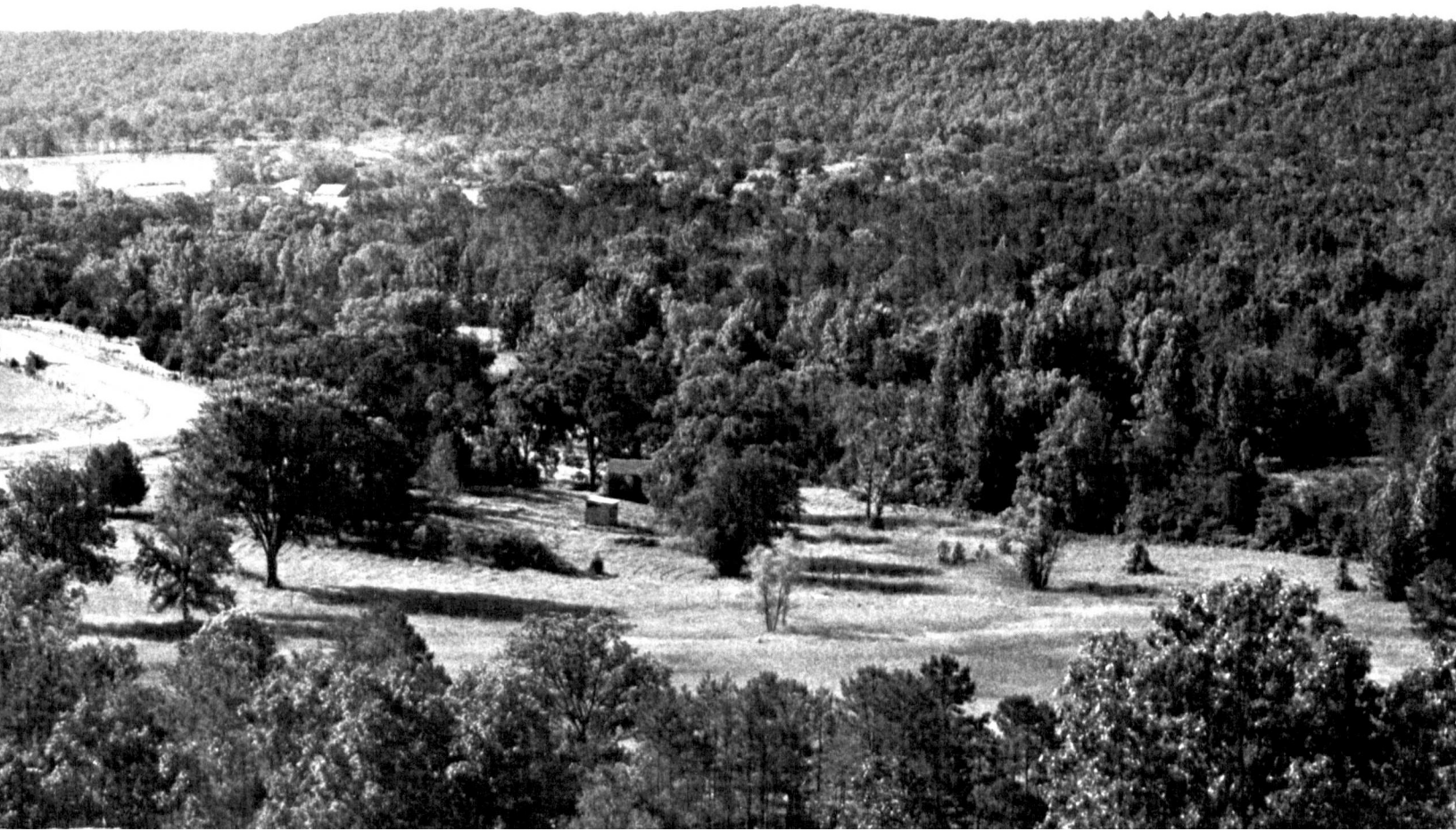
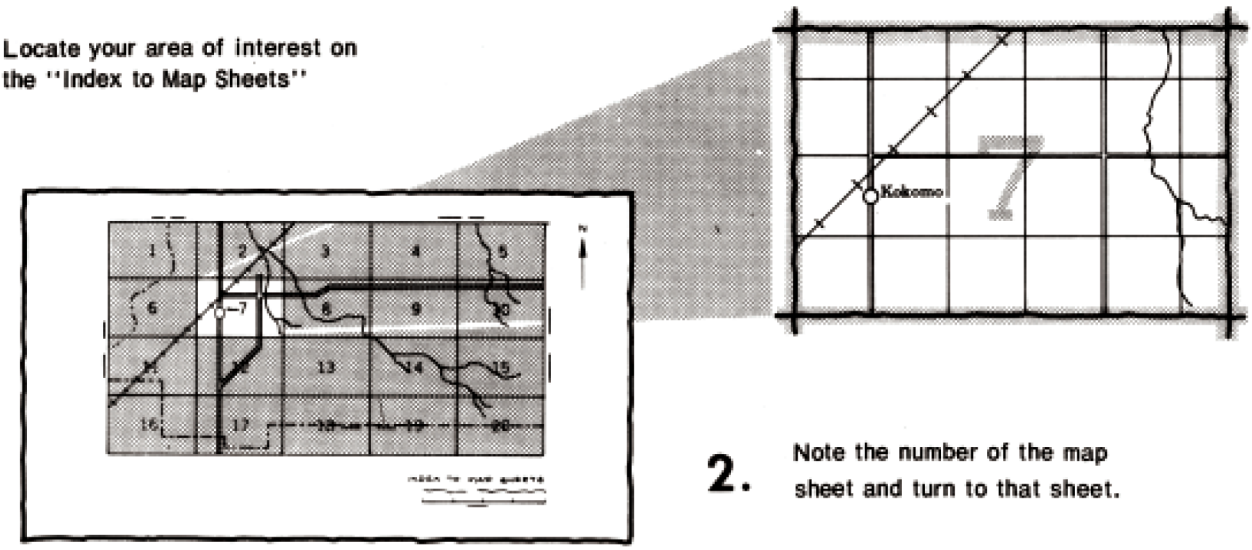
soil survey of
Logan County, Arkansas

United States Department of Agriculture
Soil Conservation Service
and Forest Service
in cooperation with
Arkansas Agricultural Experiment Station



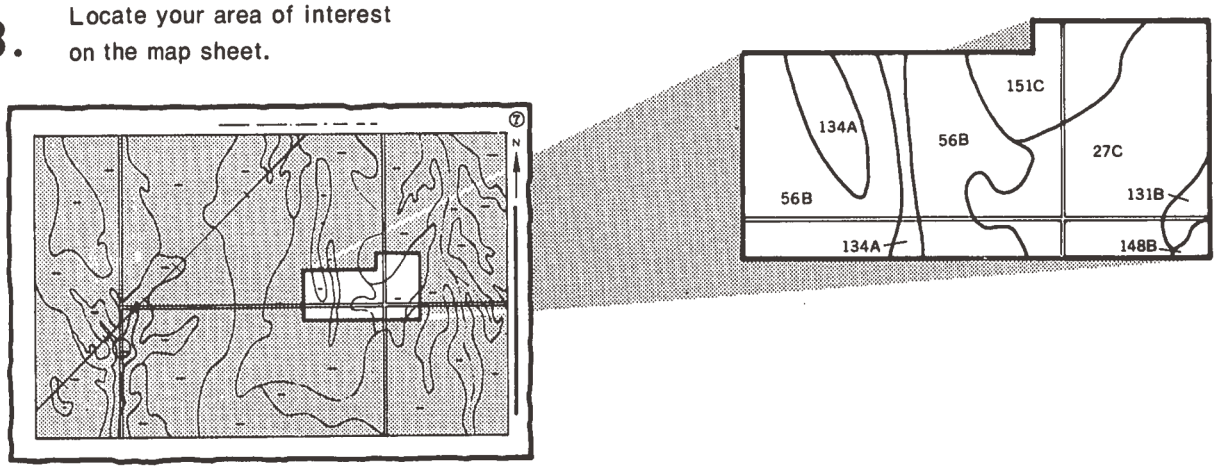
HOW TO USE

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

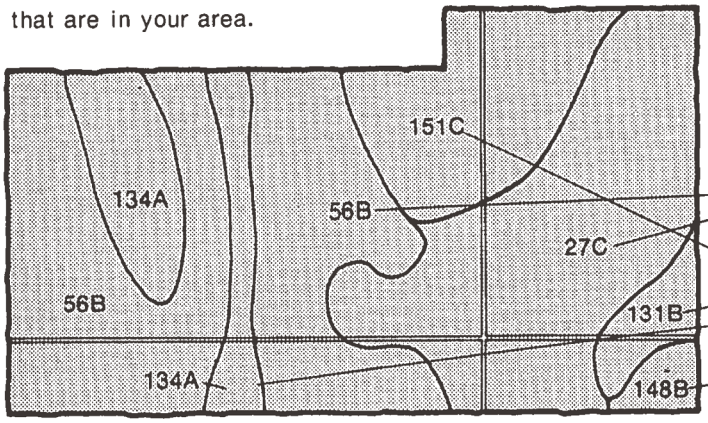


2. Note the number of the map sheet and turn to that sheet.

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



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

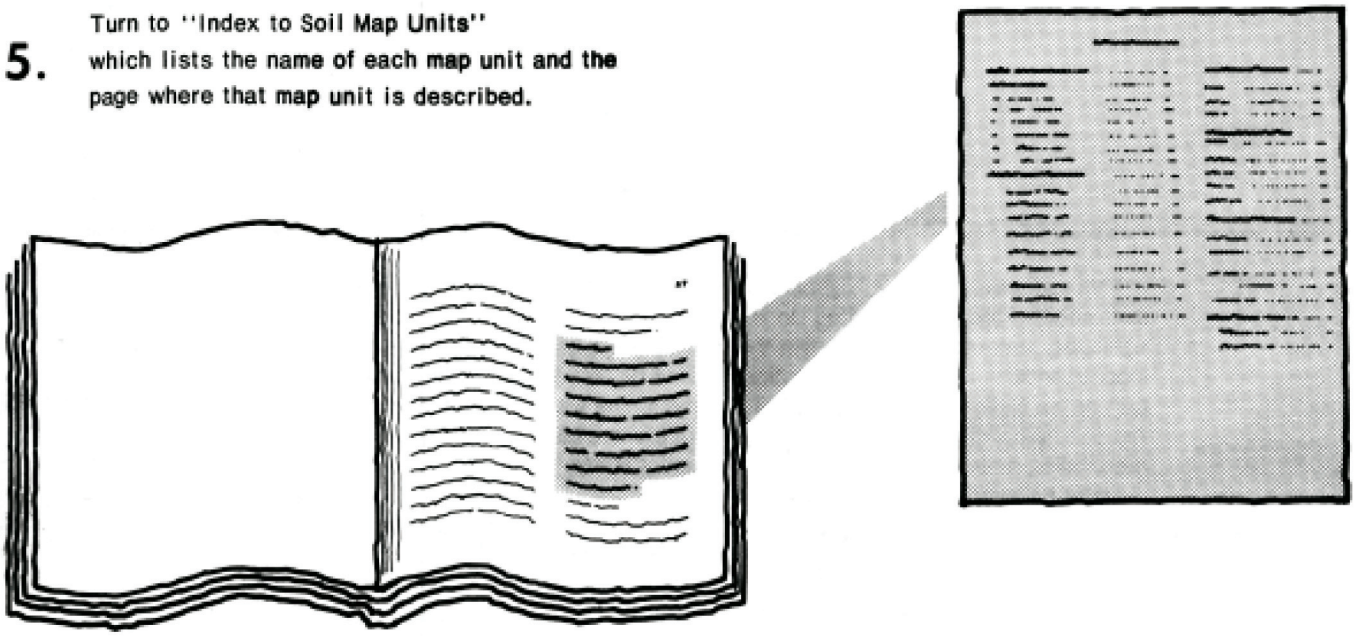


Symbols

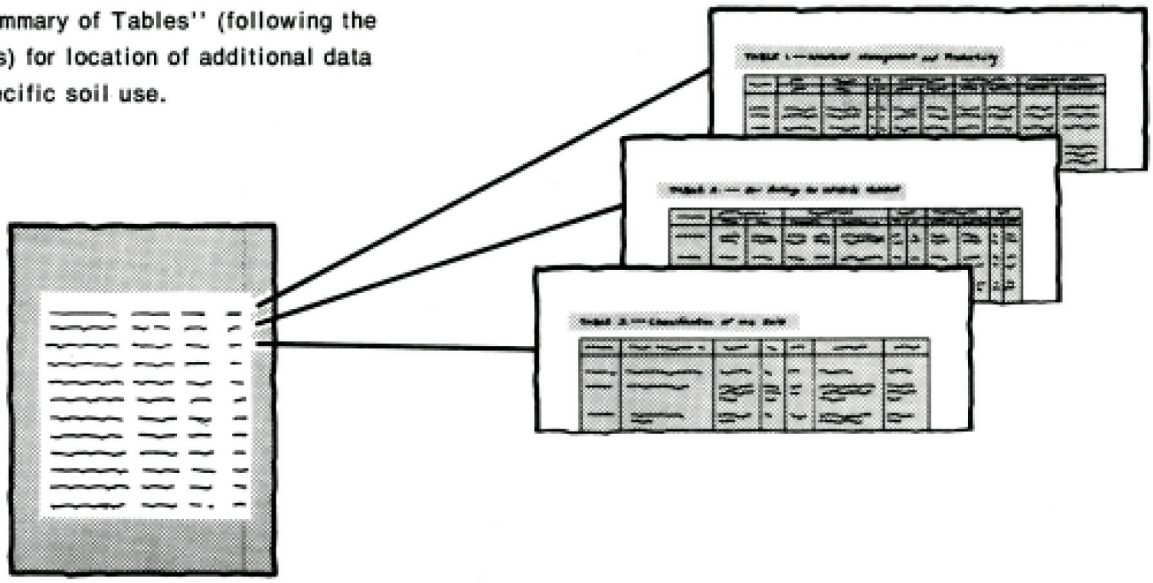
27C
56B
131B
134A
148B
151C

THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1968-76. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service, the Forest Service, and the Arkansas Agricultural Experiment Station. It is part of the technical assistance furnished to the Logan County Conservation District.

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

Cover: Leadvale soils are dominant in the valley, and Enders and Mountainburg soils are dominant on the mountains.

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soil series

Issued November 1980

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foreword

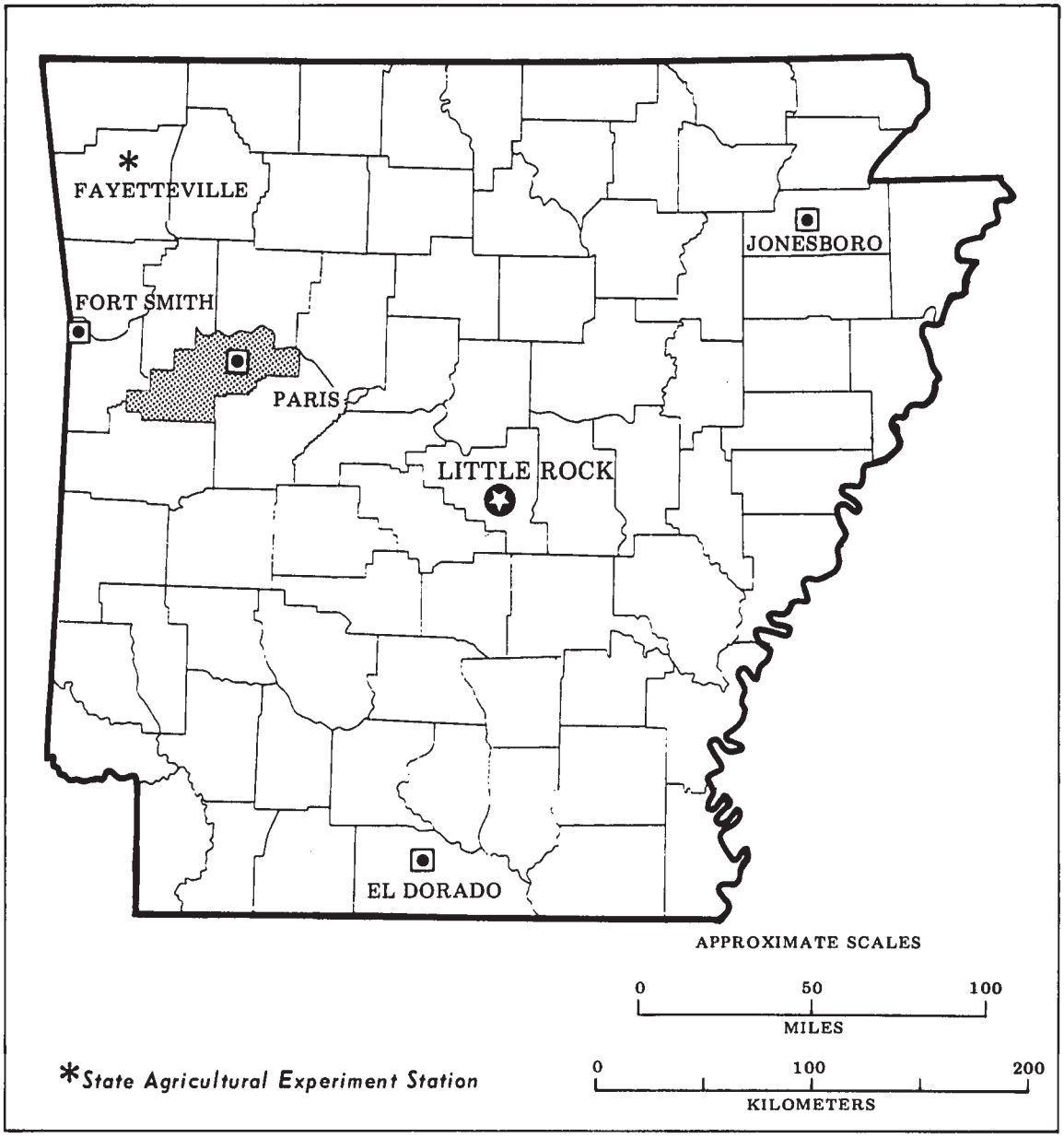
This soil survey contains information that can be used in land-planning programs in Logan County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of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

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

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

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

Maurice J. Spears
State Conservationist
Soil Conservation Service



Location of Logan County in Arkansas.

soil survey of
Logan County, Arkansas

By Bill A. Garner, John B. Cox, Frank M. Vodrazka,
and Alex L. Winfrey, Soil Conservation Service

United States Department of Agriculture
Soil Conservation Service and Forest Service
in cooperation with the
Arkansas Agricultural Experiment Station

Logan County is in the western part of Arkansas. It ranges from about 6 to 26 miles in width and is about 50 miles long. The county is bounded on the north by the Arkansas River and Franklin County, on the east by Yell County, on the south by Scott County and Yell County, and on the west by Scott County, Sebastian County, and Franklin County. The total area is 732 square miles, or 468,480 acres.

In 1970, the population of the county was 16,789. Paris, the main county seat, had a population of 3,646. Booneville, the other county seat and next largest town, had a population of 3,239. Most of the people in the county, including more than half of the farmers, work in industries or supporting businesses in Paris and Booneville.

In 1967, about 12 percent of the survey area was used for crops, and about 10 percent was used for pasture and hay (*5*). The potential of the soils in Logan County for increased production of crops is good. Considerable acreage of potentially good cropland is currently used as woodland or pasture. In addition to the reserve production capacity represented by that acreage, food production could also be increased considerably by applying the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. It was estimated that in 1976 there were about 27,000 acres of urban and built-up land in the county. That figure continues to grow at a steady rate.

The soils in Logan County, except for those on the Arkansas River flood plain, are low in nitrogen, potassium, phosphorus, and calcium and in organic matter. Many of the soils that are suitable for cultivation are erodible. Poor surface drainage or internal drainage and susceptibility to flooding are limitations in places. Many soils are poorly suited to crops and pasture because of stoniness, shallowness to bedrock, high content of coarse fragments within the soil, or a combination of these features.

general nature of the county

About 60 percent of the county is mountainous and hilly. The elevation ranges from about 500 feet at the base of the hills and mountains to 2,823 feet on the top of Magazine Mountain. In most areas the soils are too steep for intensive use. They are used mainly for production of wood corps and for native pasture. Some of the less sloping soils are suitable for improved pasture, and some soils in the narrow valleys are suitable for truck crops.

About 40 percent of the county is level to gently sloping. The areas range from young flood plains along the Arkansas River to old stream terraces in broad valleys. The elevation ranges from about 350 feet where the old channel of Six Mile Creek runs into the Arkansas River in the northeastern part of the county to about 500 feet at the top of the old stream terraces. Except for the soils on bottom lands along the Arkansas River that are intensively farmed, the soils in this part of the county are used mainly for forage crops.

farming

Farming in Logan County began on soils that had good natural drainage. These soils were in high positions near the flood plain of the Arkansas River, on hills, and in valleys. Cotton was the main cash crop. Most of the better drained soils were cleared for farming, and the areas of steep, stony, or wet soils were left as woodland.

Farming has become more diversified and generally less intensive. In the areas of ridges and valleys, dairying and raising beef cattle, hogs, pigs, and poultry, including turkeys, broiler chickens, and laying hens, now provide most of the farm income. Some farms have a small acreage in orchards, vineyards, and vegetables.

Because of flood control, improved crop varieties, and other management practices, nearly all of the flood plain along the Arkansas River is used as cropland. Most of the woodland on the bottom lands along the river has been cleared, and natural drainage on wet soils has been improved for more reliable crop production.

On bottom land farms, soybeans is the main crop, but grain sorghum and winter small grains are also grown.

Table 1 shows the acreage of principal crops and pasture in the county, and table 2 shows the kind and number of livestock on farms in 1969 and in 1974.

In 1974, according to the Census of Agriculture of that year, about 42 percent of the land area in the county was in farms. The rest consisted mainly of cities and built-up areas and federally owned land within the Ozark and Ouachita National Forests and land within the flood control project areas of the U.S. Army Corps of Engineers.

Farms in Logan County are decreasing in number and size. Between 1969 and 1974, the number of farms decreased from 1,050 to 1,021, and the average size decreased from 201 to 193 acres.

From 1969 to 1974, farms larger than 500 acres decreased from 77 to 71, and farms smaller than 500 acres decreased from 953 to 950. Of the farm operators in the county in 1974, 734 were full owners, 220 were part owners, and 67 were tenants. Of the operators, 444 worked off the farm for 100 days or more.

physiography and drainage

The Arkansas River flows eastward and forms the northern boundary of the county. Its flood plain is a relatively narrow strip that parallels the course of the river. The most fertile soils in the county, Dardanelle and Roxana soils, are in this area. The flow of the Arkansas River is regulated by major flood control impoundments upstream and by a series of locks and dams that form navigable pools. The Arkansas River is navigable to bare traffic all year round. The river is used also for fishing and boating.

Two mountainous areas rise from the Arkansas Valley in Logan County. Magazine Mountain is in the central part of the county, and the northern edge of the Ouachita Mountains is in the southern part.

Magazine Mountain and surrounding mountains are drained by Shoal Creek, Stinnett Creek, Bigger Creek, Delaware Creek, Cove Creek, and Wicked Creek. The Ouachita Mountain area in Logan County is drained by Sugar Creek, Jack Creek, Dry Creek, and Fletcher Creek. These mountains are capped by sandstone, and the sides are interbedded sandstone and shale. The slope ranges from 3 to 50 percent. The elevation ranges from about 500 feet to 2,823 feet.

The rest of the county consists of rolling, flat-topped hills, long narrow ridges, and broad valleys. The hilltops and ridges are capped with hard sandstone. The hillsides and valleys are mostly underlain by shale. The slope ranges from 1 to 30 percent. The elevation ranges from about 370 to about 500 feet. This area is drained by streams, including Petit Jean River, Sugar Creek, Six Mile Creek, Short Mountain Creek, and Cane Creek.

The main soils on the mountains and hills are Mountainburg, Enders, and Nella soils. The main soils on the ridges are Linker and Mountainburg soils. And those in the broad valleys are Leadvale and Taft Soils. Ground water is insufficient for large-scale irrigation. Domestic water is supplied mainly by dug wells and drilled wells. Livestock water is supplied mainly by ponds and creeks.

climate

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

Table 3 gives data on temperature and precipitation for the survey area as recorded at Subiaco, Arkansas, in the period 1951 to 1973. Table 4 shows probable dates of the first freeze in fall and the last freeze in spring. Table 5 provides data on length of the growing season.

In winter the average temperature is 43 degrees F, and the average daily minimum temperature is 31 degrees. The lowest temperature on record, which occurred at Subiaco on February 2, 1951, is -7 degrees. In summer the average temperature is 80 degrees, and the average daily maximum temperature is 92 degrees. The highest recorded temperature, which occurred on July 13, 1954, is 113 degrees.

Growing degree days are shown in table 3. They are equivalent to "heat units." During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 45 inches. Of this, 25 inches, or 56 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 5.48 inches at Subiaco on July 16, 1970. Thunderstorms occur on about 60 days each year, and most occur in summer.

Average seasonal snowfall is 5 inches. The greatest snow depth at any one time during the period of record was 6 inches. On an average of 2 days, at least 1 inch of snow is on the ground. The number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the northeast. Average windspeed is highest, 10 miles per hour, in March.

how this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

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

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

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

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

general soil map units

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

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

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

The soils in the survey area vary widely in their potential for major land uses. In the descriptions of the map units that follow, the soil potential ratings that are given are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for cultivated crops, pasture, woodland, and urban uses. Cultivated crops are those grown extensively in the survey area. Pasture crops are those grown for livestock forage. Woodland refers to areas of native or introduced trees. Urban uses include residential, commercial, and industrial developments.

Soil descriptions

1. Enders-Nella

Well drained, gently sloping to steep, deep, loamy and gravelly or stony soils; on hills and mountains

These soils are mainly in the southeastern part of the county. They formed in loamy and clayey residuum of sandstone and shale. Natural drainageways are mainly fast-flowing intermittent streams. There are a few perennial streams.

This map unit makes up about 17 percent of the county. About 40 percent of the unit is Enders soils, 28 percent is Nella soils, and 32 percent is soils of minor extent.

Enders soils are on hillsides and mountainsides. They have a surface layer of dark brown gravelly or stony silt loam and a subsoil of yellowish red silty clay.

Nella soils are on foot slopes of hills and mountains and on benches. They have a surface layer of dark grayish brown gravelly fine sandy loam and a subsoil of yellowish red, red, and dark red gravelly clay loam.

The minor soils are the well drained Linker, Mountainburg, and Spadra soils.

The soils in this unit are used mainly as woodland.

The soils are poorly suited to cultivated crops and have poor potential for pasture. Steep slopes, a very severe hazard of erosion, and gravel and stones on the surface are the main limitations. The soils have fair potential for woodland use. Steep slopes and the hazard of erosion are the main limitations. Stones on the surface are a severe limitation in some areas. Because of the high shrink-swell potential and the steep slopes, the Enders soils have poor potential for most urban uses. The Nella soils have fair potential for most urban uses where slopes are less than 15 percent and poor potential where slopes are more than 15 percent. Low strength is a limitation for local roads and streets.

2. Enders-Mountainburg

Well drained, gently sloping to steep, deep and shallow, loamy and gravelly or stony soils; on hills and mountains

These soils formed throughout the county in loamy and clayey residuum of sandstone and shale. Natural drainageways are mainly fast-flowing intermittent streams. There are a few perennial streams.

This map unit makes up about 31 percent of the county. About 68 percent of the unit is Enders soils, 18 percent is Mountainburg soils, and 14 percent is soils of minor extent.

Enders soils are on hillsides and mountainsides. They are deep and have a surface layer of dark brown gravelly or stony silt loam and a subsoil of yellowish red silty clay.

Mountainburg soils are on hilltops and mountaintops and on ledges and benches. They are shallow and have a surface layer of dark brown gravelly or stony fine sandy loam and a subsoil of brown and yellowish red very gravelly fine sandy loam.

The minor soils are the well drained Linker, Nella, and Spadra soils and the moderately well drained Leadvale soils.

The soils in this unit are used mainly as woodland.

The soils are not suited to cultivated crops, and they have poor potential for use as pasture. Steep slopes and stones on the surface are the main limitations. Shallowness is a further limitation on the Mountainburg soils. The potential for woodland use is fair. Steep slopes and stones on the surface are the main limitations, and shallowness is a further limitation on the Mountainburg soils. Because of the high shrink-swell potential and steepness of the slope, the Enders soils have poor potential for most urban uses. Low strength is a limitation for local roads and streets. The Mountainburg soils have poor potential for most urban uses because of shallowness to rock and slope.

3. Leadvale

Moderately well drained, nearly level to gently sloping, deep, loamy soils; on old stream terraces in broad valleys

These soils formed throughout the county in loamy sediment of weathered sandstone and shale that washed from local uplands. Natural drainageways are mainly slow-flowing intermittent streams.

This map unit makes up about 38 percent of the county. About 61 percent of the unit is Leadvale soils, and 39 percent is soils of minor extent.

Leadvale soils are on old stream terraces in broad valleys. These soils have a surface layer of dark brown silt loam and a subsoil of yellowish brown silty clay loam.

The minor soils are the moderately well drained Barling, Cane, and Muskogee soils and the well drained Enders, Linker, McKamie, Mountainburg, and Spadra soils.

The soils in this unit are used mainly as pasture (fig. 1). There are small areas of hardwood trees along drainageways.

The soils have good to fair potential for cultivated crops. The hazard of erosion is the main limitation. The soils have good potential for use as pasture and woodland. There are no significant limitations. These soils have fair potential for most urban uses. Wetness

Figure 1.—Tall fescue pasture on Leadvale silt loam, 1 to 3 percent slopes.

and slow to moderately slow permeability are the main limitations. Low strength is a limitation for local roads and streets.

4. Linker-Mountainburg

Well drained, gently sloping to moderately sloping, moderately deep and shallow, loamy and gravelly or stony soils; on hills, mountains, and ridges

These soils formed throughout the county in loamy residuum of horizontally bedded sandstone. Natural drainageways are mainly fast-flowing intermittent streams.

This map unit makes up about 8 percent of the county. About 71 percent of the unit is Linker soils, 25 percent is Mountainburg soils, and 4 percent is soils of minor extent.

Linker soils are on hilltops and mountaintops. They are moderately deep. They have a surface layer of very dark grayish brown fine sandy loam and a subsoil of yellowish red and red clay loam.

Mountainburg soils are on side slopes and benches, on hilltops and mountaintops, and on low ridges in valleys. They are shallow and have a surface layer of dark brown gravelly or stony fine sandy loam and a subsoil of brown and yellowish red very gravelly fine sandy loam.

The minor soils in this association are the well drained Enders soils and the moderately well drained Leadvale soils.

The soils in this unit are used mainly as woodland. There are small areas of pasture.

These soils are not suited to cultivated crops or at best have fair potential for crops. They have fair to poor potential for pasture. Steep slopes, shallowness, and stones on the surface are the main limitations. The soils have fair to poor potential for use as woodland. The main limitations are shallow rooting depth and stones on the surface. Because they are moderately deep and gently sloping, the Linker soils have only fair potential for most urban uses. The Mountainburg soils have poor potential for most urban uses because of shallowness to rock and slope.

5. Roxana-Dardanelle-Roellen

Well drained and poorly drained, level, deep, loamy and clayey soils; on natural levees and flood plains of the Arkansas River

These soils are in the northern part of the county. They formed in loamy and clayey alluvium deposited by the Arkansas River. Natural drainageways are mostly slow-flowing intermittent streams.

This map unit makes up about 3 percent of the county. About 26 percent of the unit is Roxana soils, 22 percent is Dardanelle soils, 17 percent is Roellen soils, and 35 percent is soils of minor extent.

Roxana soils are in higher positions on natural levees. They are well drained. They have a surface layer of dark reddish brown silt loam and a substratum of brown and strong brown very fine sandy loam and loamy very fine sand.

Dardanelle soils are in lower positions on natural levees. They are well drained. They have a surface layer of dark brown silt loam and a subsoil of dark brown and brown silty clay loam.

Roellen soils are in slack-water areas on flood plains. They are poorly drained. They have a surface layer of very dark gray silty clay and a subsoil of dark gray clay.

The minor soils in this map unit are the excessively drained Crevasse soils and the somewhat poorly drained Moreland soils.

These soils have good potential for cultivated crops and are used mainly as cropland. There are no significant limitations in most areas, but areas between the levee and the Arkansas River are subject to occasional flooding. The soils have good potential for pasture and woodland use. There are no significant limitations.

Roxana soils have good potential for most urban uses. In areas that are flooded occasionally, they have poor potential. Dardanelle soils have fair potential for most urban uses because of their shrink-swell potential and moderate permeability. Where they are subject to flooding, they have poor potential. Low strength is a limitation for local roads and streets. Roellen soils have poor potential for most urban uses because of their high shrink-swell potential, wetness, and slow permeability.

6. Barling-Spadra

Moderately well drained and well drained, level to nearly level, deep, loamy soils; on flood plains and stream terraces

These soils formed in loamy alluvium along the Petit Jean River and Sugar Creek. Natural drainageways are slow-flowing intermittent streams.

This map unit makes up about 3 percent of the county. About 47 percent of the unit is Barling soils, 37 percent is Spadra soils, and 16 percent is soils of minor extent.

The Barling soils are on flood plains at slightly lower elevations and farther from the streams than the Spadra soils. The Barling soils are moderately well drained. They have a surface layer of dark brown silt loam and a subsoil of pale brown and mottled yellowish brown and gray silt loam.

Spadra soils are on stream terraces. They are well drained. They have a surface layer of dark yellowish brown silt loam and a subsoil of brown and yellowish red loam and fine sandy loam.

The minor soils are the moderately well drained Leadvale and the poorly drained Guthrie soils.

The soils in this map unit are used mainly as pasture.

These soils have good potential for cultivated crops, but erosion control measures are needed in most areas. Occasional flooding is a limitation. The soils have good potential for pasture and woodland use. Occasional

flooding is the main limitation. The soils have poor potential for most urban uses because of flooding.

Broad land use considerations

Each year more land is converted to urban uses in Paris, Booneville, and other cities in the county. It is estimated that about 27,000 acres are presently urban or built-up land. The general soil map is helpful in planning for urban uses; however, it cannot be used in selecting sites for specific urban structures. The data about specific soils in this survey can be helpful in planning future land use patterns.

Generally, soils that have good potential for cultivated crops have good potential for urban development. Soils that are so unfavorable that urban development is prohibitive are not extensive in the survey area. However, parts of the Barling-Spadra map unit and of the Roxana-Dardanelle-Roellen map unit are on flood plains. On these soils, flooding is a severe limitation for urban development. Also, shrink-swell potential, shallowness, and steep slopes are severe limitations in some areas of the Enders-Nella map unit, the Enders-Mountainburg map unit, and the Linker-Mountainburg map unit. Wetness, low strength, and slow permeability are severe limitations in areas of the Leadvale map unit.

In the areas of the Roxana-Dardanelle-Roellen map unit that are protected by levees the soils have good potential for urban development. These soils also have good potential for use as farmland, and this potential should be considered in planning broad land uses.

In some areas of the Roxana-Dardanelle-Roellen map unit, the soils have good potential for farming but poor potential for urban development. Wetness, low strength, and shrink-swell potential are the main limitations for urban uses. These limitations generally can be overcome through proper engineering design. It should be noted, however, that because the soils have good potential for farming, many farmers have provided sufficient drainage to make crop production possible.

In some areas of the Roxana-Dardanelle-Roellen map unit and of the Barling-Spadra map unit, the soils are well suited to vegetables and other specialty crops. These soils are well drained and warm up early in spring. They are also well suited to nursery crops.

The soils in Logan County have poor to good potential for woodland use. In most areas of the Roxana-Dardanelle-Roellen map unit and the Barling-Spadra map unit, the soils have good potential for the production of bottom land hardwoods. In some areas of the Enders-Nella map unit, the Enders-Mountainburg map unit, and the Linker-Mountainburg map unit, the soils have fair to poor potential for the production of pine and upland hardwoods.

detailed soil map units

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Enders silt loam, 3 to 8 percent slopes, is one of several phases in the Enders series.

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

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Nella-Enders association, steep, is an example.

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

Table 6 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

1—Barling silt loam, occasionally flooded. This is a deep, moderately well drained, level and nearly level soil on flood plains of local streams. The soil is flooded once every 3 or 4 years for brief periods between December and April. Slopes are 0 to 2 percent. Individual areas are long and narrow and range from about 50 to 400 acres in size.

Typically, the surface layer is dark brown silt loam about 7 inches thick. The layer below that is brown silt loam and extends to a depth of about 14 inches. The subsoil is brown silt loam to a depth of about 22 inches, pale brown mottled silt loam to a depth of about 34 inches, and mottled yellowish brown, gray, strong brown, and grayish brown silt loam to a depth of 80 inches or more.

This soil is moderate in natural fertility and in content of organic matter. The surface layer is slightly acid to strongly acid, and the subsoil is slightly acid to very strongly acid. Permeability is moderate, and the available water capacity is high. Crops on this soil respond well to fertilizer. The soil is easy to till and can be cultivated within a wide range of moisture content.

Included with this soil in mapping are small areas of Guthrie, Leadvale, and Spadra soils. The poorly drained Guthrie soils are in level depressional areas, the moderately well drained Leadvale soils are in higher positions, and the well drained Spadra soils are in the same positions on the landscape as the Barling soil but are nearer to the stream.

The Barling soil has good potential for cultivated crops, including soybeans, truck crops, grain sorghum, and small grains. A sizeable acreage is used for soybeans. Most areas are flooded every 3 to 4 years, but rarely between April and December. Erosion is a slight to moderate hazard. Clean-tilled crops that leave large amounts of residue on the surface can be grown safely year after year if good management practices are used, including winter cover crops.

This soil has good potential for pasture. It is used mainly as pasture and is suited to bahiagrass, bermudagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is good. The soil is suited to southern red oak, sweetgum, eastern cottonwood, and shortleaf pine. There are no significant limitations to woodland use and management.

This soil has poor potential for most urban uses. Occasional flooding is a severe limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. This limitation can be overcome only by major flood control measures.

This soil is in capability unit IIw-1 and in woodland suitability group 2o7.

2—Cane fine sandy loam, 3 to 8 percent slopes. This is a deep, moderately well drained, gently sloping soil on colluvial foot slopes and on old stream terraces in broad valleys. Individual areas range from about 10 to 300 acres in size.

Typically, the surface layer is dark brown fine sandy loam about 5 inches thick. The subsoil is yellowish red, friable clay loam to a depth of about 30 inches, yellowish brown and strong brown, mottled, compact and brittle clay loam to a depth of about 58 inches, and mottled yellowish brown, strong brown, and light gray clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. The surface layer is medium acid to strongly acid, and the subsoil is strongly acid or very strongly acid. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is medium. The compact and brittle fragipan in the subsoil restricts root penetration and slows the movement of water through the soil. Crops and grasses on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Enders and Leadvale soils. The well drained Enders soils are in higher positions on the landscape than the Cane soil; the Leadvale soils and the Cane soil are in similar positions. Also included are a few small areas where the slope is as much as 12 percent and a few small areas where the soil is more than 15 percent gravel.

The Cane soil has fair potential for cultivated crops. Runoff is rapid, and erosion is a severe hazard. Clean-tilled crops that leave a large amount of residue on the surface can be grown safely year after year in the less sloping areas if good management practices are used, including contour cultivation and terraces. Conservation treatment needs to be intensified as slope increases. The soil is suited to soybeans, truck crops, grain sorghum, and small grains.

This soil has good potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is good. The soil is suited to loblolly pine, shortleaf pine, and sweetgum. There are no significant limitations to woodland use and management.

This soil has fair potential for most urban uses. Wetness is a moderate limitation for dwellings and small commercial buildings, and low strength is a moderate limitation for local streets and roads. These limitations can be overcome through proper engineering design. Slow permeability is a severe limitation for septic tank absorption fields. This limitation is difficult to overcome.

This soil is in capability unit IIIe-1 and in woodland suitability group 3o7.

3—Crevasse loamy fine sand, 0 to 3 percent slopes. This is a deep, excessively drained, level to nearly level soil on flood plains of the Arkansas River. Levees protect the soil from flooding. Individual areas range from about 20 to 1,000 acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 10 inches thick. The underlying layers are stratified light yellowish brown fine sand and dark yellowish brown loamy fine sand to a depth of 72 inches.

This soil is low in natural fertility and in content of organic matter. It is slightly acid to moderately alkaline throughout. Permeability is rapid, and the available water capacity is very low. Crops and grasses on this soil respond poorly to fertilizer.

Included with this soil in mapping are a few small areas of Roxana soils. The well drained Roxana soils are on older natural levees.

The Crevasse soil has poor potential for cultivated crops. Droughtiness is a severe limitation. If the soil is left bare, wind erosion is a severe hazard in spring.

The soil has fair potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, and weeping lovegrass. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood and American sycamore. The sandy surface is a moderate limitation to the use of equipment. Droughtiness results in a severe seedling mortality rate.

This soil has good potential for most urban uses. It has slight limitations for dwellings, small commercial buildings, and local streets and roads. Wetness is a moderate limitation for septic tank absorption fields. This limitation can be overcome if the soil is adequately drained.

This soil is in capability unit IIIs-1 and in woodland suitability group 2s6.

4—Crevasse loamy fine sand, frequently flooded. This is a deep, excessively drained, level to nearly level soil on flood plains of the Arkansas River. These soils are not protected by a levee and are flooded at least once every 2 years. Slopes are 0 to 3 percent. Individual areas range from about 20 to 500 acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 10 inches thick. The underlying layers are stratified light yellowish brown fine sand and dark yellowish brown loamy fine sand and extend to a depth of 72 inches.

This soil is low in natural fertility and in content of organic matter. It is slightly acid to moderately alkaline throughout. Permeability is rapid, and the available water capacity is very low. Crops and grasses on this soil respond poorly to fertilizer.

Included in mapping are a few small areas of Roxana soils. The well drained Roxana soils are on older natural levees.

The Crevasse soil is not suited to cultivated crops. Droughtiness and flooding are severe limitations.

This soil has fair potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, and weeping lovegrass. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood and American sycamore. The sandy surface is a moderate limitation to the use of equipment. Droughtiness results in a severe seedling mortality rate.

The soil has poor potential for most urban uses. Frequent flooding is a severe limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. This limitation can be overcome only by major flood control measures.

This soil is in capability unit Vw-1 and in woodland suitability group 2s6.

5—Dardanelle silt loam, 0 to 1 percent slopes. This is a deep, well drained soil on natural levees along the Arkansas River. Manmade levees protect the soil from flooding. Individual areas range from about 50 to 500 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is dark brown silty clay loam to a depth of about 35 inches and brown silty clay loam to a depth of about 59 inches. The underlying material is reddish brown silt loam to a depth of 72 inches or more.

Natural fertility is high, and the content of organic matter is high. The surface layer is medium acid or slightly acid, the subsoil is medium acid to neutral, and the underlying material is slightly acid to mildly alkaline. Permeability is moderate, and the available water capacity is high. Crops on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Moreland, Roxana, and Roellen soils. The well drained Roxana soils are in slightly higher positions on the landscape than the Dardanelle soil. The somewhat poorly drained Moreland soils and the poorly drained Roellen soils are in the lower slack-water areas. Also included are a few small areas where the surface layer is dark colored and is less than 20 inches thick and a few small areas where the soil is occasionally flooded in winter.

The Dardanelle soil has good potential for cultivated crops and is used mainly as cropland. The principal crop is soybeans. The soil is also suited to cotton, grain sorghum, small grains, truck crops, and alfalfa.

The potential for pasture is good. The soil is suited to bahiagrass, bermudagrass, tall fescue, and white clover. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood, sweetgum, and American sycamore. There are no significant limitations to woodland use or management.

This soil has fair potential for most urban uses. There are only slight limitations for dwellings without basements. Moderate shrink-swell potential is a moderate limitation for small commercial buildings. Low strength is a moderate limitation for local roads and streets, and slow permeability is a moderate limitation for septic tank absorption fields. These limitations can be overcome through proper engineering design.

This soil is in capability unit I-1 and in woodland suitability group 1o4.

6—Dardanelle silt loam, occasionally flooded. This is a deep, well drained, level soil on natural levees along the Arkansas River. This soil is not protected by a levee and is flooded about once every 3 or 4 years. Slopes are 0 to 1 percent. Individual areas range from about 20 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 10 inches thick. The subsoil is dark brown silty clay loam to a depth of about 35 inches and brown silty clay loam to a depth of about 59 inches. The underlying material is reddish brown silt loam to a depth of 72 inches or more.

Natural fertility is high, and the content of organic matter is high. The surface layer is medium acid or slightly acid, the subsoil is medium acid to neutral, and the underlying material is slightly acid to mildly alkaline. Permeability is moderate, and the available water capacity is high. Crops on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Moreland, Roxana, and Roellen soils. The well drained Roxana soils are slightly higher on the landscape than the Dardanelle soil. The somewhat poorly drained Moreland soils and the poorly drained Roellen soils are in the lower slack-water areas. Also included are a few small areas where the surface layer is dark colored and less than 20 inches thick and some

small low areas that are flooded at least once every 2 years for short periods.

The Dardanelle soil has good potential for cultivated crops and is used mainly as cropland. The principal crop is soybeans. The soil is also suited to cotton, grain sorghum, small grains, and alfalfa. This soil is flooded about once every 3 or 4 years between December and March. Erosion is a slight to moderate hazard. Clean-tilled crops that leave large amounts of residue on the surface can be grown safely year after year if good management practices are used, including winter cover crops.

The potential for pasture is good. The soil is suited to bahiagrass, bermudagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood, sweetgum, and American sycamore. There are no significant limitations to woodland use or management.

This soil has poor potential for most urban uses. Occasional flooding is a severe limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. This limitation can be overcome only by major flood control measures.

This soil is in capability unit IIw-1 and in woodland suitability group 1o4.

7—Enders silt loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on crests and toe slopes of ridges and hills. Individual areas range from about 10 to 100 acres in size.

Typically, the surface layer is dark brown silt loam about 3 inches thick. The layer below that is brown silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a depth of 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

The Enders soil is low in natural fertility and in content of organic matter. It is strongly acid to extremely acid throughout. Permeability is very slow, and the available water capacity is medium. Grasses on this soil respond well to fertilizer.

Included with this soil in mapping are a few small areas of Cane, Leadvale, Linker, and Mountainburg soils. The moderately well drained Cane and Leadvale soils are on colluvial foot slopes and old stream terraces. Linker and Mountainburg soils are on ridgetops. Also included are small areas where the surface layer is gravelly silt loam.

The Enders soil has poor potential for cultivated crops. Runoff is rapid, and erosion is a very severe hazard. Under good management, sown crops can be grown occasionally in a cropping system that includes close growing cover most of the time.

This soil has fair potential for hay and pasture. It is used mainly for hay and pasture. It is suited to bahiagrass, bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential is fair for loblolly pine, shortleaf pine, and southern red oak. There are no significant limitations to woodland use and management.

This soil has poor potential for most urban uses. The shrink-swell potential is a severe limitation for dwellings, small commercial buildings, and local streets and roads. Low strength is an additional limitation for local roads and streets. These limitations generally can be overcome through proper engineering design. The very slow permeability is a severe limitation for septic tank absorption fields and is difficult to overcome.

This soil is in capability unit IVe-1 and in woodland suitability group 4o1.

8—Enders silt loam, 8 to 20 percent slopes. This is a deep, well drained, moderately sloping to moderately steep soil on crests and side slopes of ridges and hills. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 3 inches thick. The layer below that is brown silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red mottled silty clay to a depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

This soil is low in natural fertility and in content of organic matter. It is strongly acid to extremely acid throughout. Permeability is very slow, and the available water capacity is medium. Grasses on this soil respond fairly well to fertilizer.

Included with this soil in mapping are a few small areas of Mountainburg soils. The shallow Mountainburg soils are on ridgetops. Also included are a few small areas where the surface layer is gravelly or stony silt loam.

The Enders soil is not suited to cultivated crops. Runoff is rapid, and erosion is a very severe hazard.

The soil has fair potential for pasture. It is suited to bahiagrass, bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has fair potential for woodland use. It is used mainly as woodland. The soil is suited to loblolly pine, shortleaf pine, and southern red oak. There are no significant limitations to woodland use and management.

This soil has poor potential for most urban uses. The shrink-swell potential is a severe limitation for dwellings, small commercial buildings, and local roads and streets. Low strength is an additional limitation for most local roads and streets. Slope is a severe limitation for small commercial buildings. These limitations generally can be overcome through proper engineering design. Slow permeability is a severe limitation for septic tank absorption fields and is very difficult to overcome.

This soil is in capability unit VIe-1 and in woodland suitability group 4o1.

9—Enders gravelly silt loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on crests and toe slopes of ridges and hills. Individual areas range from about 10 to 100 acres in size.

Typically, the surface layer is dark brown gravelly silt loam about 3 inches thick. The layer below that is brown gravelly silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

Natural fertility and the content of organic matter are low. The soil is strongly acid to extremely acid throughout. Permeability is very slow, and the available water capacity is medium. Grasses on this soil respond fairly well to fertilizer.

Included in mapping are small areas of Cane, Leadvale, Linker, and Mountainburg soils. The moderately well drained Cane and Leadvale soils are on adjacent colluvial foot slopes and old stream terraces. Linker and Mountainburg soils are on ridgetops.

The Enders soil has poor potential for cultivated crops. Runoff is rapid, and erosion is a very severe hazard. Gravel on the surface limits the use of equipment. Under good management, sown crops can be grown occasionally in a cropping system that includes close growing cover crops most of the time.

This soil has fair potential for pasture. It is used mainly as pasture. The soil is suited to bahiagrass, bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has fair potential for woodland use. It is suited to loblolly pine, shortleaf pine, and southern red oak. There are no significant limitations to woodland use and management.

This soil has poor potential for most urban uses. The shrink-swell potential is a severe limitation for dwellings, small commercial buildings, and local streets and roads. Low strength is an additional limitation for local roads and streets. These limitations generally can be overcome through proper engineering design. Slow permeability is a severe limitation for septic tank absorption fields and is difficult to overcome.

This soil is in capability unit IVe-1 and in woodland suitability group 4o1.

10—Enders gravelly silt loam, 8 to 20 percent slopes. This is a deep, well drained, moderately sloping to moderately steep soil on crests and side slopes of ridges and hills. Individual areas range from about 10 to 100 acres in size.

Typically, the surface layer is dark brown gravelly silt loam about 3 inches thick. The layer below that is brown gravelly silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

This soil is low in natural fertility and in content of organic matter. It is strongly acid to extremely acid throughout. Permeability is very slow, and the available water capacity is medium. Grasses on this soil respond fairly well to fertilizer.

Included with this soil in mapping are a few small areas of Mountainburg soils. The Mountainburg soils are shallow and are on ridgetops. Also included are a few small areas where the surface layer is stony silt loam.

The Enders soil is not suited to cultivated crops. Runoff is rapid, and erosion is a very severe hazard.

The soil has fair potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has fair potential for woodland use. It is suited to loblolly pine, shortleaf pine, and southern red oak (fig. 2). There are no significant limitations to woodland use and management.

This soil has poor potential for most urban uses. The shrink-swell potential is a severe limitation for dwellings, small commercial buildings, and local streets and roads. Low strength is an additional limitation for local roads and streets. Slope is a severe limitation for small commercial buildings. These limitations generally can be overcome through proper engineering design. Slow permeability is a severe limitation for septic tank absorption fields and is difficult to overcome.

This soil is in capability unit VIe-1 and in woodland suitability group 4o1.

11—Enders gravelly silt loam, 20 to 45 percent slopes. This is a deep, well drained, steep soil on side slopes of ridges and hills. Individual areas range from about 10 to 300 acres in size.

Typically, the surface layer is dark brown gravelly silt loam about 3 inches thick. The layer below that is brown gravelly silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red mottled silty clay to a depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

This soil is low in natural fertility and in content of organic matter. It is strongly acid to extremely acid throughout. Permeability is very slow, and the available water capacity is medium.

Included with this soil in mapping are a few small areas of Mountainburg soils. The Mountainburg soils are shallow and are on ridgetops.

The Enders soil is not suited to cultivated crops or pasture. Runoff is rapid, and erosion is a very severe hazard. Gravel in the surface layer limits the use of equipment.

Figure 2.—A stand of shortleaf pine on Enders gravelly silt loam, 8 to 20 percent slopes.

This soil has poor potential for woodland use. Nevertheless, it is used mainly as woodland. Erosion is a severe hazard. Steep slopes are a severe limitation to the use of equipment.

This soil has poor potential for most urban uses. Steep slopes and the shrink-swell potential are severe limitations for dwellings, small commercial buildings, and local streets and roads. Low strength is an additional limitation for local roads and streets. Slope and slow permeability are severe limitations for septic tank absorption fields. All of these limitations are difficult to overcome.

This soil is in capability unit VIIe-2 and in woodland suitability group 5r3.

12—Enders stony silt loam, 12 to 45 percent slopes. This is a deep, well drained, moderately steep to steep soil on side slopes of ridges and hills. Individual areas range from about 50 to 500 acres in size.

Typically, the surface layer is dark brown stony silt loam about 3 inches thick. The layer below that is brown stony silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a depth of about 44

inches. Rippable shale bedrock is at a depth of about 44 inches.

This soil is low in natural fertility and moderate in content of organic matter. It is strongly acid to extremely acid throughout. Permeability is very slow, and the available water capacity is medium.

Included with this soil in mapping are a few small areas of Mountainburg and Nella soils. The Mountainburg soils are shallow and are on ridgetops. The Nella soils are deep and are on benches on side slopes.

The Enders soil is not suited to cultivated crops or pasture. Runoff is rapid, and erosion is a very severe hazard. Steep slopes and stones on the surface limit the use of equipment.

This soil has poor potential for woodland use. Nevertheless, it is used mainly as woodland. Erosion is a slight to moderate hazard. Steep slopes and stones on the surface are moderate to severe limitations to the use of equipment.

This soil has poor potential for most urban uses. Large stones, the shrink-swell potential, and slope are severe limitations for dwellings, small commercial buildings, and local streets and roads. Low strength is an additional limitation for local roads and streets. Slow permeability, slope, and large stones are severe limitations for septic tank absorption fields. All of these limitations are difficult to overcome.

This soil is in capability unit VIIs-1 and in woodland suitability group 5r3.

13—Enders-Mountainburg association, rolling. This association consists of well drained soils in a regular and repeating pattern on rolling hillsides and mountainsides. Slopes are 8 to 20 percent. Enders soils are on slopes between sandstone ledges and on foot slopes. They formed in residuum of predominately acid shale bedrock. Mountainburg soils are on narrow sandstone ledges and benches. They formed in residuum of acid sandstone bedrock. The mapped areas of this association range from about 50 to 700 acres in size.

Enders soils make up about 60 percent of this association, Mountainburg soils make up 30 percent, and included soils make up the rest.

Enders soils are deep. Typically, their surface layer is dark brown gravelly silt loam about 3 inches thick. The layer below that is brown gravelly silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

Permeability of the Enders soils is very slow, and the available water capacity is medium. The natural fertility is low and the content of organic matter is moderate. These soils are strongly acid to extremely acid throughout.

Mountainburg soils are shallow. Typically, their surface layer is dark brown stony fine sandy loam about 3 inches thick. The subsoil is brown very stony fine sandy loam to a depth of about 7 inches and yellowish red very stony fine sandy loam to a depth of about 15 inches. Horizontally bedded hard sandstone bedrock is at a depth of about 15 inches.

Permeability of the Mountainburg soils is moderately rapid, and the available water capacity is very low. The natural fertility is low, and the content of organic matter is moderate. These soils are medium acid to very strongly acid in the surface layer and strongly acid or very strongly acid in the subsoil.

Included with these soils in mapping are a few small areas of well drained Nella soils on benches and foot slopes. Also included are a few small areas of rock outcrop.

The soils in this association are not suited to cultivated crops. Runoff is rapid, and erosion is a very severe hazard. Gravel and stones on the surface limit the use of equipment. Enders soils are poorly suited to pasture, and the Mountainburg soils are not suited to pasture.

The soils in this association are used mainly as woodland. The Enders soils have fair potential for shortleaf pine, loblolly pine, eastern redcedar, and southern red oak. The Mountainburg soils have poor potential for woodland use. Erosion is a slight to moderate hazard. Steep slopes and stones on the surface are severe limitations to the use of equipment.

The soils in this association have poor potential for most urban uses. On the Enders soils the shrink-swell potential, slope, and slow permeability are the main limitations. Low strength is a limitation for local roads and streets. On the Mountainburg soils depth to rock, large stones, and slope are the main limitations. For dwellings, small commercial buildings, and local roads and streets, these limitations generally can be overcome through proper engineering design. These limitations are difficult to overcome for septic tank absorption fields.

The Enders soils are in capability unit VIe-1, in woodland suitability group 4o1, and in pasture and hayland group 8D. Mountainburg soils are in capability unit VIIs-2 and in woodland suitability group 5x3.

14—Enders-Mountainburg association, steep. This association consists of well drained soils in a regular and repeating pattern on hillsides and mountainsides. Slopes are 20 to 40 percent. Enders soils are on slopes between sandstone ledges or benches and on foot slopes. They formed in residuum of predominately acid shale bedrock. Mountainburg soils are on narrow sandstone ledges and benches. They formed in residuum of acid sandstone bedrock. The mapped areas of this association range from about 50 to 1,000 acres in size.

Enders soils make up about 65 percent of this association. Mountainburg soils make up 30 percent, and included soils make up the rest.

Enders soils are deep. Typically, this surface layer is dark brown stony silt loam about 3 inches thick. The layer below that is brown stony silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

Permeability of the Enders soils is very slow, and the available water capacity is medium. The natural fertility is low, and the content of organic matter is moderate. These soils are strongly acid to extremely acid throughout.

Mountainburg soils are shallow. Typically, their surface layer is dark brown stony fine sandy loam about 3 inches thick. The subsoil is brown very stony fine sandy loam to a depth of about 7 inches and yellowish red very stony fine sandy loam to a depth of about 15 inches. Horizontally bedded hard sandstone bedrock is at a depth of about 15 inches.

Permeability of the Mountainburg soils is moderately rapid, and the available water capacity is very low. The natural fertility is low, and the content of organic matter is moderate. These soils are medium acid or very strongly acid in the surface layer and strongly acid or very strongly acid in the subsoil.

Included with these soils in mapping are a few small areas of well drained Nella soils on benches and foot slopes. Also included are a few small areas of rock outcrop and a few small areas where the slopes are more than 40 percent.

The soils in this association are not suited to cultivated crops or pasture. The main limitations are steep slopes, stones on the surface, and droughtiness.

These soils have poor potential for woodland use. Nevertheless, they are used mainly as woodland. Erosion is a severe hazard. Steep slopes and large stones on the surface are severe limitations to the use of equipment.

These soils have poor potential for most urban uses. On the Enders soils large stones, the shrink-swell potential, slope, and slow permeability are the main limitations. Low strength is a limitation for local roads and streets. On the Mountainburg soils slope, depth to rock, and large stones are the main limitations. These limitations are difficult to overcome.

The Enders soils are in capability unit VIIs-1 and in woodland suitability group 5r3. Mountainburg soils are in capability unit VIIs-2 and in woodland suitability group 5x3.

15—Guthrie silt loam, 0 to 1 percent slopes. This is a deep, poorly drained, level soil on old stream terraces on broad valleys. This soil is subject to flooding on rare occasions of abnormal weather conditions. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is grayish brown, mottled silt loam about 5 inches thick. The subsoil is gray, mottled friable silt loam to a depth of about 15 inches; light brownish gray, mottled friable silt loam to a depth of about 24 inches; gray, mottled compact and brittle silty clay loam to a depth of about 48 inches; and mottled gray and dark yellowish brown compact and brittle silty clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and moderate in content of organic matter. It is very strongly acid throughout, except for the surface layer where lime has been added. Permeability is slow, and the available water capacity is medium. The water table is seasonally high and is within 6 inches of the surface in winter and early spring. Crops and grasses on this soil respond well to fertilizer.

Included with this soil in mapping are a few small areas of Barling, Leadvale, Muskogee, and Taft soils. All of these soils are in higher positions than the Guthrie soil and are better drained. Also included are a few small areas with a few low mounds on the surface, a few areas where the soils are occasionally flooded, and an area northeast of Scranton where the soil has a clay subsoil.

The Guthrie soil has fair potential for cultivated crops, including soybeans and grain sorghum. Winter small grains can be grown where surface drainage is adequate. Clean-tilled crops that leave large amounts of residue on the surface can be grown year after year if good management practices are used, including adequate drainage.

This soil has good potential for pasture and is used mainly as pasture. It is suited to bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Surface drainage is usually needed. Other management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is good. The soil is suited to sweetgum and willow oak. Wetness is a severe limitation to the use of equipment and results in a severe seedling mortality rate. Logging should be done in the dry season. The seedling mortality rate is difficult to reduce.

This soil has poor potential for most urban uses. Wetness is a severe limitation for dwellings, small commercial buildings, and local roads and streets. Flooding is a severe limitation for dwellings and small commercial buildings. Slow permeability and wetness are severe limitations for septic tank absorption fields. All of these limitations are difficult to overcome.

This soil is in capability unit IVw-1 and in woodland suitability group 2w9.

16—Leadvale silt loam, 1 to 3 percent slopes. This is a deep, moderately well drained, nearly level soil on old stream terraces in broad valleys. Individual areas range from about 10 to 400 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is yellowish brown friable silt loam to a depth of about 11 inches; yellowish brown, mottled silty clay loam to a depth of about 23

inches; mottled yellowish brown, strong brown, and light gray compact and brittle silty clay loam to a depth of about 42 inches; and light gray, mottled firm silty clay loam to a depth of about 54 inches. Rippable shale bedrock is at a depth of about 54 inches.

This soil is low in natural fertility and in content of organic matter. The soil is strongly acid or very strongly acid throughout. Permeability is moderate above the fragipan and slow in the fragipan. The available water capacity is medium. The compact and brittle fragipan in the subsoil restricts root penetration and slows the movement of water through the soil. Crops and grasses on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Barling, Cane, Guthrie, Muskogee, and Taft soils. The Barling soils are on flood plains of local streams. The Cane soils are in similar positions on the landscape as the Leadvale soil. The Muskogee soils are in similar positions but are near the Arkansas River. The poorly drained Guthrie and somewhat poorly drained Taft soils are in level to depressional areas. Also included are a few small areas with a few low mounds on the surface and a few small areas that have slopes of less than 1 percent.

This Leadvale soil has good potential for cultivated crops. Erosion is a moderate hazard. Clean-tilled crops that leave a large amount of residue on the surface can be grown year after year if good management practices are used, including contour cultivation and terracing on long slopes. The soil is suited to soybeans, truck crops, grain sorghum, and small grains.

This soil has good potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is good. The soil is suited to loblolly pine, shortleaf pine, and southern red oak. There are no significant limitations to woodland use and management.

This soil has fair potential for most urban uses. Wetness is a moderate limitation for dwellings and small commercial buildings. Low strength is a severe limitation for local roads and streets. These limitations can be overcome through proper engineering design. Wetness and slow permeability are severe limitations for septic tank absorption fields. These limitations are difficult to overcome.

This soil is in capability unit IIe-1 and in woodland suitability group 4o7.

17—Leadvale silt loam, 3 to 8 percent slopes. This is a deep, moderately well drained, gently sloping soil on colluvial foot slopes of hills and on old stream terraces in broad valleys. Individual areas range from about 10 to 600 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil is yellowish brown friable silt loam to a depth of about 11 inches; yellowish brown friable silty clay loam to a depth of about 23 inches; mottled yellowish brown, strong brown, and light gray compact and brittle silty clay loam to a depth of about 42 inches; and light gray, mottled firm silty clay loam to a depth of 54 inches. Rippable shale bedrock is at a depth of 54 inches.

This soil is low in natural fertility and in content of organic matter. The soil is strongly acid or very strongly acid throughout. Permeability is slow, and the available water capacity is medium. The compact and brittle fragipan in the subsoil restricts root penetration and slows the movement of water through the soil. Crops and grasses on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few areas of Cane and Enders soils. The Cane soils are in similar positions as the Leadvale soil, and the Enders soils are in higher positions.

This Leadvale soil has fair potential for cultivated crops. Erosion is a severe hazard. Clean-tilled crops that leave a large amount of residue on the surface can be grown safely year after year on the less sloping areas if good management practices are used, including contour cultivation and terraces. Additional use of conservation practices is needed on the more sloping areas. The soil is suited to soybeans, truck crops, grain sorghum, and small grains.

This soil has good potential for pasture, and it is used mainly as pasture. It is suited to bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to loblolly pine, shortleaf pine, and southern red oak. There are no significant limitations to woodland use and management.

This soil has fair potential for most urban uses. Wetness is a moderate limitation for dwellings. Wetness and slope are moderate limitations for small commercial buildings. Low strength is a severe limitation for local roads and streets. However, these limitations can be overcome through proper engineering design. Wetness and slow to moderately slow permeability are severe limitations for septic tank absorption fields. These limitations are difficult to overcome.

This soil is in capability unit IIIe-1 and in woodland suitability group 4o7.

18—Linker fine sandy loam, 3 to 8 percent slopes. This is a moderately deep, well drained, gently sloping soil on hilltops and mountaintops. Individual areas range from about 5 to 200 acres in size.

Typically, the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The subsurface

layer is yellowish brown fine sandy loam about 4 inches thick. The subsoil is strong brown loam to a depth of about 11 inches, yellowish red clay loam to a depth of about 20 inches, red clay loam to a depth of about 30 inches, and red, mottled clay loam to a depth of 36 inches. Horizontally bedded hard sandstone bedrock is at a depth of 36 inches.

This soil is low in natural fertility and in content of organic matter. It is strongly acid to extremely acid throughout. Permeability is moderate, and the available water capacity is low. Crops and grasses on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Enders and Mountainburg soils. The shallow Mountainburg soils are in similar positions as the Linker soils. The deep Enders soils are on the sides of hills, mountains, and ridges. Also included are a few small areas of soils that have a gravelly surface layer and a few small areas where sandstone bedrock is at a depth of more than 40 inches.

The Linker soil has fair potential for cultivated crops. Erosion is a severe hazard. Clean-tilled crops that leave a large amount of residue on the surface can be grown safely year after year on the less sloping areas if good management practices are used, including contour cultivation and terraces. Additional use of conservation practices is needed on the more sloping areas. The soil is suited to grain sorghum, winter small grains, truck crops, apples, peaches, and grapes.

This soil has fair potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, tall fescue, sericea lespedeza, and annual lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is fair. The soil is suited to shortleaf pine and eastern redcedar. There are no significant limitations to woodland use and management.

The soil has fair potential for most urban uses. Depth to rock is a moderate limitation for dwellings and local roads and streets. Depth to rock and slope are moderate limitations for small commercial buildings. These limitations can easily be overcome through proper engineering design. Depth to rock is a severe limitation for septic tank absorption fields. This limitation is difficult to overcome.

This soil is in capability unit IIIe-1 and in woodland suitability group 4o1.

19—McKamie silt loam, 3 to 8 percent slopes. This is a deep, well drained, gently sloping soil on high terraces along the Arkansas River. Individual areas range from about 50 to 300 acres in size.

Typically, the surface layer is dark brown silt loam about 4 inches thick. The subsoil is red silty clay to a depth of about 17 inches, dark red silty clay to a depth of about 32 inches, and dark red, mottled silty clay to a depth of about 53 inches. The layer below that is stratified yellowish red silty clay loam and fine sandy loam to a depth of 72 inches or more.

This soil is moderate in natural fertility and low in content of organic matter. It is slightly acid to strongly acid in the surface layer and medium acid to very strongly acid in the upper part of the subsoil. Below a depth of about 30 inches, the soil is very strongly acid to moderately alkaline and is calcareous in places. Permeability is very slow, and the available water capacity is high. Crops and grasses on this soil respond well to fertilizer.

Included with this soil in mapping are a few small areas of Muskogee soils. Muskogee soils are in slightly lower positions on the landscape than the McKamie soil and are moderately well drained. Also included are a few small areas of soils that have slopes of more than 8 percent and an eroded surface layer.

The McKamie soil has poor potential for cultivated crops. Erosion is a very severe hazard. Occasionally, sown crops can be safely grown in a cropping system that includes close growing cover most of the time.

This soil has good potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to shortleaf pine and loblolly pine. The clayey subsoil moderately limits the use of equipment and results in a moderate seedling mortality rate.

The potential for most urban uses is poor. Shrink-swell potential is a severe limitation for dwellings, small commercial buildings, and local streets and roads. Low strength is an additional limitation for local roads and streets. These limitations can be overcome through proper engineering design. Slow permeabilty is a severe limitation for septic tank absorption fields. This limitation is difficult to overcome.

This soil is in capability unit IVe-1 and in woodland suitability group 3c2.

20—Moreland silty clay, 0 to 1 percent slopes. This is a deep, somewhat poorly drained, level soil in slack-water areas on flood plains of the Arkansas River. Individual areas range from about 30 to 500 acres in size.

Typically, the surface layer is dark brown silty clay about 18 inches thick. The subsoil is reddish brown silty clay to a depth of about 55 inches and dark reddish brown silty clay to a depth of 75 inches or more.

This soil is high in natural fertility and in content of organic matter. The surface layer is slightly acid to mildly alkaline. The subsoil is neutral to moderately alkaline and in places is calcareous between depths of 10 and 40 inches. Permeability is very slow, and the available water capacity is high. Crops on this soil respond well to fertilizer.

Included with this soil in mapping are a few small areas of Dardanelle and Roellen soils. The well drained

Dardanelle soils are in higher positions on the landscape than the Moreland soil. The poorly drained Roellen soils are in similar positions. Also included are a few small areas that are subject to occasional flooding.

The Moreland soil has fair potential for cultivated crops and is used mainly as cropland. The principal crop is soybeans. The soil is also suited to cotton, grain sorghum, and rice. Surface drains are needed in some areas. Farming operations are commonly delayed for several days after a rain because of excess water on the surface.

The potential for pasture is good. The soil is suited to bermudagrass and tall fescue. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood and American sycamore. The high clay content of the soil results in a moderate seedling mortality rate. Wetness is a severe limitation to the use of equipment. Logging should be done in the dry season.

The potential for most urban uses is poor. Wetness and shrink-swell potential are severe limitations for dwellings and small commercial buildings. Shrink-swell potential and low strength are severe limitations for local streets and roads. These limitations can generally be overcome through proper engineering design. Slow permeability and wetness are severe limitations for septic tank absorption fields. These limitations are difficult to overcome.

This soil is in capability unit IIIw-1 and in woodland suitability group 2w6.

21—Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes. This is a shallow, well drained, gently sloping soil on hilltops, mountaintops, and ridges. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is dark brown gravelly fine sandy loam about 3 inches thick. The subsoil is brown very gravelly fine sandy loam to a depth of about 7 inches and yellowish red very gravelly fine sandy loam to a depth of about 15 inches. Horizontally bedded hard sandstone bedrock is at a depth of about 15 inches.

This soil is low in natural fertility and in content of organic matter. The surface layer is medium acid to very strongly acid, and the subsoil is strongly acid or very strongly acid. Permeability is moderately rapid, and the available water capacity is very low. Crops on this soil respond poorly to fertilizer.

Included with this soil in mapping are a few small areas of Enders and Linker soils and a few small areas where the soil has stones on the surface. The Enders soils are deep and are on side slopes. The Linker soils are moderately deep and are in positions similar to the Mountainburg soils. Also included are a few small areas of rock outcrop.

The Mountainburg soil has poor potential for cultivated crops. Erosion is a very severe hazard, and the gravel in the surface layer limits the use of equipment.

This soil has poor potential for pasture. Nevertheless, it is used mainly as pasture. The soil is suited to bahiagrass, bermudagrass, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is poor. The soil is suited to shortleaf pine and Eastern redcedar. The very low available water capacity results in a moderate seedling mortality rate.

This soil has poor potential for most urban uses. Shallowness to rock is a severe limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. This limitation is difficult to overcome.

This soil is in capability unit IVe-3 and in woodland suitability group 5d2.

22—Mountainburg gravelly fine sandy loam, 8 to 12 percent slopes. This is a shallow, well drained, moderately sloping soil on side slopes and tops of hills, mountains, and ridges. Individual areas range from about 10 to 150 acres in size.

Typically, the surface layer is dark brown gravelly fine sandy loam about 3 inches thick. The subsoil is brown very gravelly fine sandy loam to a depth of about 7 inches and yellowish red very gravelly fine sandy loam to a depth of about 15 inches. Horizontally bedded hard sandstone bedrock is at a depth of about 15 inches.

This soil is low in natural fertility and in content of organic matter. The surface layer is medium acid to very strongly acid, and the subsoil is strongly acid or very strongly acid. Permeability is moderately rapid, and the available water capacity is very low. Grasses on this soil respond poorly to fertilizer.

Included with this soil in mapping are a few small areas of Enders, Linker, and Nella soils. The deep Enders soils are on side slopes. The moderately deep Linker soils are in positions similar to the Mountainburg soils. The deep Nella soils are on side slopes, foot slopes, and benches. Also included are a few small areas of rock outcrop.

The Mountainburg soil is not suited to cultivated crops. It has poor potential for pasture. Nevertheless, this soil is used mainly as pasture. It is suited to bahiagrass, bermudagrass, and sericea lespedeza. Erosion is a very severe hazard, and gravel on the surface makes seedbed preparation difficult.

The potential for woodland use is poor. The soil is suited to shortleaf pine and Eastern redcedar. The very low available water capacity results in a moderate seedling mortality rate.

This soil has poor potential for most urban uses. Shallowness to rock is a severe limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. Slope is an additional

severe limitation for small commercial buildings. These limitations are difficult to overcome.

This soil is in capability unit VIe-3 and in woodland suitability group 5d2.

23—Mountainburg stony fine sandy loam, 3 to 12 percent slopes. This is a shallow, well drained, gently sloping and moderately sloping soil on side slopes and tops of hills, mountains, and ridges. Individual areas range from about 10 to 300 acres in size.

Typically, the surface layer is dark brown stony fine sandy loam about 3 inches thick. The subsoil is brown very gravelly fine sandy loam to a depth of about 7 inches and yellowish red very gravelly fine sandy loam to a depth of 15 inches. Horizontally bedded hard sandstone bedrock is at a depth of 15 inches.

This soil is low in natural fertility and moderate in content of organic matter. The surface layer is medium acid to very strongly acid, and the subsoil is strongly acid or very strongly acid. Permeability is moderately rapid, and the available water capacity is very low.

Included with this soil in mapping are a few small areas of Enders, Linker, and Nella soils. The deep Enders soils are on side slopes. The moderately deep Linker soils are in positions similar to the Mountainburg soils. The deep Nella soils are on side slopes, foot slopes, and benches. Also included are a few small areas of soil that has a gravelly surface and a few small areas of rock outcrop.

The Mountainburg soil is not suited to cultivated crops or pasture. The soil is very droughty, and erosion is a very severe hazard. Stones on the surface limit the use of equipment.

The potential for woodland use is poor. The soil is suited to shortleaf pine and Eastern redcedar. Most areas have a scattered cover of blackjack oak, post oak, and redcedar. Stones on the surface and droughtiness are severe limitations to the use of equipment and result in a moderate seedling mortality rate.

This soil has poor potential for most urban uses. Shallowness to rock and large stones are severe limitations for dwellings, small commercial buildings, local streets and roads, and septic tank absorption fields. Slope is an additional severe limitation for small commercial buildings. All of these limitations are difficult to overcome.

This soil is in capability unit VIs-1 and in woodland suitability group 5x3.

24—Mountainburg stony fine sandy loam, 12 to 40 percent slopes. This is a shallow, well drained, moderately steep and steep soil on side slopes and tops of hills, mountains, and ridges. Individual areas range from about 10 to 400 acres in size.

Typically, the surface layer is dark brown stony fine sandy loam about 3 inches thick. The subsoil is brown very gravelly fine sandy loam to a depth of about 7 inches and yellowish red gravelly fine sandy loam to a depth of 15 inches. Horizontally bedded hard sandstone bedrock is at a depth of 15 inches.

This soil is low in natural fertility and moderate in content of organic matter. The surface layer is medium acid to very strongly acid, and the subsoil is strongly acid or very strongly acid. Permeability is moderately rapid, and the available water capacity is very low.

Included with this soil in mapping are a few small areas of Enders and Nella soils. The Enders soils are deep and are on side slopes. The Nella soils are deep and are on side slopes, foot slopes, and benches. Also included are a few small areas of soil that has a gravelly surface and a few small areas of rock outcrop.

The Mountainburg soil is not suited to cultivated crops or pasture. The soil is very droughty, and erosion is a severe hazard. Stones on the surface and steep slopes limit the use of equipment.

The potential for woodland use is poor. The soil is suited to shortleaf pine and Eastern redcedar. Most areas have a scattered cover of blackjack oak, post oak, and redcedar. Stones on the surface, steep slopes, and droughtiness are severe limitations to the use of equipment and result in a moderate seedling mortality rate.

This soil has poor potential for most urban uses. Shallowness to rock, steep slopes, and large stones are severe limitations for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. All of these limitations are difficult to overcome.

This soil is in capability unit VIIs-2 and in woodland suitability group 5x3.

25—Muskogee silt loam, 1 to 3 percent slopes. This is a deep, moderately well drained, nearly level soil on high terraces along the Arkansas River. Individual areas range from about 100 to 500 acres in size.

Typically, the surface layer is dark grayish brown silt loam about 5 inches thick. The layer below that is grayish brown silt loam about 5 inches thick. The subsoil is light yellowish brown silt loam to a depth of about 15 inches, yellowish brown and strong brown, mottled silty clay loam to a depth of about 27 inches, mottled yellowish red, strong brown, and light brownish gray silty clay to a depth of about 49 inches, and red, mottled clay to a depth of 80 inches or more.

Natural fertility of this soil is moderate, and the content of organic matter is low. The surface layer and upper subsoil are medium acid to very strongly acid. The lower subsoil is strongly acid to mildly alkaline and in some pedons contains calcareous concretions. Permeability is slow, and the available water capacity is high. Crops on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Guthrie, Leadvale, McKamie, and Taft soils. The poorly drained Guthrie and the somewhat poorly drained Taft soils are on lower terraces and are farther from the

river. The Leadvale soils are on slightly higher terraces and are farther from the river. The well drained McKamie soils are in higher positions than the Muskogee soil and are nearer the river.

The Muskogee soil has good potential for cultivated crops. Erosion is a moderate hazard. Clean-tilled crops that leave large amounts of residue on the surface can be grown safely year after year if good management practices are used, including contour cultivation and terracing on long slopes. The soil is suited to soybeans, truck crops, grain sorghum, and small grains.

This soil has good potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to loblolly pine, shortleaf pine, and sweetgum. There are no significant limitations to woodland use and management.

This soil has poor potential for urban uses. Shrink-swell potential and wetness are severe limitations for dwellings, small commercial buildings, and local streets and roads. Low strength is an additional limitation for local roads and streets. These limitations generally can be overcome through proper engineering design. Slow permeability and wetness are severe limitations for septic tank absorption fields. These limitations are difficult to overcome.

This soil is in capability unit IIe-1 and in woodland suitability group 3o7.

26—Nella gravelly fine sandy loam, 8 to 12 percent slopes. This is a deep, well drained, moderately sloping soil on foot slopes and benches on hills and mountains. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is dark grayish brown gravelly fine sandy loam about 3 inches thick. The layer below that is brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown gravelly loam to a depth of about 14 inches, yellowish red gravelly clay loam to a depth of about 30 inches, red gravelly clay loam to a depth of about 50 inches, and dark red, mottled gravelly clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and in content of organic matter. It is strongly acid or very strongly acid throughout. Permeability is moderate, and the available water capacity is medium. Grasses on this soil respond well to fertilizer.

Included with this soil in mapping are a few small areas of Enders and Mountainburg soils. The Enders soils are in similar positions on the landscape as the Nella soil, and the Mountainburg soils are on the top of hills, mountains, and ridges and on the edge of benches on side slopes. Also included are a few small areas where the surface layer of the soil is fine sandy loam and a few small areas where the slopes are less than 8 percent or more than 12 percent.

This Nella soil has poor potential for cultivated crops. Erosion is a very severe hazard, and gravel in the surface layer limits the use of equipment.

This soil has fair potential for pasture and is used mainly as pasture. It is suited to bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to loblolly pine, shortleaf pine, and northern red oak. There are no significant limitations to woodland use and management.

The potential for most urban uses is fair. Slope is a moderate limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. Low strength is an additional moderate limitation for local roads and streets. These limitations can be easily overcome through proper engineering design.

This soil is in capability unit IVe-2 and in woodland suitability group 3o7.

27—Nella-Enders association, rolling. This association consists of deep, well drained, loamy and clayey soils on rolling hillsides and mountainsides in a regular and repeating pattern. Slopes are 8 to 20 percent. The Nella soils are on foot slopes and benches. They formed in loamy colluvium of acid sandstone and shale. The Enders soils are on side slopes and benches. They formed in weathered acid shale bedrock. Mapped areas are mostly long and narrow and range from 50 to 600 acres in size.

Nella soils make up about 60 percent of the association, Enders soils make up 30 percent, and included soils make up the rest.

Typically, the surface layer of the Nella soils is dark grayish brown gravelly fine sandy loam about 3 inches thick. The layer below that is brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown gravelly loam to a depth of about 14 inches, yellowish red gravelly clay loam to a depth of about 30 inches, red gravelly clay loam to a depth of about 50 inches, and dark red, mottled gravelly clay loam to a depth of 72 inches or more.

Permeability of the Nella soils is moderate, and the available water capacity is medium. Natural fertility is low, and the content of organic matter is moderate. These soils are strongly acid or very strongly acid throughout.

Typically, the surface layer of the Enders soils is dark brown gravelly silt loam about 3 inches thick. The layer below that is brown gravelly silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a

depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

Permeability of the Enders soils is very slow, and the available water capacity is medium. Natural fertility is low, and the content of organic matter is moderate. These soils are strongly acid to extremely acid throughout.

Included with these soils in mapping are a few small areas of moderately deep Linker soils and shallow Mountainburg soils, both of which formed in weathered acid sandstone bedrock. These soils are on ridgetops. Also included in mapping are a few small areas of rock outcrop.

The soils in this association are not suited to cultivated crops. Runoff is rapid, and erosion is a very severe hazard. Gravel on the surface limits the use of equipment.

These soils have fair potential for use as pasture. They are suited to bahiagrass, bermudagrass, tall fescue, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control. Erosion is a very severe hazard.

In most areas the soils are used as woodland. The Nella soils have good potential for shortleaf pine, loblolly pine, and northern red oak. There are no significant management problems. The Enders soils have fair potential for shortleaf pine, loblolly pine, and southern red oak. There are no significant management problems.

The soils in this association have poor potential for most urban uses. On the Nella soils slope is a moderate limitation for dwellings, local roads and streets, and septic tank absorption fields; it is a severe limitation for small commercial buildings. Low strength is a moderate limitation for local roads and streets. On the Enders soils the shrink-swell potential is a severe limitation for dwellings, small commercial buildings, and local roads and streets. Low strength is an additional severe limitation for local roads and streets. Slope is a severe limitation for small commercial buildings, but it generally can be overcome through proper engineering design. The limitations for septic tank absorption fields are difficult to overcome.

The Nella soils are in capability unit VIe-2, in woodland group 3o7, and in pasture and hayland group 8B. The Enders soils are in capability unit VIe-1 and in woodland group 4o1.

28—Nella-Enders association, steep. This association consists of deep, well drained, loamy and clayey soils on steep hillsides and mountainsides in a regular and repeating pattern. Slopes are 20 to 40 percent. The Nella soils are on foot slopes and benches. They formed in loamy weathered acid sandstone and shale. The Enders soils are on side slopes and benches. They formed in weathered acid shale bedrock. The mapped areas are mostly long and narrow and are about 50 to 1,000 acres in size.

The Nella soils make up about 50 percent of the association, Enders soils make up 35 percent, and included soils make up the rest.

Typically, the surface layer of the Nella soils is dark grayish brown gravelly fine sandy loam about 3 inches thick. The layer below that is brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown gravelly loam to a depth of about 14 inches, yellowish red gravelly clay loam to a depth of about 30 inches, red gravelly clay loam to a depth of about 50 inches, and dark red, mottled gravelly clay loam to a depth of 72 inches or more.

Permeability of the Nella soils is moderate, and the available water capacity is medium. Natural fertility is low, and the content of organic matter is moderate. The soil is strongly acid or very strongly acid throughout.

Typically, the surface layer of the Enders soils is dark brown gravelly silt loam about 3 inches thick. The layer below that is brown gravelly silt loam about 4 inches thick. The subsoil is yellowish red silty clay to a depth of about 32 inches and yellowish red, mottled silty clay to a depth of about 44 inches. Rippable shale bedrock is at a depth of about 44 inches.

Permeability of the Enders soils is very slow, and the available water capacity is medium. Natural fertility is low, and the content of organic matter is moderate. The soil is strongly acid to extremely acid throughout.

Included with these soils in mapping are a few small areas of Mountainburg soils and a few small areas of rock outcrop. The Mountainburg soils are shallow and are on ridgetops.

The soils in this association are not suited to cultivated crops or pasture. Steep slopes are the main limitation. Erosion is a very severe hazard.

The soils in this association are used as woodland. The Nella soils have fair potential for woodland use. They are suited to shortleaf pine, loblolly pine, and northern red oak. Erosion is a severe hazard. Steep slopes are a severe limitation to the use of equipment. The Enders soils have poor potential for woodland use. They are suited to shortleaf pine and loblolly pine. Erosion is a slight to severe hazard. Steep slopes are a severe limitation to the use of equipment.

The soils in this association have poor potential for most urban uses. On the Nella soils, steep slopes are a severe limitation for septic tank absorption fields, dwellings, small commercial buildings, and local roads and streets. On the Enders soils, steep slopes and the shrink-swell potential are severe limitations for dwellings, small commercial buildings, and local roads and streets. Low strength is an additional limitation for local roads and streets. Slope and slow permeability are severe limitations for septic tank absorption fields. All of these limitations are extremely difficult to overcome.

The Nella soils are in capability unit VIIe-1 and in woodland suitability group 3r9. The Enders soils are in capability unit VIIe-2 and in woodland suitability group 5r3.

29—Nella-Mountainburg association, steep. This association consists of deep and shallow, well drained soils on steep hillsides and mountainsides in a regular and repeating pattern. Slopes are 20 to 40 percent. The Nella soils are on foot slopes and benches. They formed in loamy colluvium of acid sandstone and shale. The Mountainburg soils are on narrow sandstone ledges, ridgetops, and benches. They formed in residuum of acid sandstone bedrock. The mapped areas are mostly long and narrow and are about 50 to 1,000 acres in size.

The Nella soils make up about 55 percent of the association, the Mountainburg soils make up about 30 percent, and included soils make up the rest.

Nella soils are deep. Typically, the surface layer is dark grayish brown gravelly fine sandy loam about 3 inches thick. The layer below that is brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown gravelly loam to a depth of about 14 inches, yellowish red gravelly clay loam to a depth of about 30 inches, red gravelly clay loam to a depth of about 50 inches, and dark red, mottled gravelly clay loam to a depth of 72 inches or more.

Permeability of the Nella soils is moderate, and the available water capacity is medium. Natural fertility is low, and the content of organic matter is moderate. The soil is strongly acid or very strongly acid throughout.

Mountainburg soils are shallow. Typically, the surface layer is dark brown stony fine sandy loam about 3 inches thick. The subsoil is brown very gravelly fine sandy loam to a depth of about 7 inches and yellowish red very gravelly fine sandy loam to a depth of 15 inches. Horizontally bedded hard sandstone bedrock is at a depth of 15 inches.

Permeability of the Mountainburg soils is moderately rapid, and the available water capacity is very low. Natural fertility is low, and the content of organic matter is moderate. The surface layer is medium acid to very strongly acid, and the subsoil is strongly acid or very strongly acid.

Included with these soils in mapping are a few small areas of Enders soils. These soils are well drained and formed in clayey material weathered from shale. Also included are a few small areas of rock outcrop.

The soils in this association are not suited to cultivated crops or pasture. Steep slopes and stones on the surface are the main limitations.

The soils in this association are used mainly as woodland. The Nella soils have fair potential for woodland use. They are suited to shortleaf pine, loblolly pine, and northern red oak. Erosion is a severe hazard. Slope is a severe limitation to the use of equipment. The Mountainburg soils have poor potential for woodland use. They are suited to shortleaf pine and Eastern redcedar. Erosion is a severe hazard. Steep slopes and stones on the surface are severe limitations to the use of equipment.

The soils in this association have poor potential for most urban uses. On the Nella soils steep slopes are a severe limitation for septic tank absorption fields, dwellings, small commercial buildings, and local streets and roads. On the Mountainburg soils steep slopes, large stones, and shallowness to rock are severe limitations for septic tank absorption fields, dwellings, small commercial buildings, and local streets and roads. All of these limitations are extremely difficult to overcome.

The Nella soils are in capability unit VIIe-1 and in woodland suitability group 3r9. The Mountainburg soils are in capability unit VIIs-2 and in woodland suitability group 5x3.

30—Roellen silty clay, 0 to 1 percent slopes. This is a deep, poorly drained, level soil in slack-water areas on flood plains of the Arkansas River. Individual areas range from about 30 to 800 acres in size.

Typically, the surface layer is very dark gray silty clay about 10 inches thick. The subsoil is dark gray clay to a depth of about 33 inches and dark gray, mottled clay to a depth of about 56 inches. The underlying material is reddish brown silty clay to a depth of 72 inches or more.

This soil is high in natural fertility and in content of organic matter. The surface layer is medium acid to neutral, and the subsoil and underlying material are slightly acid to mildly alkaline. Permeability is slow, and the available water capacity is high.

Included with this soil in mapping are a few small areas of Dardanelle and Moreland soils. The well drained Dardanelle soils are higher on the landscape than the Roellen soil. The somewhat poorly drained Moreland soils and the Roellen soil are in similar positions on the landscape. Also included are a few small areas where the soils are subject to occasional flooding.

The Roellen soil has good potential for cultivated crops, and it is used mainly as cropland. The principal crop is soybeans. The soil is also suited to cotton, grain sorghum, and rice. Surface drains are needed in some areas. Farming operations are commonly delayed for several days after a rain because of excess water on the surface.

The potential for pasture is good. The soil is suited to bermudagrass and tall fescue. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood, American sycamore, and sweetgum. Wetness is a severe limitation to the use of equipment. Logging should be done in the dry season.

The potential for most urban uses is poor. Wetness and the shrink-swell potential are severe limitations for dwellings, small commercial buildings, and local roads and streets. Low strength is an additional severe limitation for local roads and streets. Slow permeability and wetness are severe limitations for septic tank absorption fields. These limitations are difficult to overcome.

This soil is in capability unit IIIw-1 and in woodland suitability group 2w6.

31—Roxana silt loam, 0 to 1 percent slopes. This is a deep, well drained soil on flood plains of the Arkansas River. Levees protect the soil from flooding. Individual areas range from about 50 to 1,000 acres in size.

Typically, the surface layer is dark reddish brown silt loam about 10 inches thick. The underlying layers are stratified brown and strong brown very fine sandy loam and loamy very fine sand to a depth of 72 inches or more.

Natural fertility is high, and the content of organic matter is low. The surface layer is slightly acid to mildly alkaline, and the underlying material is neutral to moderately alkaline. Permeability is moderate, and the available water capacity is medium. Crops on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Dardanelle and Crevasse soils. The Dardanelle soils are slightly lower on the landscape than the

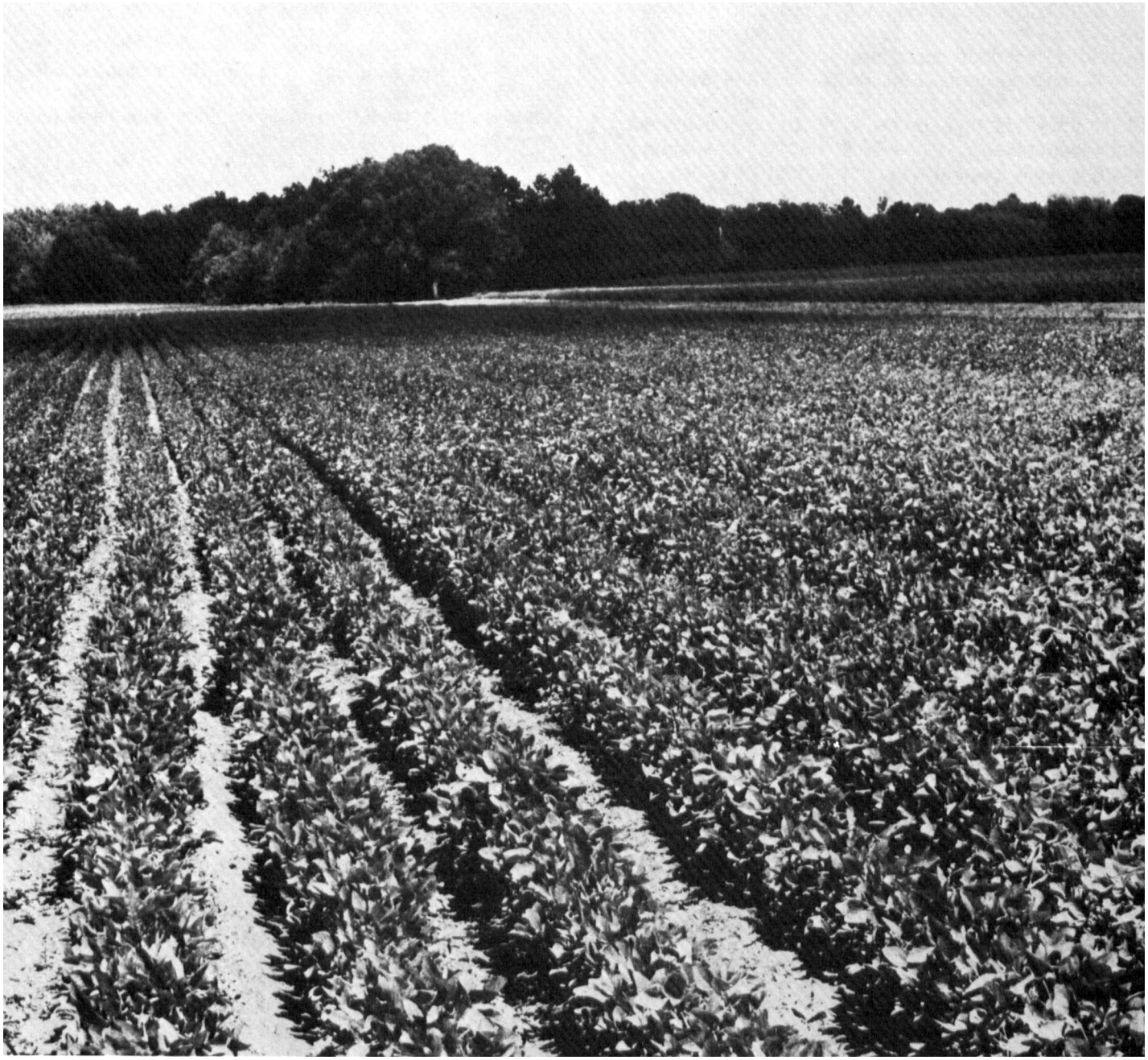


Figure 3.—Soybeans on Roxana silt loam, 0 to 1 percent slopes.

Roxana soil, and the Crevasse soils are on young natural levees.

The Roxana soil has good potential for cultivated crops and is used mainly as cropland. The principal crop is soybeans (fig. 3). The soil is also suited to grain sorghum, cotton, small grains, truck crops, and alfalfa.

The potential for pasture is good. The soil is suited to bahiagrass, bermudagrass, tall fescue, and white clover. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood, sweetgum, and American sycamore. There are no significant limitations to woodland use or management.

The potential for most urban uses is good. There are only slight limitations for dwellings, small commercial buildings, and septic tank absorption fields. Low strength is a moderate limitation for local roads and streets. This limitation can easily be overcome through proper engineering design.

This soil is in capability unit I-1 and in woodland suitability group 1o4.

32—Roxana silt loam, occasionally flooded. This is a deep, well drained, level soil on flood plains of the Arkansas River. This soil is not protected by a levee and is flooded about once every 3 or 4 years. Slopes are 0 to 1 percent. Individual areas range from about 40 to 250 acres in size.

Typically, the surface layer is dark reddish brown silt loam about 10 inches thick. The underlying layers are stratified brown and strong brown very fine sandy loam and loamy very fine sand to a depth of 72 inches or more.

Natural fertility is high, and the content of organic matter is low. The surface layer is slightly acid to mildly alkaline, and the underlying material is neutral to moderately alkaline. Permeability is moderate, and the available water capacity is medium. Crops on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Dardanelle and Crevasse soils. The Dardanelle soils are slightly lower on the landscape than the Roxana soil, and the Crevasse soils are on young natural levees. Also included are small low areas where the soil is flooded for short periods at least once every 2 years.

The Roxana soil has good potential for cultivated crops and is used mainly as cropland. The principal crop is soybeans. The soil is also suited to cotton, grain sorghum, small grains, and alfalfa. This soil is flooded about once every 3 or 4 years, but rarely between April and December. Winter small grains may be damaged by flooding in some years. Erosion is a slight to moderate hazard. Clean-tilled crops that leave large amounts of residue on the surface can be grown safely year after year if good management practices are used, including winter cover crops.

The potential for pasture is good. The soil is suited to bahiagrass, bermudagrass, tall fescue, and white clover. Management concerns include proper stocking, controlled grazing, and weed and brush control.

This soil has good potential for woodland use. It is suited to eastern cottonwood, sweetgum, and American sycamore. There are no significant limitations to woodland use or management.

The potential for most urban uses is poor. Occasional flooding is a severe limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields. This limitation can be overcome only by major flood control measures.

This soil is in capability unit IIw-1 and in woodland suitability group 1o4.

33—Spadra silt loam, occasionally flooded. This is a deep, well drained, nearly level soil on low stream terraces along the larger upland streams. This soil is flooded about once every 3 or 4 years. Slopes are 1 to 3 percent. Individual areas range from about 10 to 500 acres in size.

Typically, the surface layer is dark yellowish brown silt loam about 8 inches thick. The subsoil is brown loam to a depth of about 25 inches, yellowish red loam to a depth of about 45 inches, and yellowish red fine sandy loam to a depth of about 58 inches. The underlying layer is yellowish red sandy loam to a depth of 77 inches or more.

This soil is moderate in natural fertility and in content of organic matter. It is medium acid to very strongly acid throughout. Permeability is moderate, and the available water capacity is high. Crops on this soil respond well to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Barling soils. The moderately well drained Barling soils are in positions on the landscape similar to those of the Spadra soil but farther from the streams.

The Spadra soil has good potential for cultivated crops. It is suited to soybeans, truck crops, and grain sorghum (fig. 4). In most areas this soil is flooded every 3 or 4 years, but rarely between April and December. Clean-tilled crops that leave large amounts of residue on the surface can be grown safely year after year if good management practices are used, including contour cultivation.

This soil has good potential for pasture. It is used mainly as pasture and is suited to bahiagrass, bermudagrass, tall fescue, and white clover. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is good. This soil is suited to shortleaf pine, loblolly pine, and southern red oak. There are no significant limitations to woodland use or management.

This soil has poor potential for most urban uses. Occasional flooding is a severe limitation for dwellings, small commercial buildings, local streets and roads, and

Figure 4.—Grain sorghum being harvested on Spadra silt loam, occasionally flooded.

septic tank absorption fields. This limitation can be overcome only by major flood control measures.

This soil is in capability unit IIw-1 and in woodland suitability group 2o7.

34—Taft silt loam, 0 to 2 percent slopes. This is a deep, somewhat poorly drained, level to nearly level soil on old stream terraces in broad valleys. Individual areas range from about 10 to 400 acres in size.

Typically, the surface layer is brown silt loam about 6 inches thick. The subsoil is yellowish brown, mottled, friable silt loam to a depth of about 19 inches; light gray, mottled, friable silt loam to a depth of about 21 inches; yellowish brown, mottled, compact and brittle silty clay loam to a depth of about 30 inches; mottled gray, yellowish brown, and strong brown, compact and brittle silty clay loam to a depth of about 49 inches; and yellowish brown, mottled, firm silty clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and moderate in content of organic matter. It is strongly acid or very strongly acid throughout. Permeability is slow, and the available water capacity is medium. The firm, compact and brittle fragipan in the subsoil restricts root penetration and slows the movement of water through the soil. Crops and grasses on this soil respond well to fertilizer.

Included with this soil in mapping are a few small areas of Guthrie and Leadvale soils. The Guthrie soils are lower on the landscape than the Taft soil, and the Leadvale soils are higher. Also included are a few small areas of low mounds.

The Taft soil has fair potential for cultivated crops. It is suited to soybeans and grain sorghum. Winter small grains can be grown if surface drainage is adequate. If good management practices are used, including adequate drainage, clean-tilled crops that leave large amounts of residue on the surface can be grown year after year.

This soil has good potential for pasture, and it is used mainly as pasture. The soil is suited to bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Surface drainage is needed in some areas. Other management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is good. The soil is suited to loblolly pine, sweetgum, and water oak. Wetness is a moderate limitation to the use of equipment. Logging should be done in the dry season.

This soil has poor potential for most urban uses. Wetness is a severe limitation for dwellings, local roads and streets, and small commercial buildings. These limitations generally can be overcome through proper engineering design. Slow permeability and wetness are severe limitations for septic tank absorption fields. These limitations are difficult to overcome.

This soil is in capability unit IIIw-2 and in woodland suitability group 3w8.

35—Udorthents. This map unit consists of coal pits, abandoned pits, and nearly level to very steep areas of mine spoil. The pits are long, open excavations. Individual areas range from about 10 to 50 acres in size.

Udorthents are about 10 percent pits and 90 percent mine spoil. The soils in these areas have been altered or obscured by mining operations, which have made classification of the soils impractical. The soil material ranges from silt loam to very shaly silty clay loam. The content of coarse fragments ranges from about 15 to 90 percent.

Permeability is moderate to rapid. Natural fertility and the content of organic matter are low. The available water capacity is low. The soils are slightly acid to extremely acid throughout.

Included in mapping are a few small areas of Leadvale and Taft soils.

Areas of this map unit are not suited to cultivated crops. The smoothed areas have fair potential for pasture, and the unsmoothed areas have poor potential. Adapted pasture plants include bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The potential for woodland use is poor. Seedling mortality, erosion, droughtiness, and slope in the unsmoothed areas are severe limitations to woodland use and management.

The potential is poor for most urban uses. Slopes of less than 15 percent are a moderate limitation for dwellings, small commercial buildings, local roads and streets, and septic tank absorption fields, and slopes of more than 15 percent are a severe limitation.

Because this map unit is so variable, it is not assigned a capability unit or woodland suitability group.

use and management of the soils

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

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

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

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

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

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

crops and pasture

W. Wilson Ferguson, conservation agronomist, Soil Conservation Service, helped prepare this section.

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

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

About 102,030 acres in the survey area was used for crops and pasture in 1967 (*5*). Of this total, 45,636 acres was used for permanent pasture and 56,394 acres for other crops, mainly soybeans. Grain sorghum is grown to an increasing extent; wheat and oats are also grown.

Contour cultivation, terraces, and vegetative waterways are needed on sloping soils that are used for clean-tilled crops. Row arrangement and suitable drainage are needed for dependable growth in wet areas.

Annual cover crops of grasses and legumes should be grown regularly in the cropping system if erosion is a severe hazard or if the crops grown leave only a small amount of residue. Crop residue should be left on the surface to provide the soil with a protective cover.

A plow pan commonly forms in loamy soils that are improperly tilled or are tilled frequently with heavy equipment. Keeping tillage to a minimum, varying the depth of tillage, and tilling when the content of soil moisture is favorable help to prevent formation of a plow pan.

If left bare, the loamy soils tend to crust and pack during periods of heavy rainfall. Growing cover crops and managing crop residue help maintain good tilth.

The amount of fertilizer and lime to be applied should be determined by soil tests and will depend on the kinds of crops to be grown.

Coastal bermudagrass (improved bermudagrass), common bermudagrass, and Pensacola bahiagrass are the summer perennials most commonly grown in the county. Coastal bermudagrass and Pensacola bahiagrass are fairly new to the county, but both are highly satisfactory in providing good quality forage. Johnsongrass is also suited to many of the soils in the county. Tall fescue is the principal winter perennial grass. Annual lespedeza and white clover are the most commonly grown legumes and generally are grown in combination with grass. Alfalfa is grown on the fertile, well drained soils on the bottom land adjacent to the Arkansas River.

Proper grazing is essential for the production of high quality forage and for stand survival and erosion control. Maintaining sufficient topgrowth on the plants during the growing season insures vigorous, healthy growth. Excluding or restricting grazing of tall fescue in summer is also necessary. Brush control is essential, and weed control is often needed.

Grass pastures respond well to nitrogen, and pastures of grass and legume mixtures may require phosphate, potash, and lime in amounts based on soil tests.

According to an inventory made in 1967, about 17 percent, or 55,902 acres of Logan County is used as rangeland (*5*). Most of the rangeland is on steep slopes and ridgetops throughout the county. Information concerning range management can be obtained by contacting the Logan County Conservation District.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 7. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

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

Crops other than those shown in table 7 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

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

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

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

Class III soils have severe limitations that reduce the choice of plants or that require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants or that require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use.

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

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

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar

management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-2.

The capability classification of each map unit is given in the section "Detailed soil map units."

woodland management and productivity

Paul I. Brown, forester, Soil Conservation Service, helped prepare this section.

Originally, the area which is now Logan County was a forest. In 1969, the Arkansas Conservation Needs Inventory reported the forest cover in Logan County to be about 266,000 acres, or 58 percent of the total land area (*5*). Approximately 103,000 acres of this forested area is within the boundaries of the Ouachita National Forest, the Ozark National Forest, and the areas administered by the Corps of Engineers. Most of the original forest land suitable for food and forage production has been cleared, making the present land use patterns relatively stable.

Good to poor stands of commercial trees can be found in the county. Needle-leaved and mixed needle- and broad-leaved tree species dominate the uplands and the Ouachita Mountain area, and broad-leaved species dominate the bottom land areas.

The value of wood products in Logan County is substantial; however, it is much below its potential. In addition to wood production, the forests of Logan County are valuable as grazing land, wildlife habitat, and recreation and natural scenic areas and for soil and water conservation.

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

The first part of the *woodland suitability group symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r. The third part of the symbol, a number, indicates the kind of trees for which the soils in the group are best suited and also indicates the severity of the hazard or limitation. The numerals 1, 2, and 3 indicate slight, moderate, and severe limitations, respectively, and suitability for needleleaf trees. The numerals 4, 5, and 6 indicate slight, moderate, and severe limitations, respectively, and suitability for broadleaf trees. The numerals 7, 8, and 9 indicate slight, moderate, and severe limitations, respectively, and suitability for both needleleaf and broadleaf trees.

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

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

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

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

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. Site index ratings are based on 50 years for all species except eastern cottonwood (30 years) and American sycamore (35 years). The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

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

recreation

The soils of the survey area are rated in table 9 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a

site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

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

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

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

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

wildlife habitat

Paul M. Brady, biologist, Soil Conservation Service, helped prepare this section.

The land and water resources in Logan County provide habitat for a multitude of game and nongame fish and wildlife species.

About 58 percent of the county is forested, and more than one-third of the forested area, roughly 103,000 acres, is in the Ozark and Ouachita National Forests. These forests support white-tailed deer, wild turkey, gray squirrel, fox squirrel, gray fox, bobcat, opossum, coyote, raccoon, great-horned owl, numerous woodland songbirds, a small population of black bear, and many other species. Deer and squirrel populations are rather high in certain parts of the county.

Farmland in Logan County is almost equally divided between cropland, pasture, and rangeland. The numerous dairy and other farms in the county support populations of bobwhite quail because of interspersed land uses, the types of cover used, and the presence of fields of hybrid sudan grass, grain sorghum, and soybeans. These farms are also favorable to populations of cottontail rabbit, mourning dove, red fox, striped skunk, red-tailed hawk, and many varieties of songbirds that prefer fields, fencerows, shrubby field borders, and woodland edges. Bald eagles and golden eagles occasionally visit certain areas of Logan County in winter.

About 3,000 farm ponds throughout the county supply habitat for largemouth bass, bluegill, redear sunfish, and channel catfish. These species and many more, including white bass, white crappie, flathead catfish, bowfin, carp, suckers, and gars, may be found in Lake Dardanelle and the Arkansas River along the northern county line. Petit Jean River, Six-Mile Creek, Hurrican Creek, and Blue Mountain Reservoir also supply habitat for many species of fish.

In some years, the major lakes and streams in Logan County serve as resting areas for numerous migrating waterfowl. An open scrubland on Magazine Mountain supports Arkansas' only known breeding population of the rufous-crowned sparrow.

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

In table 10, the soils in Logan County are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining

specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, panic grass, paspalum, bristlegrass, annual lespedeza, shrub lespedeza, and white clover.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are perennial lespedeza, beggarweed, pokeweed, cheatgrass, and wild bean.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, beech, cherry, maple, grape, honeysuckle, dogwood, hickory, and greenbrier. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

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

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

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

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

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

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, vireos, thrushes, woodpeckers, great-horned owl, squirrels, raccoon, black bear, and deer.

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

engineering

James L. Janski, assistant state conservation engineer, Soil Conservation Service, helped prepare this section.

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

Information in this section is intended for land use planning, for evaluating land use alternatives, and for

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

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

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

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

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

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

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

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper

40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage due to rapid permeability of the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated *fair, poor*, or *unsuited* as a source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 13 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 properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

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

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree

and kind of soil limitations are given for pond reservoir areas and for embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

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

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

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

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

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

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics.

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

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture (*4*). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent.

Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3 bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year. establish.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the

soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt and water in swamps and marshes is not considered flooding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons that form in soils that are not subject to flooding.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The kind of bedrock and its hardness as related to ease of excavation is also given. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if

the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as low, moderate, or high. It is based on soil texture, acidity, and amount of sulfate in the saturation extract.

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 18, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquoll (*Aqu*, meaning water, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquolls (*Hapl*, meaning minimal horizonation, plus *aquoll*, the suborder of the Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine, montmorillonitic, thermic Vertic Haplaquolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

In this section, each soil series recognized in the survey area is described. The descriptions are arranged in alphabetic order.

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*4*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*6*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Barling series

The Barling series consists of deep, moderately well drained, level and nearly level soils on flood plains of local streams. These soils formed in loamy alluvium of sandstone and shale that washed from uplands. The native vegetation was chiefly mixed hardwoods. Slopes are 0 to 2 percent.

Barling soils are geographically associated with Guthrie, Leadvale, and Spadra soils. All of the associated soils have an argillic horizon, except Guthrie. Guthrie soils, which are in level depressional areas on old stream terraces, have a fine-silty control section and a fragipan and are poorly drained. Leadvale soils, which

are on old stream terraces, have a fine-silty control section and a fragipan. Spadra soils, which are on flood plains nearer the streams, have a fine-loamy control section and are well drained.

Typical pedon of Barling silt loam, occasionally flooded, in a field in the NW1/4SE1/4SE1/4 sec. 18, T. 5 N., R. 26 W.

Ap—0 to 7 inches; dark brown (10YR 4/3) silt loam; weak fine granular structure; friable; many fine roots; few fine pores; strongly acid; clear wavy boundary.
A12—7 to 14 inches; brown (10YR 4/3) silt loam; common fine faint dark brown and pale brown mottles; weak medium subangular blocky structure; friable; common fine roots; few fine pores; strongly acid; gradual smooth boundary.
B1—14 to 22 inches; brown (10YR 5/3) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; common fine roots; common fine pores; strongly acid; gradual smooth boundary.
B21—22 to 34 inches; pale brown (10YR 6/3) silt loam; common medium faint light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; friable; few fine roots; common fine pores; strongly acid; gradual smooth boundary.
B22—34 to 56 inches; mottled yellowish brown (10YR 5/6), and gray (10YR 6/1) silt loam; weak medium subangular blocky structure; friable; common fine pores; very strongly acid.
B23—56 to 80 inches; mottled yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and grayish brown (10YR 5/2) silt loam; weak medium subangular blocky structure; friable; common fine roots; very strongly acid.

Depth to horizons with gray mottles in chroma of 2 or lower ranges from 6 to 24 inches. The A horizon is slightly acid to strongly acid, and the B horizon is slightly acid to very strongly acid.

The A horizon is 5 to 16 inches thick. It has hue of 10YR, value of 4, and chroma of 2 or 3 or value of 5 and chroma of 3.

The B1 and B21 horizons have hue of 10YR, value of 4, and chroma of 3 or 4 or value of 5 or 6 and chroma of 3. Common medium mottles are in shades of gray or grayish brown. The B22 and B23 horizons are mottled dark yellowish brown, yellowish brown, strong brown, gray, or grayish brown. The B2 horizon is silt loam or very fine sandy loam.

Cane series

The Cane series consists of deep, moderately well drained, gently sloping, slowly permeable soils on colluvial foot slopes and old stream terraces in broad valleys. These soils formed in loamy sediment of sandstone and shale that washed from uplands. The native vegetation was chiefly mixed hardwoods and some pines. Slopes are 3 to 8 percent.

Cane soils are geographically associated with Enders and Leadvale soils. Enders soils are higher on the landscape than the Cane soils. They have a clayey control section, are well drained, and do not have a fragipan. Leadvale soils are in similar positions on the landscape as the Cane soils. They have a fine-silty control section and are not so red.

Typical pedon of Cane fine sandy loam, 3 to 8 percent slopes, in a pasture in the NW1/4SW1/4NW1/4 sec. 5, T. 7 N., R. 23 W.

Ap—0 to 5 inches; dark brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; friable; strongly acid; clear smooth boundary.
B21t—5 to 20 inches; yellowish red (5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; many thin patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.
B22t—20 to 30 inches; yellowish red (5YR 5/6) clay loam; moderate medium subangular blocky structure; friable; common thin clay films on faces of peds; 5 percent, by volume, quartzite fragments one-fourth of an inch to 1 inch in diameter; very strongly acid; clear smooth boundary.
Bx—30 to 58 inches; yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) clay loam with common medium prominent light gray (10YR 7/1) mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; firm; compact and brittle; common thin clay films on faces of peds; 5 percent, by volume, quartzite fragments one-fourth of an inch to 1 inch in diameter; very strongly acid; gradual smooth boundary.
B3—58 to 72 inches; variegated yellowish brown (10YR 5/6), strong brown (7.5YR 5/6), and light gray (10YR 6/1) clay loam; weak medium subangular blocky structure; friable; 5 percent, by volume, quartzite fragments one-fourth of an inch to 3 inches in diameter; very strongly acid.

The solum ranges from about 60 to more than 80 inches in thickness. The A horizon is medium acid to strongly acid, and the B horizon is strongly acid or very strongly acid. Depth to the fragipan ranges from 20 to 35 inches.

The Ap horizon is 4 to 8 inches thick. It has hue of 7.5YR, value of 4 or 5, and chroma of 4 or hue of 10YR, value of 4 or 5, and chroma of 3.

The B2t horizon has hue of 5YR, value of 4 or 5, and chroma of 4, 6, or 8. It is clay loam or silty clay loam. The Bx horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8 or hue of 5YR, value of 4 or 5, and chroma of 6 or 8. Medium and coarse mottles of light gray are common to many. In some pedons this horizon does not have a dominant matrix color; it is mottled or

variegated in the matrix color. The Bx horizon is loam, clay loam, or silty clay loam. The B3 horizon has the same color range as the Bx horizon. It is clay loam or loam.

Crevasse series

The Crevasse series consists of deep, excessively drained, rapidly permeable soils that formed in stratified sandy alluvium on young natural levees along the Arkansas River. The native vegetation was pecan, cottonwood, and willow. Slopes are 0 to 3 percent.

Crevasse soils are geographically associated with the Roxana soils. Crevasse soils and Roxana soils are on natural levees; Roxana soils, however, are on older natural levees. They have a coarse-silty control section.

Typical pedon of Crevasse loamy fine sand, 0 to 3 percent slopes, in a field in the NE1/4SE1/4NE1/4 sec. 18, T. 8 N., R. 25 W.

Ap—0 to 10 inches; dark grayish brown (10YR 4/2) loamy fine sand; weak fine granular structure; very friable; many fine roots; slightly acid; abrupt smooth boundary.
C1—10 to 40 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; common bedding planes; common fine roots; slightly acid; gradual smooth boundary.
C2—40 to 47 inches; dark yellowish brown (10YR 4/4) loamy fine sand; single grained; loose; common bedding planes; common fine roots; slightly acid; gradual smooth boundary.
C3—47 to 72 inches; light yellowish brown (10YR 6/4) fine sand; single grained; loose; common bedding planes; neutral.

Bedding planes are evident in the 10- to 40-inch control section. Reaction is slightly acid to moderately alkaline throughout.

The A horizon is 6 to 10 inches thick. It has hue of 10YR, value of 4, and chroma of 2 or value of 5 and chroma of 2 or 3.

The C horizon is stratified. It has hue of 10YR, value of 4 or 5, chroma of 3 or 4 or value of 6 and chroma of 4. Its texture is loamy fine sand, fine sand, or sand.

Dardanelle series

The Dardanelle series consists of deep, well drained, moderately permeable soils that formed in loamy alluvium on natural levees along the Arkansas River. The native vegetation was hardwoods. Slopes are 0 to 1 percent.

Dardanelle soils are geographically associated with Roxana, Roellen, and Moreland soils. Roxana soils, which are on slightly higher natural levees, have a coarse-silty control section and do not have an argillic horizon. Moreland soils, which are in slack-water areas, have a fine control section and are somewhat poorly drained. Roellen soils are in slack-water areas; they have a fine control section and are poorly drained.

Typical pedon of Dardanelle silt loam, 0 to 1 percent slopes, in a field in the NE1/4NW1/4SE1/4 sec. 14, T. 8 N., R. 26 W.

Ap—0 to 10 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; friable; many fine and medium roots; slightly acid; abrupt smooth boundary.
B21t—10 to 35 inches; dark brown (7.5YR 3/2) silty clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; common fine and medium roots; common fine pores; slightly acid; gradual wavy boundary.
B22t—35 to 59 inches; brown (7.5YR 4/4) silty clay loam; moderate medium subangular blocky structure; friable; dark reddish brown (5YR 3/3) coatings on faces of many peds; common patchy clay films on faces of peds; few fine roots; common fine pores; slightly acid; gradual wavy boundary.
C—59 to 72 inches; reddish brown (5YR 4/4) silt loam; massive; friable; slightly acid.

The solum ranges from about 45 to 70 inches in thickness. The mollic epipedon ranges from 20 to 40 inches in thickness. Reaction is medium acid or slightly acid in the A horizon and medium acid to neutral in the B horizon. The C horizon is slightly acid to mildly alkaline.

The A horizon is 6 to 10 inches thick. The Ap horizon has hue of 10YR, 7.5YR, or 5YR, value of 3, and chroma of 2.

The B21t horizon has hue of 10YR or 7.5YR, value of 3, and chroma of 2, or it has hue of 5YR, value of 3, and chroma of 3. The B22t horizon has hue of 7.5YR, value of 4, and chroma of 2 or 4 or hue of 5YR, value of 3 or 4, and chroma of 3 or 4. The texture is silt loam or silty clay loam.

The C horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 4 or 6. It is very fine sandy loam, silt loam, or loam.

Enders series

The Enders series consists of deep, well drained, very slowly permeable soils on gently sloping to steep hillsides, mountainsides, and ridges. These soils formed in a thin layer of loamy colluvial material and underlying clayey material that weathered from acid shale. The native vegetation was hardwood or mixed pine and hardwood forest. Slopes are 3 to 45 percent.

Enders soils are geographically associated with Cane, Leadvale, Linker, Mountainburg, and Nella soils. Cane and Leadvale soils are on colluvial foot slopes and old stream terraces in broad valleys. Cane soils have a fine-loamy control section and a fragipan. Leadvale soils have a fine-silty control section and a fragipan. Linker and Mountainburg soils are on mountaintops,

mountainsides, hilltops, hillsides, and benches; they are shallower to bedrock. Linker soils have a fine-loamy control section. Mountainburg soils have a loamy-skeletal control section. Nella soils, which are on mountainsides, benches, and foot slopes, have a fine-loamy control section.

Typical pedon of Enders gravelly silt loam, in a wooded area of Nella-Enders association, rolling, in the SE1/4NE1/4NE1/4 sec. 16, T. 6 N., R. 25 W.

O1—1 inch to 0; forest litter.
A11—0 to 3 inches; dark brown (10YR 3/3) gravelly silt loam; weak medium granular structure; very friable; many fine roots; 20 percent, by volume, small sandstone and shale fragments; strongly acid; clear smooth boundary.
A12—3 to 7 inches; brown (7.5YR 5/4) gravelly silt loam; weak medium subangular blocky structure; friable; common fine roots; 15 percent, by volume, sandstone and shale fragments; very strongly acid; clear smooth boundary.
B21t—7 to 32 inches; yellowish red (5YR 5/6) silty clay; moderate medium subangular blocky structure; firm; continuous clay films on faces of peds; few fine roots; few fine pores; 10 percent, by volume, shale fragments; very strongly acid; gradual wavy boundary.
B22t—32 to 44 inches; yellowish red (5YR 5/6) silty clay; common medium distinct gray (10YR 6/1) mottles; moderate medium subangular blocky structure; firm; continuous clay films on faces of peds; few fine roots; few fine pores; 10 percent, by volume, gray shale fragments; very strongly acid; abrupt wavy boundary.
R—44 to 50 inches; shale bedrock.

The solum ranges from 40 to 59 inches in thickness. Depth to bedrock ranges from 40 to more than 60 inches. Reaction is strongly acid to extremely acid throughout.

The A horizon is 3 to 8 inches thick. The A11 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The A12 horizon has hue of 10YR, value of 5, and chroma of 3 or 4 or hue of 7.5YR, value of 5, and chroma of 4 or 6. Texture is silt loam, gravelly silt loam, or stony silt loam. The gravel content ranges from 0 to 20 percent. Sandstone fragments up to 12 inches in diameter range from 0 to 20 percent, by volume.

The B1 horizon, where present, has hue of 7.5YR, value of 5, and chroma of 6 or 8. The B21t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8. The B22t and B23t horizons have hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8; or hue of 10YR, value of 6, and chroma of 1; or hue of 10YR, value of 5, and chroma of 6. Texture of the B2t horizon is silty clay or clay. Sandstone and shale fragments make up 0 to 10 percent of the B1 and B2t horizons. Shale fragments make up 10 to 25 percent of the B3 and C horizons, where present.

Guthrie series

The Guthrie series consists of deep, poorly drained, slowly permeable soils on old stream terraces in broad valleys. These soils formed in loamy sediment of weathered sandstone and shale that washed from uplands. They are saturated with water late in winter and early in spring. The native vegetation was hardwoods and tall grasses. Slopes are 0 to 1 percent.

Guthrie soils are geographically associated with Barling, Leadvale, Muskogee, and Taft soils. The moderately well drained Barling soils, which are on flood plains, have a coarse-silty control section and do not have a fragipan. The moderately well drained Leadvale and Muskogee soils are in higher positions on the landscape. Leadvale soils have an argillic horizon above the fragipan. Muskogee soils do not have a fragipan. The somewhat poorly drained Taft soils, which are in slightly higher positions, have a fine-silty control section.

Typical pedon of Guthrie silt loam, 0 to 1 percent slopes, in a pasture in the NE1/4SW1/4SW1/4 sec. 34, T. 8 N., R. 26 W.

Ap—0 to 5 inches; grayish brown (10YR 5/2) silt loam; common medium distinct dark brown (10YR 3/3) mottles; weak fine granular structure; friable; many fine roots; few fine pores; strongly acid; clear wavy boundary.
B21g—5 to 15 inches; gray (10YR 5/1) silt loam; many medium distinct dark yellowish brown (10YR 4/4) mottles; moderate medium granular structure; friable; common fine roots; few fine pores; common fine concretions; very strongly acid; gradual wavy boundary.
B22g—15 to 24 inches; light brownish gray (10YR 6/2) silt loam; common fine and medium yellowish brown (10YR 5/8) mottles; weak fine subangular blocky structure; friable; few fine roots; few fine pores; common fine and medium dark concretions; very strongly acid; abrupt wavy boundary.
Bx1—24 to 48 inches; gray (10YR 6/1) silty clay loam; many medium distinct strong brown (7.5YR 5/8) mottles; weak coarse platy structure parting to moderate medium subangular blocky; compact and brittle; thin patchy clay films on faces of peds; few fine pores; very strongly acid; gradual wavy boundary.
Bx2—48 to 72 inches; mottled gray (10YR 5/1) and dark yellowish brown (10YR 4/4) silty clay loam; weak coarse platy structure parting to moderate medium subangular blocky; compact and brittle; few fine pores; very strongly acid.

The solum ranges from about 60 to 80 inches or more in thickness. Reaction is very strongly acid throughout, except for the surface layer where lime has been added. Depth to the fragipan ranges from 20 to 35 inches.

The A horizon is 4 to 10 inches thick. It has hue of 10YR, value of 5 or 6, and chroma of 2, 3, or 4. Fine and medium mottles of brown are few to common.

The B2 horizon has hue of 10YR, value of 5, 6, or 7, and chroma of 1 or 2. Fine and medium mottles of brown are few to common. This horizon is silt loam or silty clay loam. The Bx horizon has hue of 10YR, value of 5 or 6, and chroma of 1 or 2. There are few to many red and brown mottles.

Leadvale series

The Leadvale series consists of deep, moderately well drained, slowly permeable soils on colluvial foot slopes and old stream terraces in broad valleys. These soils formed in loamy sediment of sandstone and shale that washed from uplands. The native vegetation was chiefly mixed hardwoods and some pines. Slopes are 1 to 8 percent.

Leadvale soils are geographically associated with Barling, Cane, Enders, Guthrie, Muskogee, and Taft soils. Barling soils, which are on flood plains of local streams, have a coarse-silty control section and do not have a fragipan. Cane soils and Leadvale soils are in similar positions on the landscape. Cane soils have a fine-loamy control section and are redder than Leadvale soils. Enders soils, in higher positions on the landscape, have a clayey control section, do not have a fragipan, and are well drained. Muskogee soils are on high terraces near the Arkansas River. They contain more clay in the lower part of the argillic horizon and do not have a fragipan. Guthrie and Taft soils are in similar positions on the landscape as Leadvale soils, and they do not have an argillic horizon above the fragipan. Guthrie soils are poorly drained, and Taft soils are somewhat poorly drained.

Typical pedon of Leadvale silt loam, 1 to 3 percent slopes, in a field in the SW1/4NW1/4NE1/4 sec. 27, T. 8 N., R. 26 W.

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

B1—6 to 11 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; common fine roots; few fine pores; about 3 percent, by volume, shale fragments; common fine concretions; very strongly acid; clear smooth boundary.

B2t—11 to 23 inches; yellowish brown (10YR 5/6) silty clay loam; common fine faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; few fine roots; few fine pores; about 3 percent, by volume, shale fragments; very strongly acid; clear wavy boundary.

Bx—23 to 42 inches; mottled yellowish brown (10YR 5/6) light gray (10YR 7/1), and strong brown (7.5YR 5/6) silty clay loam; weak coarse prismatic structure parting to moderate medium subangular blocky; about 70 percent of the matrix is compact and brittle; common patchy clay films on faces of peds; common medium dark brown concretions; about 5 percent, by volume, shale fragments; very strongly acid; gradual wavy boundary.

B3—42 to 54 inches; light gray (10YR 6/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; relict fragments of shale; weak medium subangular blocky structure; firm; about 10 percent, by volume, shale fragments; very strongly acid; abrupt wavy boundary.

R—54 to 60 inches; rippable shale bedrock.

The solum is about 48 inches to more than 80 inches thick. The soil is strongly acid or very strongly acid throughout. Content of shale fragments is 0 to 10 percent in each horizon. Depth to the fragipan ranges from 16 to 38 inches. Depth to bedrock ranges from 48 to more than 96 inches.

The Ap horizon is 5 to 8 inches thick. It has hue of 10YR, value of 4, and chroma of 2 or 3 or hue of 10YR, value of 5, and chroma of 3.

The B1 horizon has hue of 10YR, value of 5, and chroma of 6 or 8. It is silt loam or silty clay loam. The B2t horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8. Fine and medium mottles of light gray are few to common in the lower part of the horizon in some pedons. The B2t horizon is silt loam or silty clay loam. The Bx horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8. Medium and coarse mottles of light gray and light brownish gray are common to many. In some pedons the Bx horizon does not have a dominant matrix color; it is mottled or variegated in the matrix color. This horizon is silt loam or silty clay loam. The B3 horizon has the same color range as the Bx horizon. It is silty clay loam or silty clay.

Linker series

The Linker series consists of moderately deep, well drained, moderately permeable, gently sloping soils on hilltops and mountaintops. These soils formed in weathered acid sandstone bedrock. The native vegetation was mixed hardwoods and pines. Slopes are 3 to 8 percent.

Linker soils are geographically associated with Enders and Mountainburg soils. Enders soils, which are on the sides of hills, mountains, and ridges, are deep and have a clayey control section. Mountainburg soils and Linker soils are in similar positions on the landscape. Mountainburg soils have a loamy-skeletal control section and are 12 to 20 inches deep over sandstone bedrock.

Typical pedon of Linker fine sandy loam, 3 to 8 percent slopes, in a pasture in the NE1/4NE1/4NE1/4 sec. 32, T. 8 N., R. 22 W.

O1—1 inch to 0; partially decomposed forest litter.

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak fine granular structure; friable; many fine roots; few fine pores; about 5 percent, by volume, sandstone fragments as much as 3 inches in diameter; strongly acid; clear smooth boundary.
A2—3 to 7 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium subangular blocky structure; friable; many fine roots; few fine pores; about 5 percent, by volume, angular sandstone fragments as much as 3 inches in diameter; very strongly acid; clear smooth boundary.
B1—7 to 11 inches; strong brown (7.5YR 5/6) fine sandy loam; weak medium subangular blocky structure; friable; many fine roots; few fine pores; very strongly acid; clear smooth boundary.
B21t—11 to 20 inches; yellowish red (5YR 4/8) clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; common fine roots; common fine pores; very strongly acid; gradual smooth boundary.
B22t—20 to 30 inches; red (2.5YR 4/6) clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; common fine pores; very strongly acid; clear smooth boundary.
B3—30 to 36 inches; red (2.5YR 4/6) clay loam; common medium distinct pale brown (10YR 6/3) mottles; weak medium subangular blocky structure; friable; few fine pores; very strongly acid; abrupt wavy boundary.
R—36 to 38 inches; horizontally bedded hard sandstone bedrock.

The solum is 20 to 40 inches thick over acid sandstone bedrock. The soil is strongly acid to extremely acid throughout.

The A1 or Ap horizon ranges from 3 to 7 inches thick. It has hue of 10YR, value of 3, and chroma of 2; hue of 10YR, value of 4, and chroma of 2, 3, or 4; or hue of 7.5YR, value of 4, and chroma of 4. The A2 horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 4. The content of sandstone fragments that are as much as 12 inches in diameter ranges from 0 to 15 percent.

The B1 horizon has hue of 7.5YR or 5YR, value of 4 or 5, and chroma of 6. It is loam, sandy clay loam, and fine sandy loam. The content of sandstone fragments that are as much as 12 inches in diameter ranges from 0 to 10 percent. The B2t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8. It is sandy clay loam, clay loam, or loam. The content of sandstone fragments that are as much as 12 inches in diameter ranges from 0 to 10 percent. The B3 horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8. In some places it is mottled or variegated in shades of brown. Its texture is loam, clay loam, or sandy clay loam, and the content of sandstone fragments that are as much as 12 inches in diameter ranges from 0 to 25 percent.

McKamie series

The McKamie series consists of deep, well drained, very slowly permeable soils that formed in stratified loamy and clayey alluvium on high terraces along the Arkansas River. The native vegetation was chiefly mixed hardwoods and pines. Slopes are 3 to 8 percent.

McKamie soils are geographically associated with Muskogee soils. Muskogee soils, which are in slightly lower positions on the landscape, are moderately well drained and have a fine-silty control section.

Typical pedon of McKamie silt loam, 3 to 8 percent slopes, in a moist pasture in the SE1/4SE1/4NE1/4 sec. 2, T. 8 N., R. 24 W.

Ap—0 to 4 inches; dark brown (7.5YR 4/4) silt loam; weak fine granular structure; friable; many fine and medium roots; few fine pores; strongly acid; abrupt smooth boundary.
B21t—4 to 17 inches; red (2.5YR 4/6) silty clay; moderate medium subangular blocky structure; firm; plastic; common fine and medium roots; few fine pores; continuous clay films on faces of peds; strongly acid; gradual smooth boundary.
B22t—17 to 32 inches; dark red (2.5YR 3/6) silty clay; moderate medium subangular blocky structure; firm; very plastic; continuous clay films or pressure faces on peds; few slickensides; very strongly acid; gradual smooth boundary.
B23t—32 to 53 inches; dark red (2.5YR 3/6) silty clay; common dark stains and common yellowish red (5YR 5/6) silt coatings on peds; moderate medium subangular blocky structure; firm; very plastic; continuous clay films or pressure faces on peds; few slickensides; common medium and coarse calcium concretions; slightly acid; gradual smooth boundary.
IIC—53 to 72 inches; stratified yellowish red (5YR 4/6) silty clay loam and fine sandy loam; weak, fine and medium subangular blocky structure; friable; neutral.

The solum ranges from 36 to 60 inches in thickness. The A horizon is slightly acid to strongly acid, and the upper part of the B horizon is medium acid to very strongly acid. Below a depth of 30 inches, the soil is very strongly acid to moderately alkaline and is calcareous in places.

The A horizon is 3 to 10 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3 or hue of 7.5YR, value of 4, and chroma of 2 or 4.

The B2t horizon has hue of 2.5YR or 5YR, value of 3 or 4, and chroma of 4, 6, or 8. It is clay or silty clay.

The IIC horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 4, 6, 8. It is clay loam, silty clay loam, silt loam, or fine sandy loam.

Moreland series

The Moreland series consists of deep, somewhat poorly drained, very slowly permeable soils. These soils

formed in clayey sediment in level slack-water areas on flood plains of the Arkansas River. The native vegetation was pecan, cottonwood, and willow. Slopes are dominantly less than 1 percent.

Moreland soils are geographically associated with Dardanelle and Roellen soils. Dardanelle soils, which are on natural levees, have a fine-silty control section and are well drained. Roellen soils, which are in similar positions on the landscape as Moreland soils, have grayer colors and are poorly drained.

Typical pedon of Moreland silty clay, 0 to 1 percent slopes, in a moist soybean field in the SW1/4SW1/4SW1/4 sec. 20, T. 8 N., R. 25 W.

Ap—0 to 9 inches; dark brown (7.5YR 3/2) silty clay; moderate medium granular structure; firm; many fine and medium roots; slightly acid; clear smooth boundary.

A12—9 to 18 inches; dark brown (7.5YR 3/2) silty clay; moderate fine subangular blocky structure; firm; many fine and medium roots; neutral; gradual wavy boundary.

B21—18 to 31 inches; reddish brown (5YR 4/4) silty clay; moderate medium subangular blocky structure; firm; plastic; many fine and medium roots; common slickensides; mildly alkaline; calcareous; gradual smooth boundary.

B22—31 to 55 inches; reddish brown (5YR 4/4) silty clay; moderate medium subangular blocky structure; firm; plastic; common fine and medium roots; few calcium concretions; common slickensides; mildly alkaline; calcareous; gradual smooth boundary.

B3—55 to 75 inches; dark reddish brown (5YR 3/4) silty clay; weak medium subangular blocky structure; firm; plastic; common slickensides; few calcium concretions; mildly alkaline; calcareous.

The solum ranges from about 50 to 72 inches or more in thickness. The A horizon is slightly acid to mildly alkaline, and the B horizon is neutral to moderately alkaline. In some places the soil is calcareous between depths of 10 and 40 inches.

The A horizon is 10 to 20 inches thick. It has hue of 7.5YR, value of 3, and chroma of 2 or hue of 5YR, value of 3, and chroma of 2 or 3.

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

Moreland soils in Logan County are a taxadjunct to the Moreland series in that they do not have gray mottles within 30 inches of the surface. This difference does not affect their use, behavior, or management.

Mountainburg series

The Mountainburg series consists of shallow, well drained, moderately rapidly permeable soils on the top and sides of ridges, hills, and mountains. These soils are gently sloping to steep. They formed in residuum of acid sandstone bedrock. The native vegetation was mixed hardwoods and pines and an understory of tall grasses. Slopes are 3 to 40 percent.

Mountainburg soils are geographically associated with Enders, Linker, and Nella soils. Enders soils, which are on side slopes, have a clayey control section and are deeper to bedrock. Linker soils, which are on hilltops and mountaintops, have a fine-loamy control section and are 20 to 40 inches deep over sandstone bedrock. Nella soils, which are on hillsides, mountainsides, footslopes, and benches, have a fine-loamy control section and are deep to bedrock.

Typical pedon of Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes, in a native grass pasture in the SW1/4SE1/4NW1/4 sec. 1, T. 7 N., R. 23 W.

A1—0 to 3 inches; dark brown (10YR 3/3) gravelly fine sandy loam; weak fine granular structure; friable; many fine and medium roots; few fine pores; about 35 percent, by volume, sandstone fragments one-fourth of an inch to 12 inches or more in diameter; strongly acid; abrupt wavy boundary.

B1—3 to 7 inches; brown (7.5YR 4/4)very gravelly fine sandy loam; weak fine subangular blocky structure; friable; many fine and medium roots; few fine pores; about 40 percent, by volume, sandstone fragments one-fourth of an inch to 12 inches or more in diameter; very strongly acid; clear smooth boundary.

B2t—7 to 15 inches; yellowish red (5YR 4/8) very gravelly fine sandy loam; fine and medium subangular blocky structure; friable; thin patchy clay films on faces of some peds; about 40 percent, by volume, sandstone fragments one-fourth of an inch to 12 inches in diameter; very strongly acid; abrupt smooth boundary.

R—15 to 17 inches; horizontally bedded acid sandstone bedrock.

The solum is 12 to 20 inches thick over acid sandstone bedrock. The A horizon is medium to very strongly acid, and the B horizon is strongly acid or very strongly acid.

The A horizon is 3 to 10 inches thick. It has hue of 10YR, value of 3 or 4, and chroma of 2 or 3 or value of 5 and chroma of 3. It is gravelly fine sandy loam or stony fine sandy loam. Sandstone fragments that are as much as 12 inches in diameter make up 15 to 35 percent of the A horizon.

In some pedons, there is a B1 horizon. It has hue of 7.5YR, value of 4, and chroma of 4 or value of 5 and chroma of 4 or 6. Its texture is gravelly fine sandy loam, very gravelly fine sandy loam, or stony fine sandy loam. Sandstone fragments that are as much as 12 inches in diameter make up 15 to 50 percent of the horizon. The B2t horizon has hue of 7.5YR, value of 5, and chroma of 6, or it has hue of 5YR, value of 4, and chroma of 8. It is 35 to 65 percent sandstone gravel and stones, and the

fine earth texture is fine sandy loam, loam, or sandy clay loam or the very gravelly analogs.

Muskogee series

The Muskogee series consists of deep, moderately well drained, slowly permeable soils that formed in stratified loamy and clayey alluvium on high terraces along the Arkansas River. The native vegetation was chiefly mixed hardwoods and pine. Slopes are 1 to 3 percent.

Muskogee soils are geographically associated with Guthrie, Leadvale, McKamie, and Taft soils. Leadvale soils, which are on slightly higher terraces and foot slopes, have a fragipan. Taft soils and Guthrie soils are on slightly lower terraces and have a fragipan. Guthrie soils do not have an argillic horizon. McKamie soils are in slightly higher positions on the landscape and are nearer the river. They are well drained and have a fine control section.

Typical pedon of Muskogee silt loam, 1 to 3 percent slopes, in a pasture, SE1/4SW1/4NE1/4 sec. 2, T. 8 N., R. 24 W.

Ap—0 to 5 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; many fine roots; common fine pores; medium acid; abrupt smooth boundary.

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

B1—10 to 15 inches; light yellowish brown (10YR 6/4) silt loam; weak medium subangular blocky structure; friable; common fine roots; very strongly acid; clear smooth boundary.

B21t—15 to 27 inches; yellowish brown (10YR 5/4) and strong brown (7.5YR 5/6) silty clay loam; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; firm; thin patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—27 to 49 inches; mottled yellowish red (5YR 4/6), strong brown (7.5YR 5/6), and light brownish gray (10YR 6/2) silty clay; moderate medium subangular blocky structure; very firm; plastic; thin patchy clay films on faces of peds; strongly acid; gradual wavy boundary.

B23t—49 to 80 inches; red (2.5YR 4/6) clay; common medium prominent light gray (10YR 7/2) mottles; moderate medium subangular blocky structure; very firm; plastic; thin patchy clay films on faces of peds; neutral.

The solum ranges from 60 to 80 inches or more in thickness. Reaction is medium acid to very strongly acid in the A horizon and the upper part of the B horizon. The B23t horizon is strongly acid through mildly alkaline; in some pedons it contains calcareous concretions.

The A horizon is 4 to 10 inches thick. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B1 horizon has hue of 10YR, value of 5 or 6, and chroma of 4 or 6. It is silt loam or silty clay loam. The B21t horizon has hue of 10YR, value of 5, and chroma of 4 or 6 or hue of 7.5YR, value of 5, and chroma of 6 or 8. In some pedons, fine or medium mottles of grayish brown or light brownish gray are few or common. The B21t horizon is silt loam or silty clay loam. The B22t, B23t, and B24t horizons have hue of 10YR, value of 6 or 7, and chroma of 1 or 2 or value of 5 and chroma of 6; hue of 7.5YR, value of 5, and chroma of 6; hue of 5YR, value of 4 or 5, and chroma of 6; and hue of 2.5YR, value of 4, and chroma of 6. In some pedons, red is dominant, and mottles are in the grayer colors. In other pedons, there is a mottled or variegated pattern with no dominant color. The B22t, B23t, and B24t horizons are silty clay or clay.

Nella series

The Nella series consists of deep, well drained, moderately permeable soils on moderately sloping to steep hillsides, mountainsides, foot slopes, and benches. These soils formed in loamy colluvium of acid sandstone and shale. The native vegetation was hardwoods or mixed pine and hardwoods. Slopes are 8 to 40 percent.

Nella soils are geographically associated with Enders, Linker, and Mountainburg soils. Enders soils and Nella soils are in similar positions on the landscape. Enders soils have a clayey control section. Linker soils, on hilltops and mountaintops, have a fine-loamy control section. They are 20 to 40 inches deep over sandstone bedrock. Mountainburg soils, on the top and sides of hills, mountains, and ridges, have a loamy-skeletal control section. They are less than 20 inches deep over sandstone bedrock.

Typical pedon of Nella gravelly fine sandy loam, in an area of Nella-Enders association, rolling, NE1/4NE1/4NE1/4 sec. 16, T. 6 N., R. 25 W.

O1—1 inch to 0; forest litter.

A11—0 to 3 inches; dark grayish brown (10YR 4/2) gravelly fine sandy loam; weak fine granular structure; friable; many fine and medium roots; few fine pores; about 35 percent, by volume, sandstone fragments one-fourth of an inch to 8 inches in diameter; strongly acid; clear smooth boundary.

A12—3 to 8 inches; brown (10YR 4/3) gravelly fine sandy loam; weak fine granular structure; friable; many fine and medium roots; about 30 percent, by volume, sandstone fragments one-fourth of an inch to 8 inches in diameter; very strongly acid; clear smooth boundary.

B1—8 to 14 inches; strong brown (7.5YR 5/6) gravelly loam; weak medium subangular blocky structure; friable; common fine roots; few fine pores; about 25 percent, by volume, sandstone fragments one-fourth

of an inch to 8 inches in diameter; very strongly acid; gradual smooth boundary.

B21t—14 to 30 inches; yellowish red (5YR 5/6) gravelly clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; few fine roots; few fine pores; about 20 percent, by volume, sandstone fragments one-fourth of an inch to 8 inches in diameter; very strongly acid; gradual smooth boundary.

B22t—30 to 50 inches; red (2.5YR 5/8) gravelly clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; about 20 percent, by volume, sandstone fragments one-fourth of an inch to 8 inches in diameter; very strongly acid; gradual smooth boundary.

B23t—50 to 72 inches; dark red (2.5YR 3/6) gravelly clay loam; common medium distinct yellowish red (5YR 5/6) and red (2.5YR 5/8) mottles; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; about 20 percent, by volume, sandstone fragments one-fourth of an inch to 8 inches in diameter; very strongly acid.

The solum ranges from 60 to 80 inches in thickness. Reaction is strongly acid or very strongly acid throughout. Coarse fragments make up about 10 to 35 percent of each horizon.

The A horizon is 4 to 8 inches thick. It has hue of 10YR, value of 4, and chroma of 2 or 3.

The B1 horizon has hue of 7.5YR, value of 5, and chroma of 6 or hue of 5YR, value of 4 or 5, and chroma of 4, 6, or 8. It is loam or gravelly loam. The B2t horizon has hue of 5YR, value of 4 or 5, and chroma of 6 or 8; hue of 2.5YR, value of 3, and chroma of 6; or hue of 2.5YR, value of 4 or 5, and chroma of 6 or 8. Its texture is clay loam, sandy clay loam, gravelly clay loam, or gravelly sandy clay loam.

Roellen series

The Roellen series consists of deep, poorly drained, slowly permeable soils that formed in clayey sediment in level slack-water areas on flood plains of the Arkansas River. The native vegetation was pecan, cottonwood, and willow. Slopes are dominantly less than 1 percent.

Roellen soils are geographically associated with Dardanelle and Moreland soils. Dardanelle soils are on natural levees; they have a fine-silty control section and are well drained. Moreland soils and Roellen soils are in similar positions on the landscape. Moreland soils are redder and are somewhat poorly drained.

Typical pedon of Roellen silty clay, 0 to 1 percent slopes, in a cultivated field in the NW1/4NE1/4SE1/4 sec. 24, T. 8 N., R. 26 W.

Ap—0 to 10 inches; very dark gray (10YR 3/1) silty clay; moderate medium granular structure; firm; plastic; many fine roots; few fine pores; neutral; abrupt smooth boundary.

B21g—10 to 33 inches; dark gray (10YR 4/1) clay; moderate medium angular blocky structure; firm; very plastic; many slickensides; common fine roots; few fine pores; neutral; gradual smooth boundary.

B22g—33 to 56 inches; dark gray (10YR 4/1) clay; common fine distinct reddish brown (5YR 4/3) mottles; moderate medium angular blocky structure; firm; very plastic; many slickensides; slightly acid; diffuse wavy boundary.

C—56 to 72 inches; reddish brown (5YR 4/3) silty clay; massive; very firm; very plastic; many slickensides; mildly alkaline.

The solum ranges from about 40 to 65 inches in thickness. The A horizon is medium acid to neutral, and the B and C horizons are slightly acid to mildly alkaline.

The A horizon is 10 to 20 inches thick. It has hue of 10YR, value of 3, and chroma of 1 or 2.

The B2 horizon has hue of 10YR, value of 4, and chroma of 1 or 2. Fine and medium, brown mottles are few to common in the lower part of the horizon. The B2 horizon is silty clay or clay.

The C horizon has hue of 5YR, value of 3 or 4, and chroma of 3 or 4, or it has hue of 7.5YR, value of 4, and chroma of 4. It is silty clay or clay.

Roellen soils in Logan County are a taxadjunct to the Roellen series in that the matrix colors of the C horizon have higher chroma than defined for the series. Use, behavior, and management of the soils are not affected.

Roxana series

The Roxana series consists of deep, well drained, moderately permeable soils that formed in stratified loamy alluvium on level natural levees along the Arkansas River. The native vegetation was pecan, cottonwood, and willow. Slopes are 0 to 1 percent.

Roxana soils are geographically associated with Dardanelle and Crevasse soils. Dardanelle soils are slightly lower on the landscape than Roxana soils; they have a fine-silty control section and an argillic horizon. Crevasse soils are on young natural levees; they are sandier than Roxana soils.

Typical pedon of Roxana silt loam, 0 to 1 percent slopes, in a cultivated area in the NE1/4NE1/4NW1/4 sec. 18, T. 8 N., R. 25 W.

Ap—0 to 10 inches; dark reddish brown (5YR 3/4) silt loam; weak fine granular structure; very friable; common fine roots; few fine pores; common bedding planes; slightly acid; clear smooth boundary.

C1—10 to 31 inches; brown (7.5YR 4/4) very fine sandy loam; weak medium granular structure; very friable; few fine roots; few fine pores; common bedding planes; neutral; gradual smooth boundary.

C2—31 to 45 inches; strong brown (7.5YR 5/6) very fine sandy loam; structureless; very friable; common bedding planes; neutral; gradual smooth boundary.
C3—45 to 72 inches; brown (7.5YR 5/4) loamy very fine sand; weak medium granular structure; very friable; common bedding planes; mildly alkaline.

The A horizon is slightly acid to mildly alkaline, and the C horizon is neutral to moderately alkaline.

The A horizon is 6 to 10 inches thick. It has hue of 5YR, value of 3 or 4, and chroma of 4.

The C horizon is stratified. It has hue of 5YR, value of 4, and chroma of 6; hue of 7.5YR, value of 5, and chroma of 4 or 6; or hue of 7.5YR, value of 4, and chroma of 4. It is very fine sandy loam, silt loam, or loamy very fine sand.

Spadra series

The Spadra series consists of deep, well drained, moderately permeable, nearly level soils on low stream terraces along the larger streams on the uplands. These soils formed in alluvium of sandstone and shale that washed from uplands. The native vegetation was mixed hardwoods and pines. Slopes are 1 to 3 percent.

Spadra soils are geographically associated with Barling soils. Barling soils and Spadra soils are in similar positions, but Barling soils are farther from the streams. Barling soils are moderately well drained, have a coarse-silty control section, and do not have an argillic horizon.

Typical pedon of Spadra silt loam, occasionally flooded, in a moist cultivated field in the NW1/4NE1/4NE1/4 sec. 19, T. 5 N., R. 26 W.

Ap—0 to 8 inches; dark yellowish brown (10YR 4/4) silt loam; weak fine granular structure; very friable; many fine roots; common fine pores; strongly acid; clear smooth boundary.
B21t—8 to 25 inches; brown (7.5YR 4/4) loam; weak fine subangular blocky structure; friable; common patchy clay films on faces of peds; common fine roots; few fine pores; very strongly acid; gradual smooth boundary.
B22t—25 to 45 inches; yellowish red (5YR 4/6) loam; weak fine subangular blocky structure; friable; common patchy clay films on faces of peds; few fine roots; few fine pores; very strongly acid; gradual smooth boundary.
B3—45 to 58 inches; yellowish red (5YR 4/6) fine sandy loam; weak fine subangular blocky structure; friable; few fine pores; very strongly acid; gradual smooth boundary.
C—58 to 77 inches; yellowish red (5YR 4/6) sandy loam; massive; very friable; very strongly acid; gradual smooth boundary.

The solum is 40 to 60 inches thick. It is medium acid to very strongly acid throughout.

The A horizon is 6 to 10 inches thick. It has hue of 10YR, value of 4, and chroma of 3 or 4; hue of 7.5YR, value of 4, and chroma of 4; or hue of 5YR, value of 4, and chroma of 4.

The B2t horizon has hue of 5YR, value of 4, and chroma of 4 or 6; hue of 5YR, value of 3, and chroma of 4; or hue of 7.5YR, value of 4, and chroma of 4. It is loam or sandy clay loam. The B3 and C horizons have hue of 5YR or 7.5YR, value of 4, and chroma of 4 or 6. The texture is sandy loam or fine sandy loam.

Taft series

The Taft series consists of somewhat poorly drained, level to nearly level soils on old stream terraces in valleys. These soils formed in loamy alluvium of sandstone and shale that washed from uplands. The native vegetation was mixed hardwoods and some pine. Slopes are 0 to 2 percent.

Taft soils are geographically associated with Guthrie, Leadvale, and Muskogee soils. Guthrie soils are lower on the landscape than Taft soils, are poorly drained, and do not have an argillic horizon. Leadvale soils and Taft soils are in similar positions on the landscape. Leadvale soils are better drained than Taft soils, and they have an argillic horizon above the fragipan. Muskogee soils are slightly higher on the landscape than Taft soils, and they do not have a fragipan.

Typical pedon of Taft silt loam, 0 to 2 percent slopes, in an idle area in the SE1/4SE1/4NW1/4 sec. 15, T. 8 N., R. 24 W.

Ap—0 to 6 inches; brown (10YR 5/3) silt loam; common fine distinct dark brown (10YR 3/3) mottles; weak fine granular structure; friable; many fine roots; few fine pores; strongly acid; clear smooth boundary.
B21—6 to 12 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; common fine roots; few fine pores; very strongly acid; clear smooth boundary.
B22—12 to 19 inches; yellowish brown (10YR 5/4) silt loam; common medium distinct strong brown (7.5YR 5/8) mottles and light gray (10YR 7/2) mottles; weak medium subangular blocky structure; friable; common fine roots; few fine pores; strongly acid; clear wavy boundary.
A'2—19 to 21 inches; light gray (10YR 7/2) silt loam; common medium distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; friable; common fine dark concretions; common fine pores; very strongly acid; clear irregular boundary.
B'x1—21 to 30 inches; yellowish brown (10YR 5/4) silty clay loam; common fine distinct strong brown (7.5YR 5/6) mottles and common medium distinct light gray (10YR 7/2) mottles; weak coarse prismatic structure parting to moderate medium subangular

blocky; about 70 percent of the matrix is compact and brittle; common patchy clay films on faces of peds and in pores; common fine pores; common light brownish gray (10YR 6/2) silt loam vertical veins one-half millimeter to 5 millimeters in diameter; common medium concretions; strongly acid; gradual wavy boundary.

B'x2—30 to 40 inches; mottled gray (10YR 6/1), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) silty clay loam; weak coarse prismatic structure parting to moderate medium subangular blocky; about 70 percent of the matrix is compact and brittle; common patchy clay films on faces of peds and in pores; many fine pores; common light brownish gray (10YR 6/2) silt loam vertical veins one-half millimeter to 5 millimeters in diameter; common dark concretions; very strongly acid; gradual wavy boundary.

B'x3—40 to 49 inches; mottled gray (10YR 6/1), yellowish brown (10YR 5/6), and strong brown (7.5YR 5/6) silty clay loam; weak coarse prismatic structure parting to moderate medium subangular blocky; about 70 percent of the matrix is compact and brittle; common patchy clay films on faces of peds and in pores; common fine pores; common light brownish gray (10YR 6/2) silt loam vertical veins one-half millimeter to 5 millimeters in diameter; common medium dark concretions; very strongly acid; gradual wavy boundary.

B'2t—49 to 72 inches; yellowish brown (10YR 5/4) silty clay loam; common medium and coarse distinct gray (10YR 6/1) mottles and common fine distinct brown (7.5YR 5/2) mottles; moderate medium subangular blocky structure; common patchy clay films on faces of peds; common medium dark concretions; very strongly acid.

The solum is 50 to more than 72 inches thick. It is strongly acid or very strongly acid throughout. Depth to the fragipan ranges from 20 to 30 inches. Depth to bedrock ranges from 60 to more than 80 inches.

The A horizon is 5 to 14 inches thick. It has hue of 10YR, value of 4, and chroma of 2 or value of 5 or 6 and chroma of 3.

The B2 horizon has hue of 10YR, value of 5 or 6, and chroma of 3 or 4. Fine and medium mottles of gray are few to common and are within 10 inches of the upper boundary of this horizon. The texture is silt loam or silty clay loam.

The A'2 horizon has hue of 10YR, value of 6 or 7, and chroma of 1, 2, or 3. Brown and gray mottles are common.

The B'x horizons have either mottled patterns of gray, yellowish brown, and brown, or they have dominant hue of 10YR, value of 5, and chroma of 4 or hue of 2.5Y, value of 5 or 6, and chroma of 4. Where there is a dominant hue, fine and medium mottles of brown or yellowish brown are few to common. The texture is silt loam or silty clay loam. The B'2t horizon has the same color range as the B'x horizon. Its texture is silty clay loam or silty clay.

formation of the soils

Soil is formed by the interaction of climate, living organisms, parent material, and relief over a period of time. Each factor acts on the soil and modifies the effect of the other factors. If climate, living organisms, or any other one of the five factors is varied to a significant extent, a different soil may be formed.

Climate and living organisms are the active forces in soil formation. Relief modifies the effects of climate and living organisms, mainly by its influence on temperature and runoff. And time is needed to allow the other factors to produce changes (*3*). The interaction of the factors of soil formation is more complex for some soils than for others.

climate

The climate of Logan County is characterized by warm summers, mild winters, and fairly abundant rainfall. The present climate probably is similar to the climate under which the soils in the county formed. The average daily temperature in July is 82 degrees F, and in January it is about 40 degrees F. The total annual rainfall is about 45 inches and is well distributed throughout the year. For additional information about the climate, refer to the section "General nature of the county".

The warm, moist climate promotes rapid soil formation, and the warm temperature encourages rapid chemical reactions. The large amount of water that moves through the soil is instrumental in removing dissolved or suspended materials. Because remains of plants decompose rapidly, the organic acids thus formed hasten the removal of carbonates and the formation of clay minerals. Because the soil is frozen only to a shallow depth and for a relatively short period, soil formation continues almost the year round. Although the climate is relatively uniform throughout the county, its effect is modified locally by runoff and the aspect of the slope. Climate alone does not account for differences in the soils of the county.

living organisms

The higher plants and animals, as well as insects, bacteria, and fungi, are important in the formation of soils. These organisms help to increase the content of organic matter and the supply of nitrogen, to increase or decrease the supply of other plant nutrients, and to change the structure and porosity of the soils.

Before Logan County was settled, the native vegetation had more influence on soil formation than did animal activity. Hardwood forests covered the bottom lands. Crevasse, Dardanelle, Moreland, Roellen, and Roxana soils formed in these areas. They differ from each other mainly because of the effects of parent material and age.

The upland part of the county had several different types of native vegetation. The level and nearly level areas of the broad valleys in the northern and western part of the county supported a luxuriant growth of tall bunch grasses with scattered hardwood trees. Guthrie, Leadvale, Muskogee, and Taft soils formed in these areas. However, these soils do not have the thick, dark colored surface layer commonly associated with soils that formed under this type of vegetation. They appear to have been influenced more by parent material, climate, and relief than by vegetation. In the narrow valleys and along the streams in the sloping and hilly parts, the native vegetation was mixed pines and hardwoods. Leadvale and Spadra soils formed in these areas. These soils differ from each other chiefly in age, relief, and degree of weathering. The low hills were characterized by savannas of scattered, stunted hardwoods, cedars, and pines and an understory of tall grasses. Linker and Mountainburg soils formed there. They differ from each other mainly in age and degree of weathering, and they are shallower than the Leadvale and Spadra soils.

The native vegetation in most of the mountainous area in the central and southern parts of the county was upland oak, hickory, redcedar, and shortleaf pine. Only in the upper few inches of the soils in these areas is there a significant accumulation of organic matter and the characteristic dark color. Enders and Nella soils formed on these uplands. They differ from each other mainly in age and degree of weathering, in relief, and in the kind of parent material.

Differences in the native vegetation on the uplands seem to be related mainly to variations in the available water capacity of the soils. On the lowlands, however, the differences seem to be related mainly to variations in drainage. For example, Moreland and Roellen soils formed in swampy places and have a thick dark surface layer, resulting from the accumulation of organic debris in the swamps. The adjacent well drained soils do not have a dark surface layer. Only major differences in the original vegetation are reflected to any extent by the characteristics of the soil.

Man is important as an influence on future soil formation in the county. He clears the forest, cultivates the land, introduces new kinds of plants, and adds fertilizer, lime, and chemicals to the soils for insect, disease, and weed control. He builds levees and dams for flood control, improves drainage, and grades the soil surface. All of these activities affect the development of soils, although some results of these changes will not be evident for many centuries.

parent material

The acid sandstone and shale that cover most of Logan County were deposited in marine waters during the Pennsylvanian Period. These sedimentary rocks have various textures. They range from rather coarse-grained sandstone to shaly sandstone, from sandy shale to clay shale. There are four different rock formations in the county.

The Atoka Formation is the oldest formation in the county and is also the most extensive and the thickest. It is composed of interbedded shale and thin-bedded sandstone, with shale predominating. Residual soils, for example, Enders soils, formed in material that weathered from the sandstone and shale.

The Hartshorne Formation, in some places, rests on the Atoka Formation. It is composed of sandstone and sandy shale. Mountainburg and Linker soils formed in material that weathered from this formation. The sandstone is generally brown or yellowish brown. In some places, it is almost white. It is medium grained and well cemented; in some places, however, it is saccharoidal and poorly cemented.

The McAlester Formation rests on the Hartshorne Formation. It consists of shale with some sandstone lenses. It outcrops on the sides of some of the hills and in some of the valley floors. Enders soils formed in material that weathered from the outcrops on hillsides.

The Savanna Formation overlies the McAlester Formation and consists principally of sandstone and sandy shale. The weathered material is mostly sandy and is yellowish to reddish. Mountainburg and Linker soils are the principal residual soils that formed in this material.

Soils on the flood plains of upland drainageways, mainly the Spadra soils, formed in loamy sediment that washed from local uplands.

Soils that formed on the valley terraces include Guthrie, Leadvale, and Taft soils. These soils have well developed horizons that formed in loamy local sediment. The soils on benches along the mountainsides formed in friable, loamy and silty material that washed or rolled down from above. These are Nella soils. In many places they are stony or gravelly because coarse fragments of sandstone have rolled down from the caprock on the bluffs.

Soils along the Arkansas River formed in well sorted alluvial sediment deposited by flood waters. The Crevasse soils formed in sandy sediment deposited along or near the river as natural levees. The Moreland and Roellen soils formed in predominantly clayey sediment deposited by slack water on flats and flood bays at places farther from the river. The Dardanelle and Roxana soils formed in the loamy sediment deposited between the areas of sandy sediment and clayey sediment.

relief

Relief, or differences in elevation, in Logan County has been brought about chiefly by faulting, folding, and the subsequent entrenchment of drainage channels into the land surface. The highest point in the county is Magazine Mountain, at an elevation of 2,823 feet above sea level, in the Ozark National Forest. The lowest area, 350 feet above sea level, is Lake Dardanelle in the northeastern part of the county.

Some of the greatest differences in the soils of Logan County are caused by differences in relief through its effect on drainage, runoff, erosion, and percolation. Relief in the county ranges from broad flats to nearly vertical bluffs.

Generally, the steeper soils and those on narrow ridges are shallow because they have lost so much soil material through geologic erosion. An example is the Mountainburg soils. In contrast, nearly level or gently sloping soils in broad areas have lost little soil material through geologic erosion, and the soils are moderately deep or deep. Examples are Linker and Leadvale soils.

In coves and on foot slopes there are deep accumulations of material that washed or slid down from adjoining steep slopes. The Nella soils formed in such spots. In places where rocks have broken off and rolled downslope, these soils are stony.

The Guthrie and Taft soils are in the level to depressional areas in the broad valleys. Surface drainage is slow or ponded; the soils are poorly drained, and permeability is slow. They are gray or have gray mottles because of the reduction of iron and because of wetness.

The flood plain of the Arkansas River is level to nearly level and was subject to frequent flooding before flood control dams were built on the river. The floodwater, carrying soil particles, moved at different speeds. Rapidly moving water deposited sandy sediment in which the Crevasse soils formed. The less rapidly moving water deposited sediment high in silt in which the Dardanelle and Roxana soils formed. The slack or still water trapped in flood bays and on broad flats deposited clayey sediment in which the Moreland and Roellen soils formed.

time

The length of time required for soils to form depends largely on the other factors of soil formation. For

example, less time generally is required if the climate is warm and humid and the vegetation luxuriant. If other factors are equal, less time is required if the parent material is loamy; more time is required if it is clayey.

In geological time, most of the soils of Logan County are old, whether they are on mountaintops, mountainsides, or stream terraces. The younger soils are those that formed in alluvium along streams.

Some of the soils on the uplands, Enders and Linker soils, for example, are old soils. They formed in material that weathered from rocks and shale of the Pennsylvanian Age. Most of the soils are old enough that nearly all of the cations have been leached out, and thus the soils are strongly acid or very strongly acid. There has been considerable weathering and translocation of clay, and the horizons are clearly expressed. Iron, as well as clay, has been translocated from the A horizon to the B horizon and then oxidized, causing the B horizon to have stronger red, brown, and yellow colors than the A horizon.

The Crevasse and Roxana soils are very young soils. They formed in recent alluvium on the flood plain of the Arkansas River. No distinct horizons have formed below the A horizon. Instead, these soils still have the depositional rock structure, or bedding planes, and little or no soil structure. Base saturation is high, and the reaction is slightly acid to moderately alkaline, which indicates that leaching has been slight. Except for slight mechanical changes caused by worms and roots, there is little evidence of soil-forming activity.

processes of soil formation

The effects of the soil-forming factors are recorded in the soil profile, which is a succession of layers, or horizons, from the surface to the parent rock. The horizons differ in one or more properties, such as color, texture, structure, consistency, and porosity.

Most soil profiles contain three major horizons, which are called A, B, and C. Very young soils do not have a B horizon.

The A horizon can be the horizon of maximum accumulation of organic matter, called the A1 horizon or the surface layer. It can also be the horizon of maximum leaching of dissolved or suspended materials, called the A2 horizon or subsurface layer.

The B horizon is immediately below the A horizon and is sometimes called the subsoil. It is the horizon of maximum accumulation of suspended materials such as clay and iron. The B horizon commonly has blocky structure and is firmer than the horizons immediately above and below it (*7*).

Below the B horizon is the C horizon. The C horizon is little affected by the soil-forming processes, but it may have been modified by weathering. In some young soils, the C horizon immediately underlies the A horizon and has been slightly modified by living organisms as well as by weathering.

Several processes have been active in the formation of soil horizons in Logan County. Among these processes are (1) the accumulation of organic matter, (2) the leaching of bases, (3) the oxidation or reduction and transfer of iron, and (4) the formation and translocation of silicate clay minerals. In most soils, more than one of these processes has been active in soil formation.

Organic matter has accumulated in the upper part of the profile in some soils to form an A1 horizon.

Leaching of bases has occurred to some degree in nearly all of the soils of Logan County. Among soil scientists it is generally accepted that bases are leached downward in soils before silicate clay minerals begin to move. Most of the soils in the county are moderately leached, an important factor in horizon development. Some, such as Crevasse and Roxana soils, are only slightly leached. Others, such as Enders, Linker, and Mountainburg soils, are strongly leached.

Oxidation of iron is evident in the moderately well drained and well drained soils in the county, such as Linker, Mountainburg, and Enders soils on uplands and Leadvale soils in valleys. Red and brown colors in the B horizon indicate oxidation of iron.

Reduction and transfer of iron has occurred to a significant degree in the poorly drained and somewhat poorly drained soils in the lowlands. In the naturally wet soils, this process is called gleying. Gray colors in the horizons below the surface layer indicate the reduction and loss of iron. Some horizons contain reddish or yellowish mottles and concretions derived from segregated iron. Gleying is most pronounced in the Guthrie, Roellen, and Taft soils.

Translocation of silicate clay minerals has contributed to horizon development in most of the soils in the county. In cultivated areas, most of the eluviated A2 horizon has been destroyed. Where the A2 horizon is present, its clay content is less than that of the lower horizons, and the horizon is lighter in color. Clay films generally have accumulated in pores and on the surface of peds in the B horizon. Leaching of carbonates and soluble salts probably occurred before the translocation of silicate clay, though the content of bases is still high in some of the soils on lowlands.

Physical weathering slowly breaks rocks into small pieces through heating and cooling, wetting and drying. These pieces form the parent material for the residual soils in the county. The process of physical weathering is most evident in Linker and Mountainburg soils.

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glossary

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

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

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from 25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

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.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Depth to rock. Bedrock is too near the surface for the specified use.

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

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

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

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

Fast intake (in tables). The rapid movement of water into the soil.

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

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

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

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

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

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

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

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

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil*

Survey Manual. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.
R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous areas. Areas that have little or no natural soil and support little or no vegetation.

Moderately coarse textured soil. Sandy loam and fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, and silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium,

magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine

particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--ACREAGE OF PRINCIPAL CROPS AND PASTURE IN STATED YEARS

Crops and pasture	1969	1974
Cropland, pastured	59,109	64,184
Woodland, including wooded pasture[1]	50,235	42,214
Hay crops	18,893	23,951
Soybeans (for beans)	5,417	6,751
Cotton	645	252
Corn (for all purposes)	456	288
Wheat	670	478
Truck crops (including potatoes)	3	13
Orchards and vineyards	22	6

[1] The 1974 Census and observations during the fieldwork for this survey indicate that most of the woodland is pastured.

TABLE 2.--NUMBER OF LIVESTOCK ON FARMS IN STATED YEARS

Livestock and poultry	1969	1974
Cattle and calves (sold)	58,858	66,838
Milk cows	6,019	5,818
Hogs and pigs (sold)	2,403	2,095
Chickens more than 3 months old (sold)	205,431	144,589
Broilers (sold)	9,509,058	12,452,064

TABLE 3.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-73 at Subiaco, Ark.]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January----	51.6	28.9	40.3	77	5	13	2.32	1.12	3.29	4	1.8
February---	56.4	32.9	44.7	79	10	41	2.97	1.49	4.17	5	1.4
March------	63.9	39.6	51.8	87	17	182	4.06	2.06	5.68	7	.5
April------	74.9	50.6	62.8	91	29	384	4.94	2.62	6.82	7	.0
May--------	82.3	58.3	70.3	95	40	629	5.23	2.50	7.45	6	.0
June-------	89.8	66.1	78.0	101	51	840	3.96	1.48	5.95	6	.0
July-------	93.9	69.5	81.7	105	55	983	3.93	1.74	5.70	5	.0
August-----	93.3	67.7	80.5	105	55	946	3.28	1.66	4.59	5	.0
September--	86.9	61.7	74.3	100	44	729	3.50	1.63	5.02	5	.0
October----	77.0	50.5	63.8	93	30	428	3.73	1.40	5.60	5	.0
November---	63.3	39.5	51.4	82	18	124	3.76	1.63	5.48	5	.7
December---	53.7	32.1	42.9	78	9	24	3.60	1.52	5.28	5	.8
Yearly:											
Average--	73.9	49.8	61.9	---	---	---	---	---	---	---	---
Extreme--	---	---	---	106	3	---	---	---	---	---	---
Total----	---	---	---	---	---	5,323	45.28	36.87	53.25	65	5.2

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 4.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-73 at Subiaco, Ark.]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 26	April 2	April 14
2 years in 10 later than--	March 19	March 27	April 10
5 years in 10 later than--	March 5	March 17	April 1
First freezing temperature in fall:			
1 year in 10 earlier than--	November 4	October 29	October 23
2 years in 10 earlier than--	November 11	November 3	October 26
5 years in 10 earlier than--	November 25	November 12	November 3

TABLE 5.--GROWING SEASON

[Recorded in the period 1951-73 at Subiaco, Ark.]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	232	215	198
8 years in 10	243	223	204
5 years in 10	264	239	215
2 years in 10	286	254	226
1 year in 10	297	262	232

TABLE 6.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Barling silt loam, occasionally flooded	8,740	1.9
2	Cane fine sandy loam, 3 to 8 percent slopes	5,945	1.3
3	Crevasse loamy fine sand, 0 to 3 percent slopes	765	0.2
4	Crevasse loamy fine sand, frequently flooded	1,845	0.4
5	Dardanelle silt loam, 0 to 1 percent slopes	2,640	0.6
6	Dardanelle silt loam, occasionally flooded	530	0.1
7	Enders silt loam, 3 to 8 percent slopes	6,605	1.4
8	Enders silt loam, 8 to 20 percent slopes	7,710	1.7
9	Enders gravelly silt loam, 3 to 8 percent slopes	2,415	0.5
10	Enders gravelly silt loam, 8 to 20 percent slopes	32,520	7.1
11	Enders gravelly silt loam, 20 to 45 percent slopes	1,050	0.2
12	Enders stony silt loam, 12 to 45 percent slopes	45,400	9.9
13	Enders-Mountainburg association, rolling	18,565	4.0
14	Enders-Mountainburg association, steep	53,760	11.7
15	Guthrie silt loam, 0 to 1 percent slopes	2,235	0.5
16	Leadvale silt loam, 1 to 3 percent slopes	40,030	8.7
17	Leadvale silt loam, 3 to 8 percent slopes	71,725	15.7
18	Linker fine sandy loam, 3 to 8 percent slopes	42,175	9.2
19	McKamie silt loam, 3 to 8 percent slopes	1,125	0.2
20	Moreland silty clay, 0 to 1 percent slopes	1,260	0.3
21	Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes	11,955	2.6
22	Mountainburg gravelly fine sandy loam, 8 to 12 percent slopes	7,960	1.7
23	Mountainburg stony fine sandy loam, 3 to 12 percent slopes	8,035	1.7
24	Mountainburg stony fine sandy loam, 12 to 40 percent slopes	2,225	0.5
25	Muskogee silt loam, 1 to 3 percent slopes	1,190	0.3
26	Nella gravelly fine sandy loam, 8 to 12 percent slopes	555	0.1
27	Nella-Enders association, rolling	17,705	3.9
28	Nella-Enders association, steep	22,185	4.8
29	Nella-Mountainburg association, steep	4,915	1.1
30	Roellen silty clay, 0 to 1 percent slopes	2,405	0.5
31	Roxana silt loam, 0 to 1 percent slopes	3,010	0.7
32	Roxana silt loam, occasionally flooded	650	0.1
33	Spadra silt loam, occasionally flooded	9,145	2.0
34	Taft silt loam, 0 to 2 percent slopes	17,985	3.9
35	Udorthents	130	<0.1
	Small water areas[1]	2,110	0.5
	Approximate land area[2]	459,200	100.0
	Large water areas[3]	9,280	---
	Total area[4]	468,480	100.0

[1] Enclosed areas of water less than 40 acres and streams, sloughs, and canals less than one-eighth of a statute mile in width.

[2] 1974 Census of Agriculture.

[3] Enclosed areas of water more than 40 acres and streams, sloughs, and canals more than one-eighth of a statute mile in width.

[4] U.S. Department of Commerce, Bureau of the Census, GE-20, N. 1, May 1970.

TABLE 7.--YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Soybeans	Wheat	Tall fescue	Bahiagrass	Improved bermudagrass	Common bermudagrass
	Bu	Bu	AUM*	AUM*	AUM*	AUM*
1---------- Barling	35	40	9.0	---	12.0	8.0
2---------- Cane	25	30	7.0	7.0	9.0	7.0
3---------- Crevasse	---	---	---	---	6.0**	---
4---------- Crevasse	---	---	---	---	6.0	---
5---------- Dardanelle	40	---	---	---	13.0	8.0
6---------- Dardanelle	40	---	7.5	---	12.5	7.5
7---------- Enders	---	25	5.0	5.5	---	5.0
8---------- Enders	---	---	4.0	4.5	---	4.0
9---------- Enders	---	25	5.0	5.5	---	5.0
10---------- Enders	---	---	4.0	4.5	---	4.0
11---------- Enders	---	---	---	---	---	---
12---------- Enders	---	---	---	---	---	---
13: Enders----------	---	---	4.0	4.5	---	4.0
Mountainburg----------	---	---	---	---	---	---
14: Enders----------	---	---	---	---	---	---
Mountainburg----------	---	---	---	---	---	---
15---------- Guthrie	30	25	6.0	6.0	---	6.0
16---------- Leadvale	30	35	7.0	7.5	10.0	7.0
17---------- Leadvale	25	30	7.0	7.5	9.0	7.0
18---------- Linker	25	30	6.0	6.0	8.0	6.0
19---------- McKamie	20	---	5.5	5.5	---	5.0
20---------- Moreland	35	---	8.5	---	10.0	6.0

See footnotes at end of table.

TABLE 7.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Soybeans	Wheat	Tall fescue	Bahiagrass	Improved bermudagrass	Common bermudagrass
	Bu	Bu	AUM*	AUM*	AUM*	AUM*
21---------- Mountainburg	---	20	---	5.0	---	4.0
22---------- Mountainburg	---	---	---	4.5	---	4.0
23---------- Mountainburg	---	---	---	---	---	---
24---------- Mountainburg	---	---	---	---	---	---
25---------- Muskogee	25	30	6.5	7.5	10.0	7.0
26---------- Nella	---	35	7.0	4.5	9.0	6.0
27:						
Nella----------	---	---	6.0	4.5	---	5.0
Enders----------	---	---	4.0	4.5	---	4.0
28:						
Nella----------	---	---	---	---	---	---
Enders----------	---	---	---	---	---	---
29:						
Nella----------	---	---	---	---	---	---
Mountainburg----------	---	---	---	---	---	---
30---------- Roellen	35	25	6.5	---	---	6.0
31---------- Roxana	35	---	---	---	15.0	8.5
32---------- Roxana	35	---	---	---	15.0	8.5
33---------- Spadra	35	30	8.0	---	13.0	7.5
34---------- Taft	25	25	6.0	6.0	---	6.0
35. Udorthents						

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** Yields are for areas protected from flooding.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Woodland suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Common trees	Site index	
1---- Barling	2o7	Slight	Slight	Slight	Southern red oak----	80	Eastern cottonwood, American sycamore, shortleaf pine, loblolly pine, sweetgum, green ash, Shumard oak, cherrybark oak.
					Sweetgum----------	90	
					Eastern cottonwood--	95	
					Shortleaf pine------	80	
2---- Cane	3o7	Slight	Slight	Slight	Sweetgum----------	80	Loblolly pine, shortleaf pine.
					Loblolly pine-------	77	
3, 4---- Crevasse	2s6	Slight	Moderate	Severe	Sweetgum----------	90	Eastern cottonwood, American sycamore.
					White oak----------	90	
					Eastern cottonwood--	100	
					Sugarberry----------	---	
5, 6---- Dardanelle	1o4	Slight	Slight	Slight	Green ash----------	75	Eastern cottonwood, sweetgum, American sycamore, black walnut.
					Eastern cottonwood--	105	
					Cherrybark oak------	100	
					Sweetgum----------	100	
					American sycamore---	---	
7, 8, 9, 10---- Enders	4o1	Slight	Slight	Slight	Shortleaf pine------	60	Loblolly pine, shortleaf pine, eastern redcedar.
					Southern red oak----	60	
					White oak----------	55	
					Northern red oak----	60	
11---- Enders	5r3	Severe	Severe	Moderate	Southern red oak----	50	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak----------	50	
					Eastern redcedar----	35	
					Shortleaf pine------	50	
12---- Enders	5r3	Moderate	Severe	Moderate	Southern red oak----	50	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak----------	50	
					Eastern redcedar----	35	
					Shortleaf pine------	50	
13*:							
Enders----------	4o1	Slight	Slight	Slight	Shortleaf pine------	60	Loblolly pine, shortleaf pine, eastern redcedar.
					Southern red oak----	60	
					White oak----------	55	
					Northern red oak----	60	
Mountainburg------	5x3	Moderate	Severe	Moderate	Shortleaf pine------	50	Loblolly pine, shortleaf pine, eastern redcedar.
					Eastern redcedar----	30	
14*:							
Enders----------	5r3	Moderate	Severe	Moderate	Southern red oak----	50	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak----------	50	
					Eastern redcedar----	35	
					Shortleaf pine------	50	
Mountainburg------	5x3	Severe	Severe	Moderate	Shortleaf pine------	50	Loblolly pine, shortleaf pine, eastern redcedar.
					Eastern redcedar----	30	
15---- Guthrie	2w9	Slight	Severe	Severe	Southern red oak----	75	Loblolly pine, sweetgum.
					Loblolly pine-------	80	
					Willow oak----------	85	
					Sweetgum----------	90	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Wood-land suita-bility group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Common trees	Site index	
16, 17--Leadvale	4o7	Slight	Slight	Slight	White oak Shortleaf pine Eastern redcedar	65 65 ---	Loblolly pine, shortleaf pine, eastern redcedar.
18--Linker	4o1	Slight	Slight	Slight	Shortleaf pine Southern red oak White oak Eastern redcedar Loblolly pine	60 50 50 40 ---	Shortleaf pine, loblolly pine, eastern redcedar.
19--McKamie	3c2	Slight	Moderate	Moderate	Loblolly pine Shortleaf pine	80 70	Loblolly pine, shortleaf pine.
20--Moreland	2w6	Slight	Severe	Moderate	Green ash Eastern cottonwood Sweetgum American sycamore Water oak	70 100 90 --- 90	Eastern cottonwood, American sycamore, sweetgum.
21, 22--Mountainburg	5d2	Slight	Slight	Moderate	Shortleaf pine Eastern redcedar	50 30	Loblolly pine, shortleaf pine, eastern redcedar.
23--Mountainburg	5x3	Slight	Severe	Moderate	Shortleaf pine Eastern redcedar	50 30	Loblolly pine, shortleaf pine, eastern redcedar.
24--Mountainburg	5x3	Severe	Severe	Moderate	Shortleaf pine Eastern redcedar	50 30	Loblolly pine, shortleaf pine, eastern redcedar.
25--Muskogee	3o7	Slight	Slight	Slight	Shortleaf pine Sweetgum Loblolly pine Water oak Southern red oak	70 80 --- --- ---	Loblolly pine, shortleaf pine, eastern redcedar, Shumard oak, sweetgum.
26--Nella	3o7	Slight	Slight	Slight	Shortleaf pine Southern red oak Eastern redcedar Black oak Black walnut	71 66 61 70 ---	Shortleaf pine, loblolly pine, black walnut.
27*:							
Nella	3o7	Slight	Slight	Slight	Shortleaf pine Southern red oak Eastern redcedar Black oak Black walnut	71 66 61 70 ---	Shortleaf pine, loblolly pine, black walnut.
Enders	4o1	Slight	Slight	Slight	Shortleaf pine Southern red oak White oak Northern red oak	60 60 55 60	Loblolly pine, shortleaf pine, eastern redcedar.
28*:							
Nella	3r9	Severe	Severe	Slight	Shortleaf pine Southern red oak Eastern redcedar Black oak Black walnut	71 66 61 70 ---	Shortleaf pine, loblolly pine, black walnut.

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Map symbol and soil name	Woodland suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Common trees	Site index	
28*:							
Enders	5r3	Severe	Severe	Moderate	Southern red oak	50	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak	50	
					Eastern redcedar	35	
					Shortleaf pine	50	
29*:							
Nella	3r9	Severe:	Severe:	Slight	Shortleaf pine	71	Shortleaf pine, loblolly pine, black walnut.
					Southern red oak	66	
					Eastern redcedar	61	
					Black oak	70	
					Black walnut	---	
Mountainburg	5x3	Severe	Severe	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
30----- Roellen	2w6	Moderate	Severe	Moderate	Eastern cottonwood	100	Eastern cottonwood, sweetgum.
					Sweetgum	90	
					Water oak	90	
					Cherrybark oak	90	
31, 32----- Roxana	1o4	Slight	Slight	Slight	Eastern cottonwood	115	Eastern cottonwood, American sycamore, cherrybark oak.
					Sweetgum	100	
					Pecan	---	
					American sycamore	---	
					Water oak	---	
					Cherrybark oak	---	
33----- Spadra	2o7	Slight	Slight	Slight	Shortleaf pine	80	Loblolly pine, shortleaf pine, black walnut, southern red oak, eastern redcedar.
					Southern red oak	80	
					Eastern redcedar	60	
					Sweetgum	70	
34----- Taft	3w8	Slight	Moderate	Moderate	Loblolly pine	85	Loblolly pine, shortleaf pine, sweetgum, southern red oak.
					Sweetgum	80	
					Shortleaf pine	70	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
1--- Barling	Severe: floods, wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.
2--- Cane	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Slight.
3--- Crevasse	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Moderate: too sandy.
4--- Crevasse	Severe: floods.	Moderate: too sandy, floods.	Severe: floods.	Moderate: floods, too sandy.
5--- Dardanelle	Slight	Slight	Slight	Slight.
6--- Dardanelle	Severe: floods.	Slight	Moderate: floods.	Slight.
7--- Enders	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
8--- Enders	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
9--- Enders	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
10--- Enders	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
11--- Enders	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, percs slowly.	Severe: slope.
12--- Enders	Severe: slope, percs slowly, large stones.	Severe: slope, large stones.	Severe: slope, large stones, percs slowly.	Severe: slope, large stones.
13*: Enders	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
Mountainburg	Severe: large stones.	Severe: large stones.	Severe: slope, depth to rock, large stones.	Severe: large stones.
14*: Enders	Severe: slope, percs slowly, large stones.	Severe: slope, large stones.	Severe: slope, large stones, percs slowly.	Severe: slope, large stones.
Mountainburg	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
15--- Guthrie	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.	Severe: wetness.
16, 17--- Leadvale	Moderate: wetness.	Moderate: wetness.	Moderate: slope, percs slowly, wetness.	Slight.
18--- Linker	Slight	Slight	Moderate: slope.	Slight.
19--- McKamie	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
20--- Moreland	Severe: too clayey, percs slowly, wetness.	Severe: too clayey, wetness.	Severe: too clayey, percs slowly, wetness.	Severe: too clayey, wetness.
21--- Mountainburg	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
22--- Mountainburg	Moderate: small stones.	Moderate: small stones.	Severe: slope, small stones.	Moderate: small stones.
23--- Mountainburg	Severe: large stones.	Severe: large stones.	Severe: slope, depth to rock, large stones.	Severe: large stones.
24--- Mountainburg	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.
25--- Muskogee	Moderate: percs slowly, wetness.	Slight	Moderate: slope, percs slowly, wetness.	Slight.
26--- Nella	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
27*:				
Nella	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
Enders	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
28*:				
Nella	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Enders	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, percs slowly.	Severe: slope.
29*:				
Nella	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails
29*: Mountainburg	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.
30--- Roellen	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: too clayey, wetness.	Severe: wetness, too clayey.
31--- Roxana	Slight	Slight	Slight	Slight.
32--- Roxana	Severe: floods.	Slight	Moderate: floods.	Slight.
33--- Spadra	Severe: floods.	Slight	Moderate: floods, slope.	Slight.
34--- Taft	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.
35. Udorthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1---------- Barling	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
2---------- Cane	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
3, 4---------- Crevasse	Poor	Fair	Fair	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.
5, 6---------- Dardanelle	Good	Good	Good	Good	---	Poor	Fair	Good	Good	Poor.
7, 8, 9, 10-------- Enders	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
11---------- Enders	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
12---------- Enders	Very poor.	Very poor.	Good	Good	Good	Very poor.	Very poor.	Very poor.	Good	Very poor.
13*:										
Enders----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Mountainburg------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
14*:										
Enders----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Mountainburg------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
15---------- Guthrie	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
16---------- Leadvale	Fair	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
17---------- Leadvale	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
18---------- Linker	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
19---------- McKamie	Fair	Good	Good	---	Good	Very poor.	Very poor.	Good	Good	Very poor.
20---------- Moreland	Fair	Fair	Fair	Good	---	Good	Good	Fair	Good	Good.
21---------- Mountainburg	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.
22, 23, 24--------- Mountainburg	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
25---------- Muskogee	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
26---------- Nella	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
27*:										
Nella----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Enders----------	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
28*:										
Nella----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Enders----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
29*:										
Nella----------	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Mountainburg------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
30---------- Roellen	Poor	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
31---------- Roxana	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
32---------- Roxana	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.
33---------- Spadra	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
34---------- Taft	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
35. Udorthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1---- Barling	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.	Moderate: wetness, floods.
2---- Cane	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, slope.	Moderate: low strength.	Slight.
3---- Crevasse	Severe: cutbanks cave, wetness.	Slight----	Moderate: wetness.	Slight----	Slight----	Severe: droughty.
4---- Crevasse	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: droughty, floods.
5---- Dardanelle	Slight----	Slight----	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.	Slight.
6---- Dardanelle	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
7---- Enders	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
8---- Enders	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.	Moderate: slope.
9---- Enders	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: small stones.
10---- Enders	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.	Severe: small stones.
11---- Enders	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell,	Severe: slope, low strength, shrink-swell.	Severe: small stones, slope.
12---- Enders	Severe: slope, too clayey, large stones.	Severe: slope, shrink-swell.	Severe: slope, large stones, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, large stones.	Severe: large stones, slope.
13*: Enders----	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.	Severe: small stones.
Mountainburg----	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: small stones, large stones.
14*: Enders----	Severe: slope, too clayey, large stones.	Severe: slope, shrink-swell.	Severe: slope, large stones, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell, large stones.	Severe: large stones, slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
14*: Mountainburg	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: small stones, large stones, slope.
15--- Guthrie	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness.	Severe: wetness.
16--- Leadvale	Severe: too clayey.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness.	Severe: low strength.	Slight.
17--- Leadvale	Severe: too clayey.	Moderate: wetness.	Moderate: wetness.	Moderate: slope, wetness.	Severe: low strength.	Slight.
18--- Linker	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Moderate: thin layer.
19--- McKamie	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
20--- Moreland	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: wetness, too clayey.
21--- Mountainburg	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: thin layer.
22--- Mountainburg	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: thin layer.
23--- Mountainburg	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: small stones, large stones.
24--- Mountainburg	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: small stones, large stones, slope.
25--- Muskogee	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, shrink-swell.	Moderate: wetness.
26--- Nella	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.	Moderate: large stones, slope.
27*: Nella	Moderate: slope, small stones.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope, low strength.	Moderate: large stones, slope.
Enders	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: slope, shrink-swell.	Severe: low strength, shrink-swell.	Severe: small stones.
28*: Nella	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
28*: Enders	Severe: slope, too clayey.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: small stones, slope.
29*: Nella	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mountainburg	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: small stones, large stones, slope.
30--- Roellen	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: low strength, wetness.	Severe: wetness, too clayey.
31--- Roxana	Slight---	Slight---	Moderate: wetness.	Slight---	Moderate: low strength.	Slight.
32--- Roxana	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
33--- Spadra	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
34--- Taft	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: wetness.
35. Udorthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1--Barling	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
2--Cane	Severe: percs slowly.	Moderate: slope, wetness.	Slight	Slight	Good.
3--Crevasse	Moderate: wetness.	Severe: seepage.	Severe: too sandy, seepage, wetness.	Severe: seepage.	Poor: seepage, too sandy.
4--Crevasse	Severe: floods.	Severe: floods.	Severe: floods, seepage, wetness.	Severe: floods, seepage.	Poor: seepage, too sandy.
5--Dardanelle	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Good.
6--Dardanelle	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
7--Enders	Severe: percs slowly.	Moderate: slope, depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
8--Enders	Severe: percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
9--Enders	Severe: percs slowly.	Moderate: slope, depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
10--Enders	Severe: percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
11--Enders	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey.
12--Enders	Severe: slope, percs slowly, large stones.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: too clayey, slope, large stones.
13*:					
Enders	Severe: percs slowly.	Severe: slope, depth to rock.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
Mountainburg	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones, seepage.	Severe: seepage.	Poor: thin layer, large stones.
14*:					
Enders	Severe: slope, percs slowly, large stones.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: too clayey, slope, large stones.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
14*: Mountainburg	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, seepage.	Poor: slope, thin layer, large stones.
15--- Guthrie	Severe: percs slowly, wetness.	Slight	Severe: wetness.	Severe: wetness.	Poor: wetness.
16, 17--- Leadvale	Severe: wetness, percs slowly.	Severe: wetness.	Severe: depth to rock.	Moderate: wetness.	Fair: too clayey.
18--- Linker	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.
19--- McKamie	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
20--- Moreland	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
21--- Mountainburg	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
22--- Mountainburg	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
23--- Mountainburg	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones, seepage.	Severe: seepage.	Poor: thin layer, large stones.
24--- Mountainburg	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, seepage.	Poor: slope, thin layer, large stones.
25--- Muskogee	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Fair: thin layer, too clayey.
26--- Nella	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, small stones.
27*: Nella	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope, small stones.
Enders	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
28*: Nella	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
28*: Enders	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey.
29*: Nella	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Mountainburg	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, seepage.	Poor: slope, thin layer, large stones.
30--- Roellen	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
31--- Roxana	Slight---	Moderate: seepage.	Slight---	Slight---	Good.
32--- Roxana	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
33--- Spadra	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
34--- Taft	Severe: percs slowly, wetness.	Slight---	Severe: wetness.	Severe: wetness.	Poor: wetness.
35. Udorthents					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1---------- Barling	Fair: low strength, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
2---------- Cane	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, thin layer.
3, 4---------- Crevasse	Good----------	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.
5, 6---------- Dardanelle	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
7, 8, 9, 10---------- Enders	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
11---------- Enders	Poor: low strength, slope, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer, small stones.
12---------- Enders	Poor: shrink-swell, large stones, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones, thin layer, large stones.
13*:				
Enders----------	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Mountainburg---------	Poor: thin layer, large stones.	Unsuited: excess fines.	Poor: thin layer.	Poor: large stones, thin layer.
14*:				
Enders----------	Poor: shrink-swell, large stones, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer, large stones.
Mountainburg---------	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Poor: thin layer.	Poor: slope, large stones, thin layer.
15---------- Guthrie	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
16, 17---------- Leadvale	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
18---------- Linker	Fair: low strength, thin layer.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
19---------- McKamie	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
20--- Moreland	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
21, 22--- Mountainburg	Poor: thin layer.	Poor: excess fines.	Poor: thin layer.	Poor: thin layer.
23--- Mountainburg	Poor: thin layer, large stones.	Unsuited: excess fines.	Poor: thin layer.	Poor: large stones, thin layer.
24--- Mountainburg	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Poor: thin layer.	Poor: slope, large stones, thin layer.
25--- Muskogee	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
26--- Nella	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
27*:				
Nella---	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
Enders---	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
28*:				
Nella---	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Enders---	Poor: low strength, slope, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer, small stones.
29*:				
Nella---	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Mountainburg---	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Poor: thin layer.	Poor: slope, large stones, thin layer.
30--- Roellen	Poor: shrink-swell, wetness, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
31, 32--- Roxana	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
33--- Spadra	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
34--- Taft	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
35. Udorthents				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
1---------- Barling	Moderate: seepage.	Moderate: piping, wetness.	Floods---------	Floods: wetness.	Not needed-----	Wetness, erodes easily.
2---------- Cane	Slight---------	Slight---------	Not needed-----	Slope, percs slowly, rooting depth.	Complex slope, rooting depth.	Rooting depth.
3---------- Crevasse	Severe: seepage.	Severe: seepage, piping.	Not needed-----	Fast intake, droughty.	Too sandy------	Droughty.
4---------- Crevasse	Severe: seepage,	Severe: seepage, piping.	Floods---------	Fast intake, droughty, floods.	Too sandy------	Erodes easily, droughty.
5---------- Dardanelle	Moderate: seepage.	Moderate: seepage.	Not needed-----	Favorable------	Not needed-----	Favorable.
6---------- Dardanelle	Moderate: seepage.	Moderate: seepage.	Not needed-----	Favorable------	Not needed-----	Favorable.
7, 8, 9, 10, 11--- Enders	Moderate: depth to rock.	Severe: hard to pack.	Not needed-----	Slope, erodes easily, percs slowly.	Slope, percs slowly, erodes easily, depth to rock.	Erodes easily, percs slowly, slope.
12---------- Enders	Moderate: depth to rock.	Severe: large stones, hard to pack.	Not needed-----	Slope, erodes easily, percs slowly.	Large stones, slope, depth to rock.	Slope, large stones, erodes easily.
13*: Enders----------	Moderate: depth to rock.	Severe: hard to pack.	Not needed-----	Slope, erodes easily, percs slowly.	Slope, percs slowly, erodes easily, depth to rock.	Erodes easily, percs slowly, slope.
Mountainburg-----	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Not needed-----	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
14*: Enders----------	Moderate: depth to rock.	Severe: large stones, hard to pack.	Not needed-----	Slope, erodes easily, percs slowly.	Large stones, slope, depth to rock.	Slope, large stones, erodes easily.
Mountainburg-----	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Not needed-----	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
15---------- Guthrie	Slight---------	Moderate: piping.	Percs slowly, poor outlets.	Wetness---------	Not needed-----	Not needed.
16, 17---------- Leadvale	Moderate: seepage.	Moderate: thin layer, wetness.	Percs slowly, slope.	Wetness, slow intake, percs slowly.	Wetness, erodes easily.	Erodes easily, rooting depth.
18---------- Linker	Severe: depth to rock.	Moderate: thin layer, hard to pack.	Not needed-----	Favorable------	Slope, depth to rock, large stones.	Large stones, slope, depth to rock.
19---------- McKamie	Slight---------	Moderate: shrink-swell, hard to pack.	Not needed-----	Slope, erodes easily, slow intake.	Erodes easily, percs slowly.	Favorable.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
20---------- Moreland	Slight---------	Moderate: shrink-swell, hard to pack.	Complex slope, percs slowly.	Complex slope, slow intake.	Not needed-----	Favorable.
21, 22---------- Mountainburg	Severe: depth to rock, seepage.	Severe: thin layer.	Not needed-----	Slope, fast intake, rooting depth.	Slope, depth to rock, rooting depth.	Rooting depth, slope.
23, 24---------- Mountainburg	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Not needed-----	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
25---------- Muskogee	Slight---------	Moderate: hard to pack, wetness.	Percs slowly, slope.	Erodes easily, slope, slow intake.	Erodes easily, wetness, percs slowly.	Erodes easily, percs slowly.
26---------- Nella	Moderate: seepage.	Slight---------	Not needed-----	Slope----------	Slope----------	Favorable.
27*, 28*:						
Nella----------	Moderate: seepage.	Slight---------	Not needed-----	Slope----------	Slope----------	Slope.
Enders----------	Moderate: depth to rock.	Severe: hard to pack.	Not needed-----	Slope, erodes easily, percs slowly.	Slope, percs slowly, erodes easily, depth to rock.	Erodes easily, percs slowly, slope.
29*:						
Nella----------	Moderate: seepage.	Slight---------	Not needed-----	Slope----------	Slope----------	Slope.
Mountainburg-----	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Not needed-----	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
30---------- Roellen	Slight---------	Severe: wetness.	Percs slowly, poor outlets.	Slow intake, wetness, percs slowly.	Not needed-----	Wetness, erodes easily, percs slowly.
31---------- Roxana	Moderate: seepage.	Moderate: erodes easily, seepage, piping.	Not needed-----	Favorable------	Not needed-----	Erodes easily.
32---------- Roxana	Moderate: seepage.	Moderate: erodes easily, seepage, piping.	Not needed-----	Floods---------	Not needed-----	Erodes easily.
33---------- Spadra	Moderate: seepage.	Moderate: seepage.	Not needed-----	Floods: erodes easily.	Favorable------	Erodes easily.
34---------- Taft	Slight---------	Moderate: compressible, piping.	Percs slowly, poor outlets.	Wetness--------	Not needed-----	Not needed.
35. Udorthents						

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1---------- Barling	0-22	Silt loam-------	ML	A-4	0	100	100	90-100	70-90	<20	NP-3
	22-80	Silt loam, very fine sandy loam.	ML, CL-ML	A-4	0	100	100	90-100	70-90	<25	NP-6
2---------- Cane	0-5	Fine sandy loam	ML, CL-ML, SM, SM-SC	A-4	0-2	80-100	75-100	65-95	40-75	<30	NP-7
	5-30	Silt clay loam, clay loam.	ML, CL-ML, CL	A-4	0-2	90-100	80-95	75-95	60-70	17-32	3-10
	30-72	Silty clay loam, loam, clay loam.	ML, CL-ML, CL	A-4	0-2	90-100	80-95	75-95	55-70	18-30	3-10
3, 4---------- Crevasse	0-10	Loamy fine sand	SM	A-2	0	100	95-100	60-100	15-30	---	NP
	10-72	Sand, loamy sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	95-100	50-100	5-20	---	NP
5, 6---------- Dardanelle	0-10	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	100	100	85-100	16-30	3-11
	10-59	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	100	80-100	23-38	6-15
	59-72	Silt loam, very fine sandy loam, loam.	ML, CL, CL-ML	A-4, A-6	0	100	100	100	80-100	16-38	3-15
7, 8---------- Enders	0-7	Silt loam-------	ML, SM, SM-SC, CL-ML	A-4	0	80-100	80-97	75-90	40-85	20-35	2-10
	7-44	Silty clay, clay	CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	44-50	Weathered bedrock, unweathered bedrock.	---	---	---	---	---	---	---	---	---
9, 10, 11---------- Enders	0-7	Gravelly silt loam.	ML, SM, SM-SC, CL-ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	20-35	2-10
	7-44	Silty clay, clay	CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	44-50	Weathered bedrock, unweathered bedrock.	---	---	---	---	---	---	---	---	---
12---------- Enders	0-7	Stony silt loam	SM, ML, SM-SC, CL-ML	A-4, A-2	20-40	80-90	70-80	65-75	30-60	20-35	2-10
	7-44	Silty clay, clay	CH	A-7	0	95-100	85-100	85-100	70-95	50-65	30-40
	44-50	Weathered bedrock, unweathered bedrock.	---	---	---	---	---	---	---	---	---
13*: Enders----------	0-7	Gravelly silt loam.	ML, SM, SM-SC, CL-ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	20-35	2-10
	7-44	Silty clay, clay	CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	44-50	Weathered bedrock, unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
13*:											
Mountainburg	0-3	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	---	NP
	3-15	Very gravelly sandy clay loam, very gravelly loam, very gravelly fine sandy loam.	GM, GC, GM-GC	A-1, A-2	15-30	40-60	35-55	25-50	10-30	<30	NP-10
	15-17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
14*:											
Enders	0-7	Stony silt loam	SM, ML, SM-SC, CL-ML	A-4, A-2	20-40	80-90	70-80	65-75	30-60	20-35	2-10
	7-44	Silty clay, clay	CH	A-7	0	95-100	85-100	85-100	70-95	50-65	30-40
	44-50	Weathered bedrock, unweathered bedrock.	---	---	---	---	---	---	---	---	---
Mountainburg	0-3	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	---	NP
	3-15	Very gravelly sandy clay loam, very gravelly loam, very gravelly fine sandy loam.	GM, GC, GM-GC	A-1, A-2	15-30	40-60	35-55	25-50	10-30	<30	NP-10
	15-17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
15 Guthrie	0-5	Silt loam	ML, CL-ML	A-4	0	100	100	90-100	85-95	18-28	2-7
	5-24	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	90-100	85-95	23-39	5-15
	24-72	Silty clay loam, silt loam.	CL, ML, CL-ML	A-6, A-7, A-4	0-5	90-100	85-100	80-100	70-95	20-50	4-25
16, 17 Leadvale	0-6	Silt loam	ML, CL-ML, CL	A-4	0	100	95-100	85-95	65-85	18-32	2-10
	6-23	Silt loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	95-100	90-98	75-90	22-36	3-14
	23-42	Silt loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6, A-7	0	100	95-100	80-98	70-90	23-42	3-18
	42-54	Silty clay loam, silty clay.	CL, MH, CH	A-6, A-7	0-5	90-100	90-100	85-95	70-90	32-58	12-26
18 Linker	0-7	Fine sandy loam	SM, ML	A-4	0	85-100	80-100	70-100	40-70	<30	NP-7
	7-36	Fine sandy loam, sandy clay loam, clay loam.	CL, SC, SM, ML	A-4, A-6	0-10	90-100	80-100	70-100	40-80	<40	NP-18
	36-38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
19 McKamie	0-4	Silt loam	SM, ML, CL-ML, SM-SC	A-4	0	100	100	90-100	40-60	<25	NP-5
	4-53	Clay, silty clay	CH, CL	A-7	0	100	100	95-100	85-100	45-70	22-40
	53-72	Silty clay loam, silt loam, very fine sandy loam.	CL, CL-ML	A-4, A-6, A-7	0	100	100	95-100	50-95	25-45	5-22

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
20---------- Moreland	0-18	Silty clay------	CH	A-7	0	100	95-100	90-100	90-100	51-74	25-45
	18-75	Clay, silty clay	CH	A-7	0	100	95-100	90-100	90-100	51-74	25-45
21, 22---------- Mountainburg	0-3	Gravelly fine sandy loam.	GM, SM	A-1, A-2	0-15	60-80	50-70	20-40	15-30	---	NP
	3-15	Very gravelly sandy clay loam, very gravelly sandy loam, very gravelly fine sand.	GM, GC, GP-GM, GM-GC	A-1, A-2	15-30	40-60	30-50	25-50	10-25	<30	NP-10
	15-17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
23, 24---------- Mountainburg	0-3	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	---	NP
	3-15	Very gravelly sandy clay loam, very gravelly loam, very gravelly fine sandy loam.	GM, GC, GM-GC	A-1, A-2	15-30	40-60	35-55	25-50	10-30	<30	NP-10
	15-17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
25---------- Muskogee	0-15	Silt loam-------	ML, CL, CL-ML	A-4	0	100	100	95-100	85-100	18-30	1-10
	15-27	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-55	15-30
	27-80	Silty clay, clay	CH	A-7	0	100	100	95-100	90-100	55-70	30-40
26---------- Nella	0-8	Gravelly fine sandy loam.	ML, CL, GM, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	8-72	Gravelly loam, gravelly clay loam, gravelly sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-2	0-30	75-95	60-90	45-70	30-60	25-40	6-20
27*, 28*: Nella----------	0-8	Gravelly fine sandy loam.	ML, CL, GM, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	8-72	Gravelly loam, gravelly clay loam, gravelly sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-2	0-30	75-95	60-90	45-70	30-60	25-40	6-20
Enders----------	0-7	Gravelly silt loam.	ML, SM, SM-SC, CL-ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	20-35	2-10
	7-44	Silty clay, clay	CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	44-50	Silty clay, stony silty clay.	CH	A-7	0-15	95-100	90-100	85-100	70-95	65-80	35-45
	50-62	Weathered bedrock, unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
29*:											
Nella	0-8	Gravelly fine sandy loam.	ML, CL, GM, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	8-72	Gravelly loam, gravelly clay loam, gravelly sandy clay loam.	CL, SC, CL-ML, SM-SC	A-4, A-6, A-2	0-30	75-95	60-90	45-70	30-60	25-40	6-20
Mountainburg	0-3	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	---	NP
	3-15	Very gravelly sandy clay loam, very gravelly loam, very gravelly fine sandy loam.	GM, GC, GM-GC	A-1, A-2	15-30	40-60	35-55	25-50	10-30	<30	NP-10
	15-17	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
30	0-10	Silty clay	CL, CH	A-7	0	100	100	95-100	90-100	45-65	20-40
Roellen	10-72	Clay, silty clay	CH	A-7	0	100	100	95-100	90-100	55-80	30-50
31, 32	0-10	Silt loam	ML, CL-ML	A-4	0	100	100	85-100	50-75	<27	NP-7
Roxana	10-72	Silt loam, very fine sandy loam, loamy very fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-85	<27	NP-7
33	0-8	Silt loam	ML, SM	A-2, A-4	0	85-100	80-100	65-80	30-75	<20	NP-3
Spadra	8-45	Loam, sandy clay loam.	CL, ML	A-4, A-6	0	90-100	90-100	80-95	55-75	25-40	8-15
	45-77	Fine sandy loam, sandy loam.	ML, CL, SM, SC	A-4, A-2	0	85-100	80-100	40-85	20-65	<30	NP-10
34	0-6	Silt loam	CL-ML, ML	A-4	0	100	95-100	90-100	75-95	18-30	2-7
Taft	6-21	Silt loam, silty clay.	CL-ML, CL	A-4, A-6	0	100	95-100	95-100	85-95	23-38	5-16
	21-49	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	95-100	90-100	85-100	80-95	23-42	5-20
	49-72	Silty clay loam, silty clay.	MH, CL	A-6, A-7	0	90-100	90-100	80-90	60-85	35-65	12-30
35. Udorthents											

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm³	In/hr	In/in	pH				Pct
1----------	0-22	8-17	1.25-1.60	0.6-2.0	0.13-0.24	5.1-6.5	Low----------	0.37	5	1-4
Barling	22-80	10-17	1.25-1.55	0.6-2.0	0.13-0.24	45-65	Low----------	0.37		
2----------	0-5	7-18	0.60-2.00	0.6-2.0	0.10-0.18	5.6-6.5	Low----------	0.32	3	0.5-3
Cane	5-30	18-30	0.60-2.00	0.6-2.0	0.14-0.19	4.5-6.0	Low----------	0.37		
	30-72	18-35	0.06-0.20	0.06-0.2	0.05-0.08	4.5-6.0	Low----------	0.37		
3, 4----------	0-10	5-12	---	6.0-20	0.04-0.08	5.6-8.4	Low----------	0.15	5	0.5-2
Crevasse	10-72	2-8	---	6.0-20	0.02-0.06	5.6-8.4	Low----------	0.15		
5, 6----------	0-10	10-25	1.25-1.50	0.6-2.0	0.13-0.24	5.6-7.3	Low----------	0.37	5	2-5
Dardanelle	10-59	20-35	1.25-1.60	0.6-2.0	0.15-0.24	5.1-7.3	Moderate-----	0.32		
	59-72	10-25	1.25-1.60	0.6-2.0	0.13-0.24	5.6-8.4	Low----------	0.32		
7, 8----------	0-7	10-25	1.25-1.60	0.6-2.0	0.10-0.20	3.6-5.5	Low----------	0.37	3	0.5-2
Enders	7-44	35-60	1.15-1.45	<0.06	0.12-0.18	3.6-5.5	High---------	0.37		
	44-50	---	---	---	---	---	----------	---		
9, 10, 11--------	0-7	10-25	1.25-1.60	0.6-2.0	0.07-0.15	3.6-5.0	Low----------	0.32	3	0.5-2
Enders	7-44	35-60	1.15-1.45	<0.06	0.12-0.18	3.6-5.5	High---------	0.37		
	44-50	---	---	---	---	---	----------	---		
12----------	0-7	10-25	1.25-1.60	0.6-2.0	0.15-0.22	3.6-5.0	Low----------	0.43	3	1-4
Enders	7-44	35-60	1.15-1.45	<0.06	0.09-0.13	3.6-5.5	High---------	0.24		
	44-50	---	---	---	---	---	----------	---		
13*:										
Enders----------	0-7	10-25	1.25-1.60	0.6-2.0	0.07-0.15	3.6-5.0	Low----------	0.32	3	1-4
	7-44	35-60	1.15-1.45	<0.06	0.12-0.18	3.6-5.5	High---------	0.37		
	44-50	---	---	---	---	---	----------	---		
Mountainburg----	0-3	4-12	1.30-1.60	2.0-6.0	0.05-0.10	4.5-6.0	Low----------	0.17	1	1-4
	3-15	10-18	1.30-1.60	2.0-6.0	0.05-0.10	4.5-5.5	Low----------	0.24		
	15-17	---	---	---	---	---	----------	---		
14*:										
Enders----------	0-7	10-25	1.25-1.60	0.6-2.0	0.15-0.22	3.6-5.0	Low----------	0.43	3	1-4
	7-44	35-60	1.15-1.45	<0.06	0.09-0.13	3.6-5.5	High---------	0.24		
	44-50	---	---	---	---	---	----------	---		
Mountainburg----	0-3	4-12	1.30-1.60	2.0-6.0	0.05-0.10	4.5-6.0	Low----------	0.17	1	1-4
	3-15	10-18	1.30-1.60	2.0-6.0	0.05-0.10	4.5-5.5	Low----------	0.24		
	15-17	---	---	---	---	---	----------	---		
15----------	0-5	10-25	1.35-1.55	0.6-2.0	0.20-0.22	3.6-5.0	Low----------	0.43	5	1-4
Guthrie	5-24	18-30	1.40-1.60	0.6-2.0	0.18-0.20	3.6-5.0	Low----------	0.43		
	24-72	18-32	1.60-1.75	0.06-0.2	0.03-0.05	3.6-5.0	Low----------	0.43		
16, 17----------	0-6	12-22	1.30-1.40	0.6-2.0	0.17-0.22	4.5-5.5	Low----------	0.43	3	0.5-3
Leadvale	6-23	20-32	1.30-1.50	0.6-2.0	0.17-0.20	4.5-5.5	Low----------	0.43		
	23-42	20-35	1.55-1.70	0.06-0.6	0.06-0.11	4.5-5.5	Low----------	0.43		
	42-54	30-45	1.40-1.60	0.06-0.6	0.06-0.11	4.5-5.5	Low----------	0.24		
18----------	0-7	5-20	1.30-1.60	0.6-2.0	0.11-0.20	3.6-5.5	Low----------	0.28	3	0.5-2
Linker	7-36	18-35	1.30-1.60	0.6-2.0	0.11-0.20	3.6-5.5	Low----------	0.32		
	36-38	---	---	---	---	---	----------	---		
19----------	0-4	18-35	1.42-1.76	0.6-2.0	0.14-0.22	5.1-6.5	Low----------	0.43	3	0.5-2
McKamie	4-53	35-60	1.20-1.45	<0.06	0.18-0.20	4.5-6.0	High---------	0.32		
	53-72	14-35	1.40-1.76	0.2-2.0	0.14-0.22	4.5-8.4	Moderate-----	0.37		
20----------	0-18	39-50	1.20-1.50	<0.06	0.18-0.20	6.1-7.8	Very high----	0.32	5	2-5
Moreland	18-75	39-60	1.20-1.45	<0.06	0.18-0.20	6.6-8.4	High---------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay <2mm	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	G/cm³	In/hr	In/in	pH				Pct
21, 22----------	0-3	3-10	1.40-1.60	2.0-6.0	0.05-0.10	4.5-6.0	Low----------	0.20	1	0.5-2
Mountainburg	3-15	15-25	1.50-1.70	2.0-6.0	0.05-0.10	4.5-5.5	Low----------	0.17		
	15-17	---	---	---	---	---	----------	---		
23, 24----------	0-3	4-12	1.30-1.60	2.0-6.0	0.05-0.10	4.5-6.0	Low----------	0.17	1	1-4
Mountainburg	3-15	10-18	1.30-1.60	2.0-6.0	0.05-0.10	4.5-5.5	Low----------	0.24		
	15-17	---	---	---	---	---	----------	---		
25----------	0-15	10-27	1.25-1.50	0.6-2.0	0.16-0.24	4.5-6.0	Low----------	0.43	5	1-3
Muskogee	15-27	20-40	1.25-1.45	0.2-0.6	0.16-0.24	4.5-6.0	Moderate-----	0.37		
	27-80	30-55	1.20-1.45	0.06-0.2	0.14-0.18	5.1-7.8	High---------	0.32		
26----------	0-8	12-25	1.30-1.50	0.6-2.0	0.08-0.15	4.5-5.5	Low----------	0.20	5	0.5-3
Nella	8-72	30-40	1.35-1.60	0.6-2.0	0.07-0.14	4.5-5.5	Low----------	0.17		
27*, 28*:										
Nella----------	0-8	12-25	1.30-1.50	0.6-2.0	0.08-0.15	4.5-5.5	Low----------	0.20	5	1-4
	8-72	30-40	1.35-1.60	0.6-2.0	0.07-0.14	4.5-5.5	Low----------	0.17		
Enders----------	0-7	10-25	1.25-1.60	0.6-2.0	0.07-0.15	3.6-5.0	Low----------	0.32	3	1-4
	7-44	35-60	1.15-1.45	<0.06	0.12-0.18	3.6-5.5	High---------	0.37		
	44-50	---	---	<0.06	0.08-0.10	3.6-5.5	Moderate-----	0.37		
29*:										
Nella----------	0-8	12-25	1.30-1.50	0.6-2.0	0.08-0.15	4.5-5.5	Low----------	0.20	5	1-4
	8-72	30-40	1.35-1.60	0.6-2.0	0.07-0.14	4.5-5.5	Low----------	0.17		
Mountainburg----	0-3	4-12	1.30-1.60	2.0-6.0	0.05-0.10	4.5-6.0	Low----------	0.17	1	1-4
	3-15	10-18	1.30-1.60	2.0-6.0	0.05-0.10	4.5-5.5	Low----------	0.24		
	15-17	---	---	---	---	---	----------	---		
30----------	0-10	35-50	1.40-1.55	0.06-0.2	0.15-0.19	5.6-7.8	High---------	0.32	5	2-6
Roellen	10-72	40-60	1.40-1.55	0.06-0.2	0.14-0.17	5.6-7.8	High---------	0.37		
31, 32----------	0-10	5-27	1.35-1.80	0.6-2.0	0.10-0.21	6.1-8.4	Low----------	0.37	5	0.5-2
Roxana	10-72	10-18	1.35-1.80	0.6-2.0	0.10-0.19	6.6-8.4	Low----------	0.37		
33----------	0-8	10-26	1.30-1.60	0.6-2.0	0.11-0.24	4.5-6.0	Low----------	0.37	5	1-4
Spadra	8-45	18-32	1.30-1.60	0.6-2.0	0.12-0.20	4.5-6.0	Low----------	0.37		
	45-77	15-25	1.30-1.60	0.6-2.0	0.10-0.15	4.5-6.0	Low----------	0.24		
34----------	0-6	10-25	1.30-1.40	0.6-2.0	0.20-0.22	4.5-5.5	Low----------	0.43	3	2-4
Taft	6-21	18-35	1.30-1.50	0.6-2.0	0.18-0.20	4.5-5.5	Low----------	0.43		
	21-49	15-35	1.50-1.65	0.06-0.2	0.03-0.07	4.5-5.5	Low----------	0.43		
	49-72	8-45	1.35-1.60	0.2-0.6	0.01-0.03	4.5-5.5	Low----------	0.37		
35. Udorthents										

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1---------- Barling	C	Occasional	Brief-----	Dec-Apr	1.0-4.0	Perched	Dec-Apr	>60	---	Moderate	Moderate.
2---------- Cane	C	None--------	---	---	2.0-3.0	Perched	Nov-Mar	>60	---	Moderate	High.
3---------- Crevasse	A	Protected*	---	---	3.5-6.0	Apparent	Nov-Mar	>60	---	Low------	Moderate.
4---------- Crevasse	A	Frequent----	Brief-----	Oct-Mar	3.5-6.0	Apparent	Nov-Mar	>60	---	Low------	Moderate.
5---------- Dardanelle	B	Protected*	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
6---------- Dardanelle	B	Occasional	Brief-----	Dec-Mar	>6.0	---	---	>60	---	Moderate	Moderate.
7, 8, 9, 10, 11, 12---------- Enders	C	None--------	---	---	>6.0	---	---	40-60	Ripable	High-----	High.
13, 14: Enders----------	C	None--------	---	---	>6.0	---	---	40-60	Ripable	High-----	High.
Mountainburg-----	D	None--------	---	---	>6.0	---	---	12-20	Hard	Low------	High.
15---------- Guthrie	D	Rare--------	---	---	0.5-1.0	Perched	Jan-Apr	>60	---	High-----	High.
16, 17---------- Leadvale	C	None--------	---	---	2.0-3.0	Perched	Jan-Apr	>48	Ripable	Moderate	Moderate.
18---------- Linker	B	None--------	---	---	>6.0	---	---	20-40	Hard	Low------	High.
19---------- McKamie	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
20---------- Moreland	D	None--------	---	---	0-1.5	Perched	Dec-Apr	>60	---	High-----	Low.
21, 22---------- Mountainburg	D	None--------	---	---	>6.0	---	---	12-20	Hard	Low------	High.
23, 24---------- Mountainburg	D	None--------	---	---	>6.0	---	---	12-20	Hard	Low------	High.
25---------- Muskogee	C	None--------	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High-----	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
26---------- Nella	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
27, 28:											
Nella----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Enders----------	C	None--------	---	---	>6.0	---	---	40-60	Ripable	High-----	High.
29:											
Nella----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Mountainburg-----	D	None--------	---	---	>6.0	---	---	12-20	Hard	Low------	High.
30---------- Roellen	D	None--------	---	---	0-1.0	Apparent	Jan-May	>60	---	High-----	Low.
31---------- Roxana	B	Protected*	---	---	4.0-6.0	Apparent	Dec-Apr	>60	---	Low------	Low.
32---------- Roxana	B	Occasional	Brief to long.	Dec-Jun	4.0-6.0	Apparent	Dec-Apr	>60	---	Low------	Low.
33---------- Spadra	B	Occasional	Very brief to brief.	Dec-Apr	>6.0	---	---	>60	---	Low------	High.
34---------- Taft	C	None--------	---	---	1.0-2.0	Perched	Jan-Apr	>60	---	High-----	High.
35. Udorthents											

* The soil is on flood plains but is protected from flooding by manmade levees.

TABLE 18.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Barling	Coarse-silty, mixed, thermic Fluvaquentic Dystrochrepts
Cane	Fine-loamy, siliceous, thermic Typic Fragiudults
Crevasse	Mixed, thermic Typic Udipsamments
Dardanelle	Fine-silty, mixed, thermic Typic Argiudolls
Enders	Clayey, mixed, thermic Typic Hapludults
Guthrie	Fine-silty, siliceous, thermic Typic Fragiaquults
Leadvale	Fine-silty, siliceous, thermic Typic Fragiudults
Linker	Fine-loamy, siliceous, thermic Typic Hapludults
McKamie	Fine, mixed, thermic Vertic Hapludalfs
*Moreland	Fine, mixed, thermic Vertic Hapludolls
Mountainburg	Loamy-skeletal, siliceous, thermic Lithic Hapludults
Muskogee	Fine-silty, mixed, thermic Aquic Paleudalfs
Nella	Fine-loamy, siliceous, thermic Typic Paleudults
*Roellen	Fine, montmorillonitic, thermic Vertic Haplaquolls
Roxana	Coarse-silty, mixed, nonacid, thermic Typic Udifluvents
Spadra	Fine-loamy, siliceous, thermic Typic Hapludults
Taft	Fine-silty, siliceous, thermic Glossaquic Fragiudults

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

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