the effects of the temperate climate and abundant rainfall. For the most part they are strongly weathered, highly leached, acid, and low in fertility.

Living organisms

Vegetation is the main factor in living organisms; however, earthworms, burrowing insects, moles, bacteria, and fungi are important in the formation of soils. Two general functions of living organisms are involved in soil formation. First, some organisms produce organic matter from inorganic materials, and second, other organisms decompose organic materials for their own food and energy. Earthworms, moles, and other animals that live in the soil serve mainly as mixing agents.

The native vegetation in White and Van Buren Counties was mostly hardwoods. The litter produced from fallen leaves, twigs, and branches produces organic acids as it decomposes. These acids greatly increase the mineral weathering and leaching effects of the water percolating through the soil.

Oak, hickory, beech, and yellow-poplar trees were dominant on the well drained soils. Sycamore, gum, and water-tolerant oaks grew in the wet places. Eastern redcedar and hickory were dominant on the rocky slopes.

Because of the climate and the rapid decomposition of organic material, the content of organic matter in all the soils generally is low.

Relief

Relief influences soil formation through its effect on drainage, erosion, runoff, plant cover, and soil temperature. Even in areas that receive the same rainfall, slope influences the amount of water that runs off of, accumulates on, or enters into the soil. For example, in depressional areas where there is no runoff and where 10 to 20 inches of additional water from runoff accumulates, the soil has actually formed in a water regime equal to 60 or 70 inches of annual rainfall. On the hillsides and slopes surrounding the depressions where as much as half of the rainfall runs downslope, the soil has actually formed with about 25 inches of water instead of the 50 inches of rainfall that falls on it. Thus, the soils on the level and in depressional areas are more strongly weathered, more highly leached, and have thicker layers than the ones in the sloping areas.

Slope also affects thickness of soils and soil layers through a slow process of erosion. On level areas, lit-

tle soil is moved, but on steeper and longer slopes, some soil is moved downhill by running water and gravity during each torrential rain. Over a long period this removal keeps the soil thin. The transported material accumulates on the benches, foot slopes, and flood plains, thus thickening and freshening the soils on these positions. Such effects are prominent below the escarpment at the edge of the plateau.

Another important effect of relief is in the sinkhole or karst topography near the eastern edge of the Highland Rim. In numerous spots the underlying limestone has dissolved to permit the overlying soil to cave in. These sinkholes have changed drastically the topography, drainage pattern, and formation and distribution of the soils.

Within White and Van Buren Counties are three major topographic areas: Highland Rim, Cumberland Escarpment, and Cumberland Plateau.

The Highland Rim is dominantly undulating to hilly. The topography is modified in places by limestone sinks and fairly large shallow depressions. Ages ago giant dust storms settled a fairly thick layer of loess over this landscape. This loess, or windblown silt, either did not stick on the hillsides or it was subsequently removed by water running downslope. On the broad, smooth areas one to two or more feet or loess still remain. Thus, the differences between the soils on the broad hilltops and those on the slopes can be attributed directly or indirectly to the effects of topography controlling the thickness of the loess layer. The soils on the gently rolling areas, such as Bewleyville, Mountview, and Dickson, have thicker and siltier upper layers than those on the hillsides, such as Christian and Waynesboro. Where the low hilltops are relatively flat, the soils, such as Dickson, are not well drained and have a fragipan. The mottled colors in the Dickson soils reflect excess water at times in the soil.

Even more striking effects of topography on soil formation in the Highland Rim can be seen in the numerous shallow basins. Here, the topography has had a major influence on the climate, time, vegetation, and parent material under which the soil formed. The depressional topography makes large amounts of water enter the soil and hasten soil development. Because of the excess water only water-tolerant trees, such as sycamore, maples, and gums, grew here. Moreover, the loess layer was thicker because none of it eroded away. The soils, such as Guthrie, that formed in these depressions are gray, poorly drained, and poorly aerated. In addition, clay has been washed to great depths in the soil profile.

The Cumberland Plateau Escarpment traverses the survey area in a southwest-northeast direction. It is a steep, rough, and rocky slope that rises irregularly nearly 1,000 feet to the level of the plateau. The steep topography has, over a long period, brought about massive downslope creep of soil materials. These materials, also called talus, are several feet thick in concave-shaped gorges, and they thin to a smear or none on the convex-shape points and ridges. The Bouldin, which are deep stony soils, formed on the talus slopes and the Talbott soils formed on the ridge points and outliers not covered with the colluvium.

The kinds of soils that formed on the Cumberland Plateau are almost directly related to the topography. The soils on the broad gently rolling areas, such as Hartsells and Lonewood, range from about 2 to 5 feet deep to sandstone or shale rock. On the hillsides the soils, such as Ramsey, generally are less than 2 feet deep to rock and, in some places, bare sandstone is exposed. On these hillsides the soil moved downslope almost as fast as it formed.

Time

A long time is required for the formation of soils that have distinct horizons. Probably the first signs of horizon development is the leaching of soluble salts and the darkening of the upper few inches as an A1 horizon begins to form. As a soil matures, the surface layer is stripped of solubles and fines and the subsoil shows an increase in clay content. Many of the pores, ped faces, and root channels will have clay films in subsoils of mature soils. They will remain in the mature stage for a very long time.

The Staser and Waynesboro soils are examples that differ mostly because of difference in time. The Staser soils lack strongly developed horizons because the alluvial parent material has been in place for only a short time. The Waynesboro soils formed in alluvium that has been in place long enough for development of a strong subsoil that is redder and contains more clay. The Waynesboro soils are strongly acid as the carbonates have been leached out.

Processes of soil formation

Most soils form three major horizons. The A horizon is the surface layer. It can be the horizon or organic matter accumulation called the A1 or the horizon of maxiumum leaching of fine materials called the A2. Areas that have been disturbed by plowing are called Ap.

The B horizon lies beneath the A horizon and is called the subsoil. It is the horizon of maxium accumulation of dissolved or suspended materials, such as iron or clay. It is commonly firmer than the horizon above it, and commonly has blocky structure. The B horizon, however, is not highly developed in young soils.

Below the B horizon is the C horizon. It is little affected by the soil-forming processes, but it can be highly modified by weathering.

The formation of horizons in the soils of White and Van Buren Counties is the result of one or more of the following processes: the accumulation organic matter, the leaching of calcium corbonates or bases, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals (*4*).

The accumulation of organic matter in the upper part of the profile is important because this results in the formation of an A1 horizon. The soils of this survey area are medium to very low in organic-matter content.

Carbonates and bases have been leached from nearly all of the soils in these counties. The leaching of bases ordinarly precedes the translocation of silicate clay minerals. Most of the soils in White and Van Buren are moderately to strongly leached.

The reduction and transfer of iron, a process called gleying, is evident in the poorly drained soils. The gleying is indicated by the gray colcrs of the subsoil, which indicates the reduction and loss of iron. Some horizons contain reddish-brown mottles and concretions, which indicate the segregation of iron.

The translocaton of clay minerals has contributed to horizon development in most of the soils in White and Van Buren Counties. The A horizon which is above the B horizon, has a granular structure and is less clayey than the B horizon. The B horizon has accumulations of clay and clay films in pores and on ped surfaces. The leaching of bases and the subsequent translocation of silicate clay are among the most important processes in horizon development that have taken place in the soils of White and Van Buren Counties.

Classification

Soils are classified so that we can more easily remember their significant characteristics. Classification helps in assembling knowledge about the soils, in showing their relationship to one another and to the whole environment, and in developing principles for understanding their behavior and their response to management. First through classification, and then through use of soil maps, we can apply our knowledge of soils to a specific field or other tract of land.

The narrow categories of classification, such as those used in detailed soil surveys, are intended to help organize and apply knowledge about soils in managing areas; in performing engineering work; and in many other ways. Soils are assigned to broad classes to facilitate study and comparison of large areas, such as counties.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*6*).

The system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the bases for classification are the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 17 the soils of the survey area are classi-

TABLE 17.—*Classification of the soils*

Series	Family	Subgroup	Order
Allen	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Atkins[1]	Fine-loamy, mixed, acid, mesic	Typic Fluvaquents	Entisols.
Bewleyville	Fine-silty, siliceous, thermic	Typic Paleudults	Ultisols.
Bodine	Loamy-skeletal, siliceous, thermic	Typic Paleudults	Ultisols.
Bonair	Fine-loamy, siliceous, acid, mesic	Humic Haplaquepts	Inceptisols.
Bouldin	Loamy-skeletal, siliceous, mesic	Typic Paleudults	Ultisols.
Christian	Clayey, kaolinitic, mesic	Typic Hapludults	Ultisols.
Curtistown	Fine-silty, siliceous, thermic	Typic Paleudults	Ultisols.
Decatur	Clayey, kaolinitic, thermic	Rhodic Paleudults	Ultisols.
Dickson	Fine-silty, siliceous, thermic	Glossic Fragiudults	Ultisols.
Emory	Fine-silty, siliceous, thermic	Fluventic Umbric Dystrochrepts	Inceptisols.
Etowah	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Gilpin	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Greendale	Fine-loamy, siliceous, mesic	Fluventic Dystrochrepts	Inceptisols.
Guthrie	Fine-silty, siliceous, thermic	Typic Fragiaquults	Ultisols.
Hamblen	Fine-loamy, siliceous, thermic	Fluvaquentic Eutrochrepts	Inceptisols.
Hartsells	Fine-loamy, siliceous, thermic	Typic Hapludults	Ultisols.
Jefferson	Fine-loamy, siliceous, mesic	Typic Hapludults	Ultisols.
Lonewood[2]	Fine-loamy, siliceous, mesic	Typic Hapludults	Ultisols.
Melvin[3]	Fine-silty, mixed, nonacid, mesic	Typic Fluvaquents	Entisols.
Minvale	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Mountview	Fine-silty, siliceous, thermic	Typic Paleudults	Ultisols.
Nella	Fine-loamy, siliceous, thermic	Typic Paleudults	Ultisols.
Ramsey	Loamy, siliceous, mesic	Lithic Dystrochrepts	Inceptisols.
Sequatchie	Fine-loamy, siliceous, thermic	Humic Hapludults	Ultisols.
Sewanee	Coarse-loamy, siliceous, mesic	Fluvaquentic Dystrochrepts	Inceptisols.
Staser	Fine-loamy, mixed, thermic	Cumulic Hapludolls	Mollisols.
Taft	Fine-silty, siliceous, thermic	Glossaquic Fragiudults	Ultisols.
Talbott	Fine, mixed, thermic	Typic Hapludalfs	Alfisols.
Tilsit[4]	Fine-silty, mixed, mesic	Typic Fragiudults	Ultisols.
Waynesboro	Clayey, kaolinitic, thermic	Typic Paleudults	Ultisols.
Welchland	Coarse-loamy, siliceous, mesic	Humic Hapludults	Ultisols.

[1]The Atkins soils of White and Van Buren Counties are taxadjuncts to the series. The amount of weatherable minerals is believed to be somewhat less than 10 percent. They are otherwise similar in morphology, use, behavior, and management.

[2]The Lonewood loam, 3 to 12 percent slopes, unit is a taxadjunct to the Lonewood series in that the B2t horizons are yellowish red throughout. It is otherwise similar in morphology, use, behavior, and management.

[3]The Melvin soils of this survey are taxadjuncts to this series. The amount of weatherable minerals is believed to be somewhat less than 10 percent. They are otherwise similar in morphology, use, behavior, and management.

[4]The Tilsit soils of this survey are taxadjuncts to the series. They occur on the Cumberland Plateau in association with soils that have siliceous mineralogy. Other than mineralogy, they are similar in morphology, use, behavior, and management.

fied according to the system. Classes of the system are briefly discussed in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in sol. An example is ultisol.

SUBORDER: Each order is divided into suborders based primarily on properties that influence soil genesis and that are important to plant growth, or that were selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is udult (*Ud* meaning humid, plus *ult* from ultisol).

GREAT GROUP: Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. The name of a great group ends with the name of a suborder. A prefix added to the name suggests something about the properties of the soil. An example is Hapludults (*Hapl,* meaning simple horizons, plus *udult,* the suborder of ultisols that have an udic moisture regime).

SUBGROUP: Each great group is divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades that have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. The names of subgroups are derived by placing one or more adjectives before the name of the great group. The adjective *Typic* is used for the subgroup that is thought to typify the great group. An example is Typic Hapludults.

FAMILY: Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, siliceous, mesic, Typic Hapludults.

SERIES: The series has the narrowest range of characteristics of the categories in the classification system. It is described fully in the section "How this Survey was Made." The profiles described under the series in the section "Descriptions of the Soils" are considered representatives of the soil series recognized in this survey.

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Glossary

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.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expresed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches		*Inches*
Very low	0 to 3	Moderate	6 to 9
Low	3 to 6	High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

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 coat, clay skin.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is

unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Creep soil. The downward movement of masses of soil and soil material, primarily through the action of gravity. The movement is generally slow and irregular. It occurs most commonly when the lower part of the soil is nearly saturated with water, and it may be facilitated by alternate freezing and thawing.

Depth to rock. Bedrock at a depth that adversely affects 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.

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.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

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

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called normal field capacity, normal moisture capacity, or capillary capacity.

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

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

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

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.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming 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.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Illuviation. The accumulation of material in a soil horizon through the deposition of suspended material and organic matter removed from horizons above. Since part of the fine clay in the B horizon (or subsoil) of many soils has moved into the B horizon from the A horizon above, the B horizon is called an illuvial horizon.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. Inadequate strength for supporting loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—few, common, and many; size—fine, medium, and coarse; and contrast—faint, distinct, and prominent. The size measurements are of the diameter along the greatest dimension. Fine indicates less than 5 millimeters (about 0.2 inch); medium, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and coarse, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are very slow (less than 0.06 inch), slow (0.06 to 0.20 inch), moderately slow (0.2 to 0.6 inch), moderate (0.6 to 2.0

inches), moderately rapid (2.0 to 6.0 inches), rapid (6.0 to 20 inches), and very rapid (more than 20 inches)

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water forms subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

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.

Second bottom. The first terrace above the normal flood plain of a stream.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

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.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that 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 quality. An attribute of a soil that cannot be seen or measured directly but which is inferred from the characteristics and behavior of the soil under defined conditions. Fertility, productivity, and erodibility are examples of soil qualities.

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining 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.

Surface soil. 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."

Talus. Fragments of rock and other soil material accumulated by force of gravity at the base of cliffs or steep slopes.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent.—A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian.—A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched.—A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to capability unit groups, read the introduction to the section for general information concerning management of the soils.

Map symbol	Mapping unit		Capability unit		Woodland group
		Page	Symbol	Page	Number
AeC	Allen loam, 5 to 12 percent slopes	14	IIIe-1	46	3o
AeD	Allen loam, 12 to 20 percent slopes	16	IVe-1	47	3o
AeE	Allen loam, 20 to 35 percent slopes	16	VIe-1	48	3r
AnD3	Allen clay loam, 12 to 25 percent slopes, severely eroded	16	VIe-1	48	4c
At	Atkins silt loam	17	IIIw-1	46	2w
BeB	Bewleyville silt loam, 2 to 5 percent slopes	17	IIe-1	45	3o
BeC	Bewleyville silt loam, 5 to 12 percent slopes	17	IIIe-1	46	3o
BdF	Bodine cherty silt loam, 25 to 50 percent slopes	18	VIIs-1	48	4f
Bn	Bonair silt loam	19	IIIw-1	46	2w
BoF	Bouldin stony loam, 25 to 50 percent slopes	19	VIIs-1	48	3x
ChC2	Christian silt loam, 5 to 12 percent slopes, eroded	20	IVe-2	47	3o
ChD2	Christian silt loam, 12 to 20 percent slopes, eroded	20	VIe-2	48	3o
CnC2	Christian cherty silt loam, 5 to 12 percent slopes, eroded	20	IVe-2	47	3r
CnD2	Christian cherty silt loam, 12 to 20 percent slopes, eroded	21	VIe-2	48	3r
CnE2	Christian cherty silt loam, 20 to 35 percent slopes, eroded	21	VIe-2	48	3r
CsD3	Christian cherty silty clay loam, 5 to 20 percent slopes, severely eroded	21	VIe-2	48	4c
CuB	Curtistown silt loam, 2 to 5 percent slopes	22	IIe-1	45	2o
DeB	Decatur silt loam, 2 to 5 percent slopes	23	IIe-1	45	3o
DeC2	Decatur silt loam, 5 to 12 percent slopes, eroded	23	IIIe-1	46	3o
DkB	Dickson silt loam, 1 to 3 percent slopes	23	IIe-3	45	3o
Em	Emory silt loam	24	I-1	45	2o
EtB	Etowah silt loam, 2 to 5 percent slopes	25	IIe-1	45	2o
EtC	Etowah silt loam, 5 to 12 percent slopes	25	IIIe-1	46	2o
EtD	Etowah silt loam, 12 to 20 percent slopes	25	IVe-1	47	2o
EwC	Etowah cherty silt loam, 5 to 12 percent slopes	25	IIIe-1	46	2o
EwD	Etowah cherty silt loam, 12 to 20 percent slopes	25	IVe-1	47	2o
EwE	Etowah cherty silt loam, 20 to 35 percent slopes	26	VIe-1	48	2r
GpD	Gilpin silt loam, 12 to 20 percent slopes	26	IVe-1	47	3o
GpE	Gilpin silt loam, 20 to 40 percent slopes	26	VIe-1	48	3r
Gr	Greendale silt loam	27	I-1	45	2o
Gu	Guthrie silt loam	27	IVw-1	47	2w
Ha	Hamblen silt loam	29	IIw-1	46	2w
HsB	Hartsells loam, 2 to 5 percent slopes	29	IIe-2	45	4o
HsC	Hartsells loam, 5 to 12 percent slopes	29	IIIe-2	46	4o
JfC	Jefferson loam, 5 to 12 percent slopes	30	IIIe-1	46	3o
JfD	Jefferson loam, 12 to 20 percent slopes	30	IVe-1	47	3o
JfE	Jefferson loam, 20 to 35 percent slopes	30	VIe-1	48	3r
LoB	Lonewood silt loam, 2 to 5 percent slopes	31	IIe-2	45	3o
LoC	Lonewood silt loam, 5 to 12 percent slopes	31	IIIe-2	46	3o
LwC	Lonewood loam, 3 to 12 percent slopes	32	IIIe-2	46	3o
Me	Melvin silt loam	32	IIIw-1	46	2w
MnC	Minvale cherty silt loam, 5 to 12 percent slopes	33	IIIe-1	46	3o
MnD	Minvale cherty silt loam, 12 to 20 percent slopes	33	IVe-1	47	3o
MoB	Mountview silt loam, 2 to 5 percent slopes	34	IIe-1	45	3o
MoC	Mountview silt loam, 5 to 12 percent slopes	34	IIIe-1	46	3o
NeD	Nella cobbly loam, 5 to 20 percent slopes	34	VIe-1	48	3x
NeE	Nella cobbly loam, 20 to 45 percent slopes	35	VIIe-1	48	3x
RaD	Ramsey loam, 5 to 20 percent slopes	35	VIIe-1	48	4d
RaE	Ramsey loam, 20 to 40 percent slopes	36	VIIe-1	48	4d
RcD	Ramsey-Rock outcrop complex, 5 to 20 percent slopes	36	VIIs-1	48	5x
RcE	Ramsey-Rock outcrop complex, 20 to 50 percent slopes	36	VIIs-1	48	5x
RoF	Rock outcrop-Ramsey complex, 35 to 75 percent slopes	36	VIIs-1	48	5x

Map symbol	Mapping unit	Page	Capability unit Symbol	Capability unit Page	Woodland group Number
Sa	Sequatchie loam	37	I-1	45	2o
Se	Sewanee loam	37	IIw-1	46	2w
Ss	Staser silt loam	38	I-1	45	2o
Ta	Taft silt loam	38	IIIw-2	47	3w
TbC2	Talbott silt loam, 5 to 12 percent slopes, eroded	39	IVe-2	47	3c
TcD	Talbott silty clay loam, 5 to 20 percent slopes, rocky areas	39	VIe-2	48	4x
TcE	Talbott silty clay loam, 20 to 50 percent slopes, rocky areas	39	VIIs-1	48	4x
TrD	Talbott-Rock outcrop complex, 5 to 20 percent slopes	39	VIIs-1	48	5x
TrF	Talbott-Rock outcrop complex, 20 to 50 percent slopes	40	VIIs-1	48	5x
TtB	Tilsit silt loam, 2 to 5 percent slopes	41	IIe-3	45	3o
Um	Udorthents-Mine pits complex	41	VIIs-2	48	5x
WaB	Waynesboro loam, 2 to 5 percent slopes	42	IIe-1	45	3o
WaC	Waynesboro loam, 5 to 12 percent slopes	42	IIIe-1	46	3o
WaD	Waynesboro loam, 12 to 20 percent slopes	42	IVe-1	47	3o
WaE2	Waynesboro loam, 20 to 35 percent slopes, eroded	42	VIe-1	48	3r
WbC3	Waynesboro clay loam, 5 to 12 percent slopes, severely eroded	42	IVe-1	47	4c
WbD3	Waynesboro clay loam, 12 to 20 percent slopes, severely eroded	43	VIe-1	48	4c
We	Welchland cobbly loam	43	IIs-1	45	3x

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