SOIL SURVEY OF

Crawford County, Arkansas

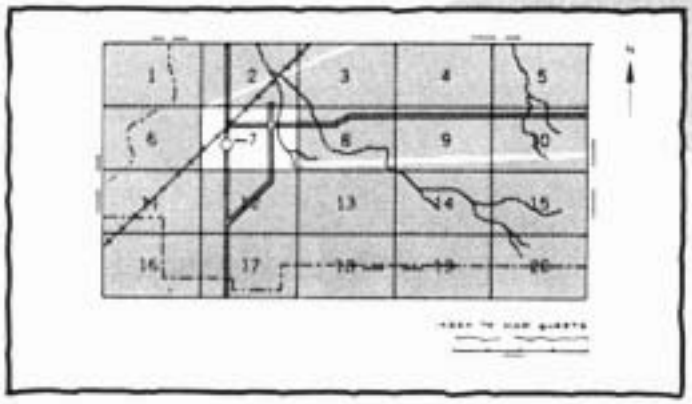
United States Department of Agriculture
Soil Conservation Service and Forest Service

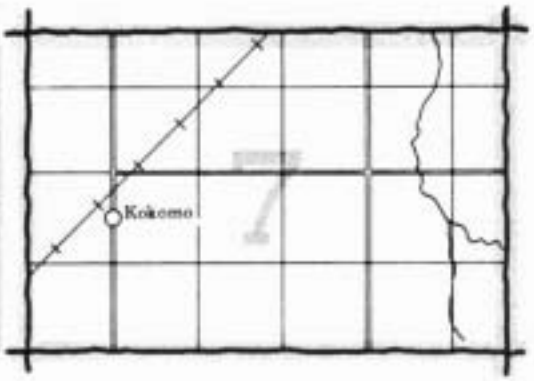
In cooperation with

Arkansas Agricultural Experiment Station

HOW TO USE

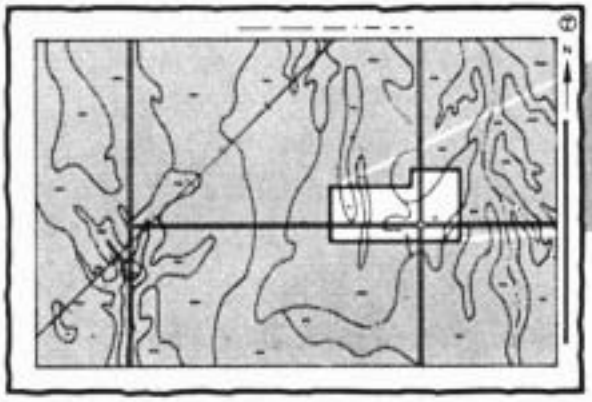
1. Locate your area of interest on the "Index to Map Sheets" (the last page of this publication).

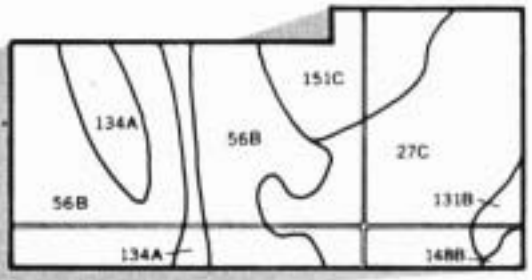




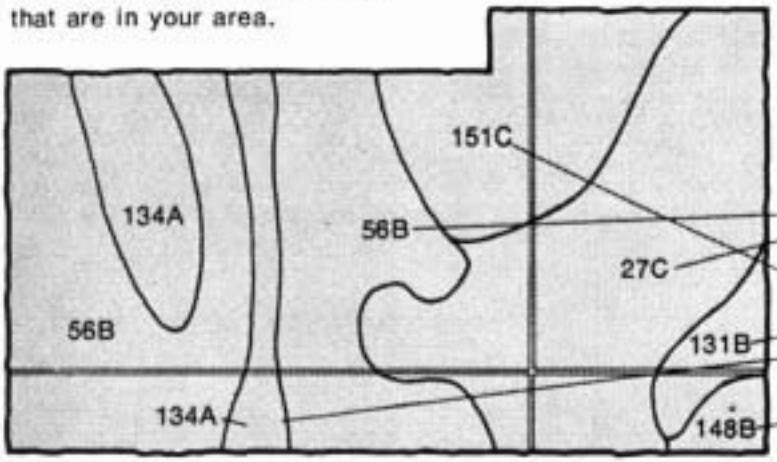
2. Note the number of the map sheet and turn to that sheet.

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





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

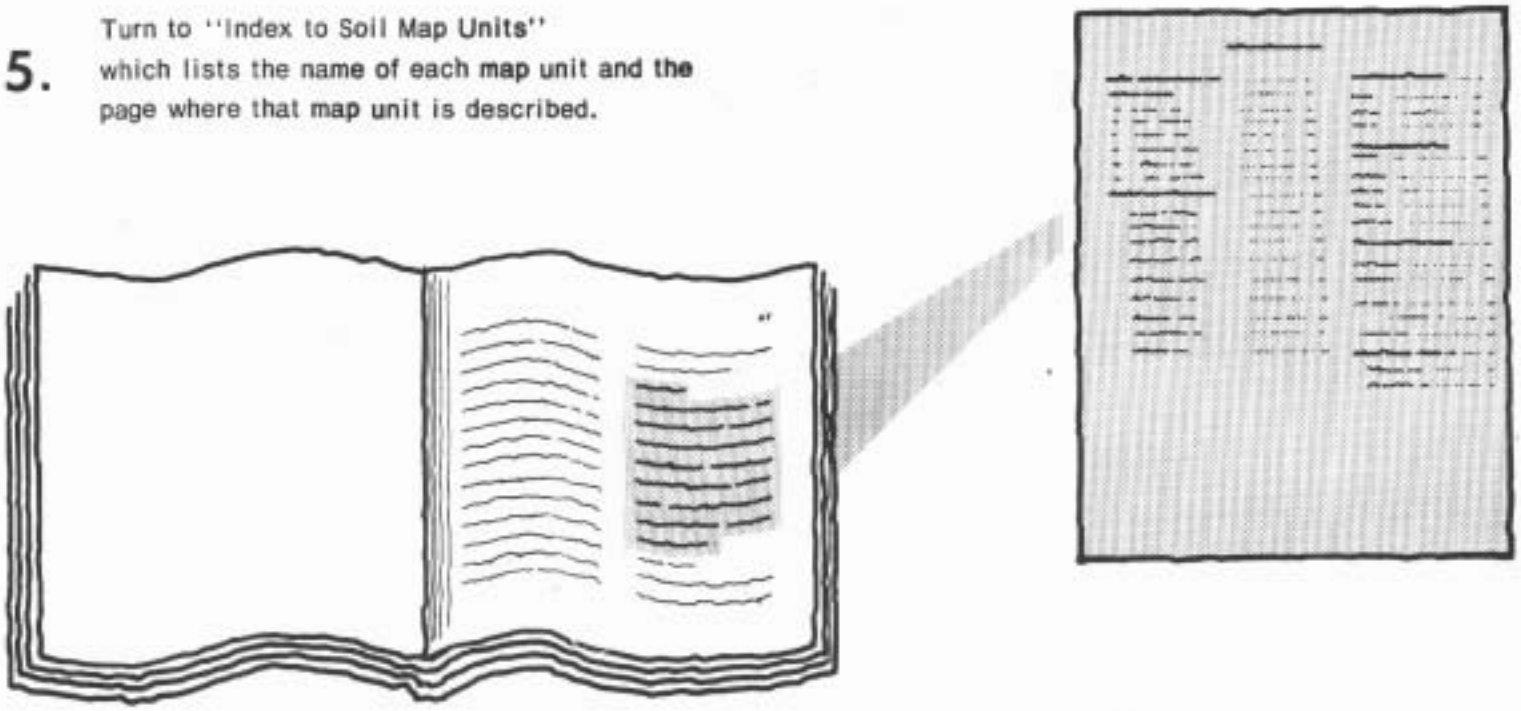


Symbols

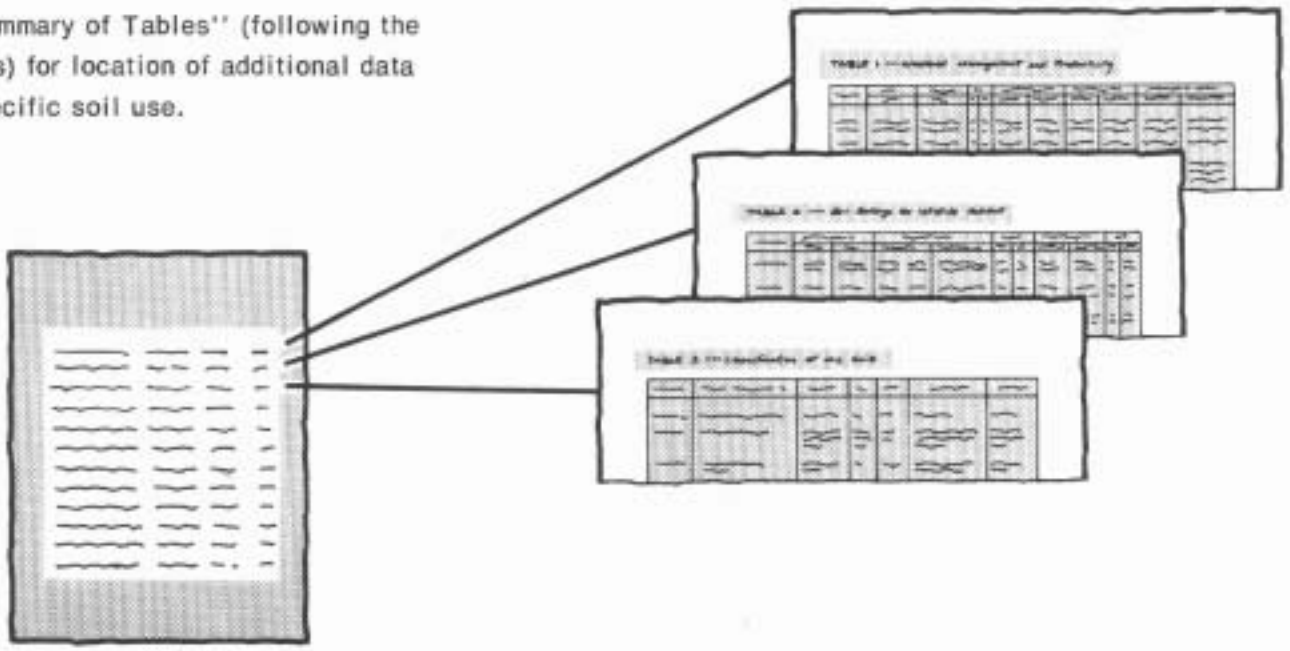
27C
56B
131B
134A
148B
151C

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.

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Issued September 1979

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Summary of Tables

Foreword

The Soil Survey of Crawford County, Arkansas, contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

Great differences in soil properties can occur even within short distances. Soils may be seasonally wet or subject to flooding. They may be shallow to bedrock. They may be too unstable to be used as a foundation for buildings or roads. Very clayey or wet soils are poorly suited to 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 kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

M. J. Spears
State Conservationist
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Location of Crawford County in Arkansas.

SOIL SURVEY OF CRAWFORD COUNTY, ARKANSAS

By B. A. Garner and J. B. Cox, Soil Conservation Service

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

CRAWFORD COUNTY is in the western part of Arkansas (see map on facing page). It is irregularly shaped; it ranges from about 6 to 34 miles in width and is about 27 miles in length. The county is bounded on the north by Washington, Madison, and Franklin Counties; on the east by Franklin County; on the south by the Arkansas River and Sebastian County; and on the west by Sequoyah and Adair Counties, Oklahoma. Its total area is 388,480 acres. According to the 1969 United States Census of Agriculture, the approximate land area is 381,440 acres, or 596 square miles.

In 1970, the population of the county was about 25,677. Van Buren is the county seat and largest incorporated place in the county; its population was 8,373 in 1970. The next largest place is Alma, which had a population of 1,613. Most of the people in the county, including more than half of the farmers, work in industries or supporting businesses in the Van Buren-Fort Smith area.

General nature of the county

About 70 percent of the county, the central and northern parts, is mountainous or hilly. Elevation ranges from about 500 feet at the bases of hills and mountains to 2,381 feet atop Shepherd Mountain. The soils in most of these areas are too steep for intensive use. They are used mainly for the production of wood crops and for native pasture. Some of the less sloping soils are suitable for improved pasture, and the soils in some of the narrow valleys are suitable for truck crops.

About 30 percent of the county is level to gently sloping valley fill and alluvial sediments. These areas range from young flood plains along the Arkansas River to old stream terraces in the broad valleys. Elevation ranges from about 370 feet where the Mulberry River runs into the Arkansas River in the southeastern part of the county to about 500 feet atop the old stream terraces. Except for the intensively farmed soils on bottom lands along the Arkansas River, the soils in this area are used mainly for forage crops.

Farming

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

Farming has since become more diversified and generally less intensive. In the areas of ridges and valleys, most farm income is derived from dairying; the raising of beef cattle, hogs, and pigs; and the raising of poultry, including turkeys, broilers, and laying hens. Some farms have a small acreage of orchards, vineyards, and vegetables.

On the bottom lands along the Arkansas River, flood control, use of improved crop varieties, and other improved management techniques have led to the expansion of cropland into nearly all of the flood plain. Most of the woodland on the bottom lands along the river has been cleared, and the natural drainage has been improved for more reliable crop production on wet soils.

On these farms on bottom lands, soybeans is the main crop. Grain sorghum and winter small grains are also grown, and some farms grow truck crops such as spinach, beets, cucumbers, kale, and squash.

Table 1 shows the acreage of principal crops and pasture, and table 2 gives the kinds and numbers of livestock in selected years. A large acreage of pasture and range was not differentiated in the 1969 Census of Agriculture but was included under "All other land." Additionally, the Census and the fieldwork for this survey indicate that most of the woodland is pastured.

At the time of the 1969 Census of Agriculture, about 35 percent of the land area in the county was in farms. The rest was mainly in cities and built-up areas, transportation facilities, and federally-owned land within the Ozark National Forest.

Farms in Crawford County are decreasing in number and increasing in size. Between 1964 and 1969, the

number of farms decreased from 1,296 to 916, and the average size increased from about 124 to 148 acres.

The number of farms larger than 500 acres decreased from 55 in 1964 to 37 in 1969, and the number of farms smaller than 500 acres decreased from 1,241 in 1964 to 879 in 1969. Of the net decrease of 380 farms, 362 farms, or 95 percent, were smaller than 100 acres. Of the farm operators in the county in 1969, 664 were full owners, 193 were part owners, and 59 were tenants; 539 worked off the farm for 100 days or more.

Physiography and drainage

The Arkansas River flows eastward and forms the southern boundary of the county. Its remaining flood plain is a relatively narrow strip that parallels the course of the river. The most fertile soils in the county, those of the Dardanelle and Roxana series, 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 barge traffic all year round. The river provides recreational facilities for fishing, boating, and waterfowl hunting.

The northern half of Crawford County is in the Boston Mountains. In this area steep, stony mountains rise from the Arkansas Valley. They are drained by Lee Creek, Frog Bayou, Little Mulberry Creek, and the Mulberry River. These mountains are capped by sandstone, and their sides are interbedded sandstone and shale. Slope ranges from 3 to 50 percent. Elevation ranges from about 500 to 2,380 feet.

The Arkansas Valley, which makes up most of 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. Slope ranges from 1 to 30 percent. Elevation ranges from about 370 to about 500 feet. This area is drained by streams such as Frog Bayou, Little Mulberry Creek, and the Mulberry River.

The main soils on the mountains and hills are Mountainburg, Enders, and Nella soils. Linker and Mountainburg soils are the main soils on ridges, and Leadvale and Wrightsville soils are the main soils in the broad valleys. 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

Crawford County is hot in summer, especially at low elevations, and moderately cool in winter, especially on mountains and high hills. Rainfall is fairly heavy and well distributed throughout the year. Snow falls nearly every winter, but snow cover lasts only a few days.

Table 3 gives data on temperature and precipitation in the survey area, as recorded in Fort Smith in adjacent Sebastian County, for the period 1951 to 1974. 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. Data for this section were obtained from the National Climatic Center, Asheville, North Carolina.

In winter the average temperature is 41 degrees F, and the average daily minimum is 30 degrees. The lowest temperature on record, -9 degrees, occurred at Fort Smith on February 2, 1951. In summer the average temperature is 80 degrees, and the average daily maximum is 92 degrees. The highest temperature, 111 degrees, was recorded on July 13, 1954.

Growing degree days, shown in table 3, are equivalent to "heat units." Beginning in spring, 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.

Of the total annual precipitation, 23 inches, or 56 percent, usually falls during the period April through September, which includes the growing season for most crops. Two years in 10, the April-September rainfall is less than 18 inches. The heaviest 1-day rainfall during the period of record was 6.81 inches at Fort Smith on November 24, 1974. There are about 57 thunderstorms each year, 22 in summer.

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

The average relative humidity in midafternoon is less than 55 percent. Humidity is higher at night in all seasons, and the average at dawn is about 85 percent. The percentage of possible sunshine is 70 percent in summer and 51 percent in winter. Prevailing winds are northeasterly. Average windspeed is highest, 10 miles per hour, in March.

Rainfall is normally adequate for all crops in most of the county, but low available water capacity in the shallow soils and in the sandy soils results in brief droughts nearly every year.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. 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; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the

sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

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

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices 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 is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

The general soil map at the back of this publication shows, in color, map units that have a distinct pattern of soils and of relief and drainage. Each map unit 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 provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it 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 kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. Soil properties that pose limitations to the use are indicated in this section. The ratings of soil potential are based on the assumption that practices in common use in the survey area are being used to overcome soil limitations. These ratings reflect the ease of overcoming the soil limitations and the probability of soil problems persisting after such practices are used.

Each map unit is rated for *cultivated farm crops, specialty crops, woodland,* and *urban uses.* Cultivated farm crops are those grown extensively by farmers in the survey area. Specialty crops include vegetables, fruits, and nursery crops grown on limited acreage and generally requiring intensive management. Woodland refers to land that is producing either trees native to the area or introduced species. Urban uses include residential, commercial, and industrial developments.

Descriptions of the map units

1. Nella-Enders

Well drained, gently sloping to very steep, deep, loamy and stony soils on hills and mountains

This unit is mainly in the northern part of the county. The soils formed in loamy and clayey residuum weathered from sandstone and shale. Natural drainageways are mainly fast-flowing, intermittent streams, and there are a few perennial streams.

This unit occupies about 40 percent of the county. About 42 percent of the unit is Nella soils, 38 percent is Enders soils, and the remaining 20 percent is soils of minor extent.

Nella soils are on toeslopes and benches, and Enders soils are on hillsides and mountainsides. These soils are well drained. They have a surface layer of fine sandy loam, gravelly fine sandy loam, or very stony fine sandy loam.

The minor soils in this unit are the well drained Linker, Mountainburg, and Spadra soils and the moderately well drained Leadvale soils.

This unit is used mainly for woodland. Steep slopes are the main limitation, and stones on the surface are severe limitations in some areas.

This unit is not suitable for cultivated crops and has poor potential for pasture; the main limitations are steep slopes and stones on the surface. This unit has fair potential for woodland; steep slopes and stones on the surface are the main limitations. This unit has poor potential for most residential and urban uses; steep slopes and shrink-swell potential are the main limitations.

2. Enders

Well drained, gently sloping to very steep, deep, loamy and stony soils on hills and mountains

This unit is mainly in the west-central part of the county. The soils formed in loamy and clayey residuum weathered from sandstone and shale. Natural drainageways are mainly fast-flowing, intermittent streams, and there are a few perennial streams.

This unit occupies about 23 percent of the county. About 83 percent of the unit is Enders soils, and the remaining 17 percent is soils of minor extent.

Enders soils are on hillsides and mountainsides. These soils are well drained and have a surface layer of fine sandy loam, gravelly fine sandy loam, or stony fine sandy loam. They have a clayey subsoil.

The minor soils in this association are the well drained Linker, Mountainburg, Nella, and Spadra soils.

This unit is used mainly for woodland. Steep slopes and stones on the surface are the main limitations.

This unit is not suitable for cultivated crops and has poor potential for pasture; the main limitations are steep slopes and stones on the surface. This unit has fair potential for woodland; steep slopes and stones on the surface are the main limitations. This unit has poor potential for most residential and urban uses; steep slopes, shrink-swell potential, and slow permeability are the main limitations.

3. Linker-Mountainburg

Well drained, nearly level to moderately steep, moderately deep and shallow, loamy and stony soils on hills, mountains, and ridges

This unit is throughout the county. The soils formed in loamy residuum weathered from horizontally bedded sandstone. Natural drainageways are mainly fast-flowing, intermittent streams.

This unit occupies about 10 percent of the county. About 41 percent of the unit is Linker soils, 35 percent is Mountainburg soils, and the remaining 24 percent is soils of minor extent.

Linker and Mountainburg soils are on the tops of hills and mountains, on side slopes and benches, and on low ridges within valleys. Linker soils are moderately deep, and Mountainburg soils are shallow to bedrock. These soils are well drained. They have a surface layer of fine sandy loam, gravelly fine sandy loam, or stony fine sandy loam.

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

This unit is used mainly for woodland, and there are small areas of pasture. Shallow rooting depth and stones on the surface are the main limitations.

This unit is not suitable for cultivated crops and has poor potential for pasture; the main limitations are steep slopes, depth to bedrock, and stones on the surface. This unit has fair potential for woodland; the main limitations are rooting depth and stones on the surface. This unit has low potential for most residential and urban uses; steep slopes and depth to bedrock are the main limitations.

4. Leadvale-Wrightsville

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

This unit is mostly in the southern part of the county. The soils formed mainly in loamy sediment of weathered sandstone and shale washed from local uplands. Natural drainageways are mainly slow-flowing, intermittent streams.

This unit occupies about 12 percent of the county. About 57 percent of the unit is Leadvale soils, 20 percent is Wrightsville soils, and the remaining 23 percent is soils of minor extent.

Leadvale soils are moderately well drained and are at slightly higher elevations than the poorly drained Wrightsville soils. Both soils have a surface layer of silt loam and a seasonal high water table.

The minor soils in this unit are the moderately well drained Muskogee soils and the well drained Enders, Linker, Mountainburg, and Spadra soils.

This unit is used mainly for pasture, and there are small areas of hardwood trees along drainageways. Wetness is the main limitation, and the water table is within 30 inches of the surface during winter and early spring.

This unit has fair potential for cultivated crops; farming operations are delayed several days after a rain because of excess water, and surface drains are needed. This unit has good potential for woodland; there are no significant limitations. These soils have poor potential for most residential and urban uses; wetness and shrink-swell potential are the main limitations.

5. Spadra

Well drained, nearly level, deep, loamy soils on stream terraces

This unit is along the Mulberry River, Lee Creek, and Frog Bayou. The soils formed in loamy alluvium. Natural drainageways are slow-flowing, intermittent streams.

This unit occupies about 6 percent of the county. About 84 percent of the unit is Spadra soils, and the remaining 16 percent is soils of minor extent.

Spadra soils are on stream terraces. They are well drained and have a surface layer of fine sandy loam.

The minor soils in this unit are the moderately well drained Leadvale soils.

This association is used mainly for pasture. Occasional flooding is the main limitation.

This unit has good potential for cultivated crops, but most areas require erosion control measures; occasional flooding is also a limitation. This unit has good potential for woodland; there are no significant limitations. This unit has poor potential for most residential and urban uses; flooding is the main limitation.

6. Dardanelle-Roxana-Roellen

Well drained and poorly drained, nearly level and level, deep, loamy soils on the flood plain of the Arkansas River

This unit is in the southern part of the country. The soils formed in loamy and clayey alluvium deposited by the Arkansas River. Natural drainageways are mostly slow-flowing, intermittent streams.

This unit occupies about 9 percent of the county. About 27 percent of the unit is Dardanelle soils, 25 percent is Roxana soils, 19 percent is Roellen soils, and the remaining 29 percent is soils of minor extent.

Dardanelle soils are at slightly lower elevations than Roxana soils. Dardanelle soils are loamy throughout, and Roxana soils have a loamy and sandy substratum. These soils are well drained. Roellen soils are in slightly depressional backwater areas, are poorly drained, and have a clayey subsoil.

The minor soils in this unit are the excessively drained Crevasse soils and the well drained Gallion soils. Also included are small areas of water.

This unit is used mainly for cultivated crops. There are no significant limitations in most areas, but areas between the levee and the Arkansas River are subject to occasional flooding.

This unit has good potential for cultivated crops; occasional flooding in areas between the levee and the Arkansas River is the main limitation. This unit has good potential for woodland; there are no significant limitations. This unit has good potential for residential and urban development if the soils are protected from flooding.

Broad land use considerations

The use of land for urban development is an important issue in the survey area. Each year land is being developed for urban uses in Van Buren, Alma, and other towns in the county. About 9,000 acres is urban or built-up land. The General Soil Map is helpful for planning the general outline of urban areas, but it cannot be used for the selection of sites for specific urban structures. Generally, soils in the survey area that have good potential for cultivated crops also have good potential for urban development. The data about specific soils in this survey can be helpful in planning future land use patterns.

Areas where soil properties are so unfavorable that urban development is prohibitive are not extensive in the survey area. Parts of the Spadra unit and the Dardanelle-Roxana-Roellen unit, however, are on flood plains in which flooding is a severe limitation to urban development. Also, shrink-swell potential, depth to bedrock, and steep slopes are severe limitation on soils in parts of the Nella-Enders unit, the Enders unit, and the Linker-Mountainburg unit. Wetness and shrink-swell potential are severe limitations on some soils in the Leadvale-Wrightsville unit.

There are areas of the county in which the soils have good potential for urban development. These include the parts of the Dardanelle-Roxana-Roellen association that are protected by levees. The soils in these areas also have good potential for farmland, and this potential should be considered in broad land use decisions.

Some areas in the Dardanelle-Roxana-Roellen unit have good potential for farming but poor potential for urban development. Wetness and shrink-swell potential are the main limitations to urban development on these soils. With proper engineering design, these limitations can usually be overcome. It should be noted, however, that the soils have good potential for farming, and many farmers have provided sufficient drainage for crop production.

Vegetables and other specialty crops are uniquely suited to parts of the Dardanelle-Roxana-Roellen unit and of the Spadra unit (fig. 1). These soils are well drained, and they warm up early in spring. Nurseries are also well suited on these soils.

Soils in Crawford County have poor to good potential for woodland. Most areas of the Dardanelle-Roxana-Roellen unit and of the Spadra unit have good potential for the production of bottom-land hardwoods. Areas of the Nella-Enders unit and of the Linker-Mountainburg unit have fair to poor potential for the production of pines and upland hardwoods.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil ...ue survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have similar profiles make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped. The Enders series, for example, is the name of a soil series in Crawford County.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Enders fine sandy loam, 3 to 8 percent slopes, is one of several phases within the Enders series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil associations and undifferentiated groups.

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Enders-Mountainburg association, steep, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Crevasse soils, frequently flooded, is an undifferentiated group in this survey area.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or strongly contrasting soils that are included are identified by a special symbol on the soil map.

Areas too small to be delineated on the soil maps are identified by a special symbol.

The acreage and proportionate extent of each map unit are given in table 6, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

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

Typically, the surface layer is dark grayish brown loamy fine sand about 9 inches thick. The underlying layer is stratified yellowish brown and light yellowish brown fine sand, loamy fine sand, and sand extending to a depth of 72 inches or more.

This soil is low in natural fertility and organic matter content. Reaction ranges from slightly acid to moderately alkaline throughout the profile. Permeability is rapid, and available water capacity is low. Crops on this soil give poor response to fertilizer, but tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Roxana soils and a few areas of soils that are occasionally flooded. Included soils make up about 10 percent of this map unit.

This soil has poor potential for cultivated crops. Droughtiness is a severe limitation. Some areas are subject to occasional flooding. Soil blowing is a severe hazard in spring if the soil is bare. Suited crops include soybeans and small grains. This soil has poor potential for pasture, but this is the main use. Adapted pasture plants include bahiagrass, bermudagrass, and weeping lovegrass.

This soil has good potential for eastern cottonwood and American sycamore. Seedling mortality due to droughtiness is a severe hazard.

This soil has good potential for most urban uses. There are no significant limitations. Capability unit IIIs-1; woodland suitablity group 2s6; pasture and hayland group 3B.

2—Crevasse soils, frequently flooded. This undifferentiated group consists of deep, excessively drained, nearly level soils on flood plains of the Arkansas River. It consists of Crevasse loamy fine sand and soils that are similar to Crevasse soils but that have variable surface texture. There is no regular pattern of occurrence of the soils. 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 20 to 500 acres in size.

Typically, the surface layer is dark grayish brown loamy fine sand about 9 inches thick. The underlying layer is stratified yellowish brown and light yellowish brown fine sand, loamy fine sand, and sand extending to a depth of 72 inches or more.

These soils are low in natural fertility and organic matter content. Reaction ranges from slightly acid to moderately alkaline throughout the profile. Permeability is rapid, and available water capacity is low. Crops on these soils give poor response to fertilizer, but tilth is easy to maintain.

Included with these soils in mapping are a few small areas of Roxana soils. Included soils make up about 10 percent of this map unit.

This map unit is not suitable for cultivation. Droughtiness and flooding are severe limitations. This map unit

has poor potential for pasture, but this is the main use. Adapted pasture plants include bahiagrass, bermudagrass, and weeping lovegrass.

This map unit has good potential for eastern cottonwood and American sycamore. Seedling mortality due to droughtiness is a severe hazard.

This map unit has poor potential for most urban uses. It is subject to frequent flooding. This limitation can be overcome only by major flood control measures. Capability unit Vw-1; woodland suitability group 2s6; pasture and hayland group 3B.

3—Dardanelle silt loam. This deep, well drained, level to nearly level soil is on old natural levees along the Arkansas River. Slopes are less than 2 percent. 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 upper part of the subsoil is dark brown silt loam that extends to a depth of about 30 inches, and the lower part is reddish brown silt loam that extends to a depth of about 55 inches. The underlying material is reddish brown very fine sandy loam.

This soil is high in natural fertility and medium in organic matter content. 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 available water capacity is high. Crops on this soil give good response to fertilizer, and tilth is easy to maintain. Some areas are flooded occasionally during winter.

Included with this soil in mapping are a few small areas of Gallion, Roxana, and Roellen soils and a few areas of soils that are occasionally flooded. Also included are a few areas of soils that have dark brown colors extending below a depth of 40 inches. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops, and this is the main use. The principal crops are soybeans and truck crops. Other suited crops include cotton, grain sorghum, small grain, and alfalfa. The small grain crops may be damaged by occasional winter flooding in some areas. The soil has good potential for pasture. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and white clover.

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

This soil has fair potential for most urban uses in areas that are not flooded. Low bearing strength for roads and streets, building foundations, and industrial sites is the main limitation. This limitation can be overcome by proper engineering design. Areas that are occasionally flooded have severe limitations for all urban uses. Capability unit I-1; woodland suitability group 1o4; pasture and hayland group 2A.

4—Dardanelle silt loam, overwash. This deep, well drained, level to nearly level soil is on natural levees along the Arkansas River. Slopes are less than 2 percent. Individual areas range from about 50 to 500 acres in size.

Typically, the surface layer is reddish brown silt loam about 12 inches thick. The subsurface layer is dark brown silt loam extending to a depth of about 18 inches. The upper part of the subsoil is dark brown silt loam that extends to a depth of about 30 inches, and the lower part is reddish brown silt loam that extends to a depth of about 55 inches. The underlying material is reddish brown very fine sandy loam.

This soil is high in natural fertility and medium in organic matter content. 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 available water capacity is high. Crops on this soil give good response to fertilizer, and tilth is easy to maintain. Some areas are flooded occasionally during winter.

Included with this soil in mapping are a few areas of Gallion, Roxana, and Roellen soils and a few areas of soils that are occasionally flooded. Included soils make up about 10 percent of the map unit.

This soil has good potential for cultivated crops, and this is the main use. The principal crops are soybeans and truck crops. Other suited crops include cotton, grain sorghum, small grain, and alfalfa. The small grain crops may be damaged by occasional winter flooding in some areas. The soil has good potential for pasture. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and white clover.

This soil has good potential for eastern cottonwood, sweetgum, and American sycamore. There is no significant limitation for woodland use or management.

This soil has fair potential for most urban uses in areas that are not flooded. Low bearing strength for roads and streets and shrink-swell potential for building foundations and industrial sites are the main limitations. These limitations can be overcome by proper engineering design. Areas that are occasionally flooded have severe limitations for all urban uses. Capability unit I-1; woodland suitability group 1o4; pasture and hayland group 2A.

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

Typically, the surface layer is dark brown and strong brown fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated red, yellowish brown, and light gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains fragments of shale. Acid shale bedrock is at a depth of about 58 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout the profile. Permeability is very slow, and available water capacity is medium. Crops on this soil give fair response to fertilizer, and tilth is difficult to maintain.

Included with this soil in mapping are a few small areas of Leadvale and Mountainburg soils. Also included are a few small areas of soils that have a silt loam surface layer. Included soils make up about 10 percent of this map unit.

This soil has poor potential for cultivated crops. Runoff is rapid, and the hazard of erosion is severe. Under good management sown crops can be grown occasionally in a cropping system that includes close-growing cover most of the time. The soil has fair potential for pasture, and this is the main use. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza.

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

This soil has poor potential for urban uses. High shrink-swell potential and low bearing strength are severe limitations for dwellings, industrial sites, and roads and streets. These limitations can usually be overcome with proper engineering design. Very slow permeability is a severe limitation for septic tank filter fields and is very difficult to overcome. Capability unit IVe-1; woodland suitability group 4o1; pasture and hayland group 8C.

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

Typically, the surface layer is dark brown and strong brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated red, yellowish brown, and light gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains fragments of shale. Acid shale bedrock is at a depth of about 58 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout the profile. Permeability is very slow, and available water capacity is medium. Crops on this soil give fair response to fertilizer.

Included with this soil in mapping are a few small areas of Leadvale and Mountainburg soils. Included soils make up about 10 percent of this map unit.

This soil is not suited to cultivated crops. It has fair potential for pasture. Runoff is rapid, and the hazard of erosion is severe. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza. The main use of this soil is for pasture and woodland.

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

This soil has poor potential for urban uses. High shrink-swell potential and low bearing strength are severe limitations for dwellings, industrial sites, and roads and streets. These limitations can usually be overcome with proper engineering design. Very slow permeability is a severe limitation for septic tank filter fields and is very difficult to overcome. Capability unit VIe-2; woodland suitability group 4o1; pasture and hayland group 8C.

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

Typically, the surface layer is dark brown and strong brown stony fine sandy loam about 5 inches thick. The subsoil is strong brown stony loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated red, yellowish brown, and light gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains fragments of shale. Acid shale bedrock is at a depth of about 58 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout the profile. Permeability is very slow, and available water capacity is medium. Crops on this soil give fair response to fertilizer.

Included with this soil in mapping are a few small areas of Mountainburg and Nella soils. Also included are a few small areas of soils that are yellowish red in the upper part of the subsoil and a few areas of soils that have a gravelly surface. Included soils make up about 10 percent of this map unit.

This soil is not suited to cultivated crops and has poor potential for pasture. Rapid runoff, severe hazard of erosion, and steep slopes are severe limitations. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, annual lespedeza, and sericea lespedeza.

This soil has fair potential for loblolly pine, shortleaf pine, and southern red oak, and it is used mainly as woodland. Management concerns include slight to moderate erosion hazard and moderate to severe equipment limitations due to steep slopes and to stones on the surface.

This soil has poor potential for urban uses. High shrink-swell potential, low bearing strength, steep slopes, and stones on the surface are severe limitations for dwellings, industrial sites, and roads and streets. These limitations can usually be overcome with proper engineering design. Very slow permeability is a severe limitation for septic tank filter fields and is very difficult to overcome. Capability group VIIs-1; woodland suitability group 4x2; pasture and hayland group 8D.

8—Enders-Mountainburg association, rolling. This association consists of deep and shallow, well drained soils on rolling hillsides and mountainsides in a regular and repeating pattern. The Enders soils are on side slopes between sandstone ledges or benches and on foot slopes; they formed in predominantly acid shale bedrock. The Mountainburg soils are on narrow sandstone ledges and benches and formed in acid sandstone bedrock. Slopes range from 8 to 20 percent. Mapped areas of this association range from about 50 to 500 acres in size.

The well drained, deep Enders soils make up about 50 percent of this association. Typically, the surface layer is dark brown and strong brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated red, yellowish brown, and gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains shale fragments. Acid shale bedrock is at a depth of about 58 inches.

Enders soils have very slow permeability and medium available water capacity. Natural fertility and organic matter content are low. These soils are strongly acid or very strongly acid throughout the profile, and crops give fair response to fertilizer.

The well drained, shallow Mountainburg soils make up about 35 percent of this association. Typically, the surface layer is dark brown and brown stony fine sandy loam about 9 inches thick. The subsoil is strong brown very stony sandy loam. Horizontal bedded acid sandstone bedrock is at a depth of about 17 inches.

Mountainburg soils have moderately rapid permeability and low available water capacity. Natural fertility and organic matter content are low. These soils are strongly acid or very strongly acid throughout the profile, and crops give poor response to fertilizer.

Included with these soils in mapping are a few areas of the well drained Nella soils on benches and foot slopes. Nella soils formed in loamy colluvium. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 15 percent of this association.

This association is not suited to cultivated crops. The Mountainburg soils are not suited to pasture, and the Enders soils have poor potential for pasture. Runoff is rapid, and the hazard of erosion is very severe. Adapted pasture plants are bahiagrass, bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza.

This association is used mainly for woodland. The Enders soils have fair potential for shortleaf pine and loblolly pine and have no significant management concerns. The Mountainburg soils have poor potential for shortleaf pine, loblolly pine, and eastern redcedar. Management concerns include a moderate erosion hazard and severe equipment limitations due to stones on the surface.

This association has poor potential for urban uses. The Enders soils have high shrink-swell potential, and the Mountainburg soils are shallow to bedrock. These soils have severe limitations for all urban uses. Limitations for septic tank filter fields are very difficult to overcome. Limitations for dwellings, small commercial buildings, and roads and streets can usually be overcome with proper engineering design. Where slopes are more than 15 percent, there are additional limitations for urban uses. Enders soils in capability unit VIe-1; woodland suitability group 4o1; pasture and hayland group 8D. Mountainburg soils in capability unit VIIs-2; woodland suitability group 5x3; not in a pasture and hayland group.

9—Enders-Mountainburg association, steep. This association consists of deep and shallow, well drained soils on steep hillsides and mountainsides in a regular and repeating pattern. The Enders soils are on side slopes between sandstone ledges or benches and on foot slopes; they formed in predominantly acid shale bedrock. The Mountainburg soils are on narrow sandstone ledges and benches and formed in acid sandstone bedrock. Slopes range from 20 to 40 percent. Mapped areas of this association range from about 50 to 500 acres in size.

The well drained, deep Enders soils make up about 60 percent of this association. Typically, the surface layer is dark brown and strong brown stony fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated red, yellowish brown, and gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains shale fragments. Acid shale bedrock is at a depth of about 58 inches.

Enders soils have very slow permeability and medium available water capacity. Natural fertility and organic matter content are low. These soils are strongly acid or very strongly acid throughout the profile.

The well drained, shallow Mountainburg soils make up about 30 percent of this association. Typically, the surface layer is dark brown and brown stony fine sandy loam about 9 inches thick. The subsoil is strong brown very stony sandy loam. Horizontally bedded acid sandstone bedrock is at a depth of about 17 inches.

Mountainburg soils have moderately rapid permeability and low available water capacity. Natural fertility and organic matter content are low. These soils are strongly acid or very strongly acid throughout the profile.

Included with these soils in mapping are a few small areas of the well drained Nella soils on benches and foot slopes. Nella soils formed in loamy colluvium. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 10 percent of this association.

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

This association has poor potential for shortleaf pine, loblolly pine, and eastern redcedar, but woodland is the main use. Management concerns include a moderate to severe erosion hazard and severe equipment limitations due to steep slopes and stones on the surface.

This association has poor potential for urban uses. The Enders soils have high shrink-swell potential, and the Mountainburg soils are shallow to bedrock. These soils have severe limitations for all urban uses. Limitations for septic tank filter fields are very difficult to overcome. Limitations for dwellings, roads and streets, and industrial sites can usually be overcome with proper engineering design. Enders soils in capability unit VIIs-1; woodland suitability group 4x2; not in a pasture and hayland group. Mountainburg soils in capability unit VIIs-2; woodland suitability group 5x3; not in a pasture and hayland group.

10—Gallion silt loam. This deep, well drained, level to nearly level soil is on protected flood plains of the Arkansas River. Levees protect the soil from flooding. Slopes are 0 to 2 percent. Individual areas range from 50 to 500 acres in size.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil is reddish brown silty clay loam to a depth of 31 inches and reddish brown silt loam to a depth of 42 inches. The underlying material is brown very fine sandy loam that extends to a depth of 72 inches or more.

This soil is high in natural fertility and low in organic matter content. The surface layer is medium acid to neutral, the subsoil is medium acid to moderately alkaline, and the underlying material is slightly acid to moderately alkaline. Permeability is moderate, and available water capacity is high. Crops on this soil give good response to fertilizer, and tilth is easy to maintain. Some areas are flooded occasionally during winter.

Included with this soil in mapping are a few small areas of Dardanelle, Roellen, and Roxana soils and a few areas of Gallion soils that are occasionally flooded. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops, and this is the main use. The principal crops are soybeans and truck crops. Other suited crops include alfalfa, cotton, grain sorghum, and small grain. The soil has good potential for pasture. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and white clover.

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

This soil has fair potential for most urban uses in areas that are not flooded. Low bearing strength and shrink-swell potential are moderate limitations for roads and streets, building foundations, and industrial sites. These limitations can be overcome by proper engineering design. Areas that are occasionally flooded have severe limitations for all urban uses. Capability unit I-1; woodland suitability group 2o4; pasture and hayland group 2A.

11—Gallion silt loam, occasionally flooded. This deep, well drained, level to nearly level soil is on the flood plain of the Arkansas River. This soil is not protected by a levee, and it is flooded less frequently than once every 2 years. Slopes are 0 to 2 percent. Individual areas range from 20 to 200 acres in size.

Typically, the surface layer is brown silt loam about 10 inches thick. The subsoil is reddish brown silty clay loam to a depth of 31 inches and reddish brown silt loam to a depth of 42 inches. The underlying material is brown very fine sandy loam that extends to a depth of 72 inches or more.

This soil is high in natural fertility and low in organic matter content. The surface layer is medium acid to neutral, the subsoil is medium acid to moderately alkaline, and the underlying material is slightly acid to moderately alkaline. Permeability is moderate, and available water capacity is high. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Dardanelle and Roxana soils. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops, and this is the main use. The areas, however, are flooded about once every 3 or 4 years. Most flooding occurs between December and April, but crops are damaged in some years. The principal crops are soybeans and truck crops. Other suited crops include alfalfa, cotton, grain sorghum, and small grain. The soil has good potential for pasture. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and white clover.

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

This soil has poor potential for urban uses. It is subject to occasional flooding. This is the main limitation and can be overcome only by major flood control measures. Capability unit IIw-1; woodland suitability group 2o4; pasture and hayland group 2A.

12—Leadvale silt loam, 1 to 3 percent slopes. This deep, moderately well drained, nearly level soil is on old stream terraces in broad valleys. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is dark brown silt loam about 6 inches thick. The subsoil extends to a depth of 77 inches. The upper 6 inches of the subsoil is yellowish brown, friable silt loam; the next 11 inches is yellowish brown, friable silty clay loam; the next 5 inches is yellowish brown, mottled, friable silty clay loam; the next 28 inches is a mottled yellowish brown and light gray, compact and brittle silty clay loam fragipan; and the lower part is mottled yellowish brown and light gray, firm silty clay loam that contains fragments of shale.

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

Included with this soil in mapping are a few small areas of Muskogee, Spadra, and Wrightsville soils. Also included are a few small areas of a few low mounds, and a few small areas of soils that have slopes of less than 1 percent. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops. Erosion is a moderate hazard. With good management that includes contour cultivation and terracing on long slopes, clean-tilled crops that leave a large amount of residue can be grown year after year. Suited crops are soybeans, truck crops, grain sorghum, and small grain. This soil has good potential for pasture, and this is the main use (fig. 2). Suitable pasture plants are bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza.

This soil has good potential for loblolly pine, shortleaf pine, and white oak. There are no significant limitations for woodland use and management.

This soil has fair potential for most urban uses. Low bearing strength is a moderate limitation for industrial sites and for roads and streets, but this can be overcome with proper engineering design. Slow permeability in the lower part of the subsoil and a seasonally perched water table are severe limitations for septic tank filter fields. These limitations are difficult to overcome. Capability unit IIe-1; woodland suitability group 3o7; pasture and hayland group 8A.

13—Leadvale silt loam, 3 to 8 percent slopes. This deep, moderately well drained, gently sloping soil is on foot slopes of hills 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 silt loam about 6 inches thick. The subsoil extends to a depth of about 77 inches. The upper 6 inches of the subsoil is yellowish brown, friable silt loam; the next 11 inches is yellowish brown, friable silty clay loam; the next 5 inches is yellowish brown, mottled silty clay loam; the next 28 inches is a mottled yellowish brown and light gray, firm and brittle silty clay loam fragipan; and the lower part is mottled yellowish brown and light gray silty clay loam that contains fragments of shale.

This soil is low in natural fertility and organic matter content. The surface layer is slightly acid to very strongly acid, and the subsoil is strongly acid or very strongly acid. Permeability is moderately slow, and 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 on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Enders soils and a few small areas of soils that have a subsoil of yellowish red clay loam or sandy clay loam. Included soils make up about 10 percent of this map unit.

This soil has fair potential for cultivated crops. Erosion is a severe hazard. With good management that includes contour cultivation and terraces, clean-tilled crops that leave a large amount of residue can be safely grown year after year in the less sloping areas. Conservation treatment needs to be intensified as slope increases. Suited crops include soybeans, truck crops, grain sorghum, and small grain. This soil has good potential for pasture, and this is the main use (fig. 3). Suitable pasture plants include bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza.

This soil has good potential for loblolly pine, shortleaf pine, and white oak. There are no significant limitations for woodland use and management.

This soil has fair potential for most urban uses. Low bearing strength is a moderate limitation for industrial sites and for roads and streets, but this can be overcome with proper engineering design. Slow permeability in the lower part of the subsoil and a seasonally perched water table are severe limitations for septic tank filter fields. These limitations are difficult to overcome. Capability unit IIIe-1; woodland suitability group 3o7; pasture and hayland group 8A.

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

Typically, the surface layer is dark brown fine sandy loam about 6 inches thick. The subsurface layer is yellowish brown fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 17 inches; yellowish red clay loam to a depth of 29 inches; and variegated yellowish red, red, and pale brown sandy clay loam to a depth of about 37 inches. Below this is horizontally bedded acid sandstone bedrock.

This soil is low in natural fertility and organic matter content. Reaction is medium acid or strongly acid in the surface layer and strongly acid or very strongly acid in the subsoil. Permeability is moderate, and available water capacity is medium. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Enders and Mountainburg soils and a few small areas of soils that have a gravelly surface. Also included are soils that are deeper than 40 inches over sandstone bedrock. Included soils make up about 10 percent of this map unit.

This soil has fair potential for cultivated crops. Erosion is a severe hazard. With good management that includes contour cultivation and terraces, clean-tilled crops that leave a large amount of residue can be safely grown year after year in the less sloping areas. Conservation treatments need to be intensified as slope increases. Suited crops include soybeans, grain sorghum, winter small grain, truck crops, apples, peaches, and grapes. This soil has fair potential for pasture, and this is the main use. Suitable pasture plants include bahiagrass, bermudagrass, tall fescue, sericea lespedeza, and annual lespedeza (fig. 4).

This soil has fair potential for loblolly pine, shortleaf pine, and eastern redcedar. There are no significant limitations for woodland use or management.

This soil has fair potential for most urban uses. Depth to bedrock is the main limitation for building foundations, roads and streets, and building sites, but this can be overcome with proper engineering design. Depth to bedrock is also a severe limitation for septic tank filter fields and is difficult to overcome for this use. Capability unit IIIe-1; woodland suitability group 4o1; pasture and hayland group 8A.

15—Linker-Mountainburg association, undulating. This association consists of well drained, moderately deep and shallow, nearly level to gently sloping soils on hilltops and mountaintops in a regular and repeating pattern. The shallow Mountainburg soils occur near the rims of the hilltops and mountaintops, and the Linker soils occur in areas where depth to bedrock is greater. Both of these

soils developed in material weathered from sandstone. Slopes range from 1 to 8 percent. Mapped areas of this association range from 50 to 200 acres in size.

The well drained, moderately deep Linker soils make up about 55 percent of the association. Typically, the surface layer is dark brown fine sandy loam about 6 inches thick. The subsurface layer is yellowish brown fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 17 inches; yellowish red clay loam to a depth of 29 inches; and variegated yellowish red, red, and pale brown sandy loam to a depth of about 37 inches. Below this is horizontally bedded acid sandstone bedrock.

Linker soils have moderate permeability and medium available water capacity. Natural fertility and organic matter content are low. Reaction is medium acid or strongly acid in the surface layer and strongly acid or very strongly acid in the subsoil. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

The well drained, shallow Mountainburg soils make up about 30 percent of the association. Typically, the surface layer is dark brown stony fine sandy loam about 4 inches thick. The subsurface layer is brown stony fine sandy loam about 5 inches thick. The subsoil is strong brown very stony sandy loam that extends to a depth of about 17 inches. Below this is horizontally bedded acid sandstone bedrock.

Mountainburg soils have moderately rapid permeability and low available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile. Crops on this soil give poor response to fertilizer.

Included with these soils in mapping are a few small areas of Enders and Nella soils. The Enders soils formed in clayey material weathered from shale. The Nella soils formed in loamy colluvium. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 15 percent of the association.

The Linker soils have fair potential for cultivated crops. Erosion is a severe hazard, but with good management that includes contour cultivation and terraces, clean-tilled crops that leave large amounts of residue can be safely grown year after year in the less sloping areas. Conservation treatments need to be intensified as slope increases. Suited crops include soybeans, grain sorghum, truck crops, winter small grain, apples, peaches, and grapes. Mountainburg soils are not suitable for cultivated crops. They are very droughty, and erosion is a very severe hazard. Linker soils have fair potential for pasture, and Mountainburg soils have poor potential. Suitable pasture plants on both soils include bahiagrass, bermudagrass, tall fescue, annual lespedeza, and sericea lespedeza. Management concerns include controlled grazing, fertilization, weed control, and stone removal on the Mountainburg soils.

Potential for woodland is fair to poor, but this is the main use. The Linker soils have fair potential for shortleaf pine, loblolly pine, and eastern redcedar. Mountainburg soils have poor potential for shortleaf pine, loblolly pine, and eastern redcedar. Both soils have restricted rooting zones and limited available water capacity. The stones in the Mountainburg soils are a moderate limitation for new seedlings and a severe limitation for equipment.

This association has poor potential for most urban uses. Depth to bedrock and stones are the main limitations and are costly to overcome. Linker soils in capability unit IIIe-1; woodland suitability group 4o1; pasture and hayland group 8A. Mountainburg soils in capability unit VIs-1; woodland suitability group 5x3; pasture and hayland group 14A.

16—Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes. This shallow, well drained, gently sloping soil is on hilltops, mountaintops, 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 4 inches thick. The subsurface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown very stony sandy loam that extends to a depth of about 17 inches. Below this is horizontally bedded acid sandstone bedrock.

This soil is low in natural fertility and organic matter content. Reaction is strongly acid or very strongly acid throughout the profile. Permeability is moderately rapid, and available water capacity is low. Crops on this soil give poor response to fertilizer, but tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Enders and Linker soils and a few small areas of soils that have a stony surface. Also included are a few small areas of rock outcrops. These included soils and rock outcrops make up about 10 percent of this map unit.

This soil has poor potential for cultivated crops. The hazard of erosion is severe, and the soil is very droughty. Under good management sown crops can be grown in a cropping system that includes close-growing cover most of the time. This soil has poor potential for pasture, but this is the main use. Suitable pasture plants include bahiagrass, bermudagrass, and sericea lespedeza.

This soil has poor potential for shortleaf pine, loblolly pine, and eastern redcedar. The restricted rooting zone and the low available water capacity cause moderate seedling mortality.

This soil has poor potential for most urban uses. Depth to bedrock is a severe limitation for most urban uses and is costly to overcome. Capability unit IVe-2; woodland suitability group 5d2; pasture and hayland group 14A.

17—Mountainburg gravelly fine sandy loam, 8 to 12 percent slopes. This shallow, well drained, moderately sloping soil is on the sides 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 4 inches thick. The subsurface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown very stony sandy loam that extends to a depth of about 17 inches. Below this is horizontally bedded acid sandstone bedrock.

This soil is low in natural fertility and organic matter content. Reaction is strongly acid or very strongly acid throughout the profile. Permeability is moderately rapid, and available water capacity is low. Crops on this soil give poor response to fertilizer.

Included with this soil in mapping are a few small areas of Enders, Linker, and Nella soils and a few small areas of soils that have a stony surface. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 10 percent of this map unit.

This soil is not suitable for cultivated crops. It has poor potential for pasture. The soil is very droughty, and the hazard of erosion is very severe. The gravel on the surface limits the use of equipment. Suitable pasture plants include bahiagrass, bermudagrass, and sericea lespedeza.

This soil has poor potential for woodland; however, this is the main use. Shortleaf pine, loblolly pine, and eastern redcedar are the best adapted species. The restricted rooting zone and the low available water capacity cause moderate seedling mortality.

This soil has poor potential for most urban uses. Depth to bedrock is a severe limitation for most urban uses and is costly to overcome. Capability unit VIe-3; woodland suitability group 5d2; pasture and hayland group 14A.

18—Mountainburg stony fine sandy loam, 3 to 12 percent slopes. This shallow, well drained, gently sloping to moderately sloping soil is on the sides and tops of hills, mountains, and ridges. Individual areas range from about 10 to 120 acres in size.

Typically, the surface layer is dark brown stony fine sandy loam about 4 inches thick. The subsurface layer is brown stony fine sandy loam about 5 inches thick. The subsoil is strong brown very stony sandy loam that extends to a depth of about 17 inches. Below this is horizontally bedded acid sandstone bedrock.

This soil is low in natural fertility and organic matter content. Reaction is strongly acid or very strongly acid throughout the profile. Permeability is moderately rapid, and available water capacity is low. Crops on this soil give poor response to fertilizer.

Included with this soil in mapping are a few small areas of Enders, Linker, and Nella soils and a few small areas of soils that have a gravelly surface. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 10 percent of this map unit.

This soil is not suitable for cultivated crops or pasture. The soil is very droughty, and the hazard of erosion is severe. Stones on the surface limit the use of equipment.

This soil has poor potential for woodland. Most areas have a scattered cover of blackjack oak, post oak, and redcedar. Shortleaf pine, loblolly pine, and eastern redcedar are the best adapted species. This soil has a restricted rooting zone and low available water capacity. The stony surface is a severe limitation for new seedlings and for equipment.

This soil has poor potential for most urban uses. Depth to bedrock and stones are severe limitations for most urban uses and are costly to overcome. Capability unit VIs-1; woodland suitability group 5x3; not in a pasture and hayland group.

19—Muskogee silt loam, 3 to 8 percent slopes. This deep, moderately well drained, gently sloping soil is on high terraces along the Arkansas River. Individual areas range from 100 to 500 acres in size.

Typically, the surface layer is brown silt loam about 5 inches thick. The subsoil is yellowish brown silt loam to a depth of 10 inches; yellowish brown, mottled silty clay loam to a depth of 29 inches; and mottled red, light gray, and yellowish brown clay to a depth of 72 inches or more.

This soil is moderate in natural fertility and low in organic matter content. Reaction is strongly acid or very strongly acid throughout. Permeability is slow, and available water capacity is high. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Leadvale and Wrightsville soils and a few small areas of eroded soils that have slopes greater than 8 percent and that have a red subsoil. Included soils make up about 10 percent of this map unit.

This soil has fair potential for cultivated crops. Erosion is a severe hazard. With good management that includes contour cultivation and terraces, clean-tilled crops that leave large amounts of residue can be safely grown year after year in the less sloping areas. Conservation treatment needs to be intensified as slope increases. Suited crops include soybeans, truck crops, grain sorghum, and small grain. This soil has good potential for pasture, and this is the main use. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza.

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

This soil has poor potential for urban uses. High shrink-swell potential and low bearing strength are severe limitations for dwellings, roads and streets, and industrial sites. These limitations can usually be overcome with proper engineering design. Very slow percolation is a severe limitation for septic tank filter fields and is very difficult to overcome. Capability unit IIIe-1; woodland suitability group 3o7; pasture and hayland group 8A.

20—Nella gravelly fine sandy loam, 3 to 8 percent slopes. This deep, well drained, gently sloping soil is on foot slopes and benches. Individual areas range from about 10 to 200 acres in size.

Typically, the surface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is yellowish red gravelly sandy clay loam to a depth of 50 inches and yellowish red, mottled gravelly sandy clay loam to a depth of 72 inches or more.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout except for the surface layer in limed areas. Permeability is moderate, and available water capacity is medium. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Enders, Linker, and Mountainburg soils and a few small areas of soils that have a surface layer of fine sandy loam. Included soils make up about 10 percent of this map unit.

This soil has fair potential for cultivated crops. Because of the runoff from soils upslope, erosion is a severe hazard. With good management that includes contour cultivation and terraces, tilled crops that leave large amounts of residue can be grown year after year in the less sloping areas. Conservation treatments need to be intensified as slope length and gradient increase. Gravel in the surface layer makes tillage somewhat difficult. Suited crops include soybeans, grain sorghum, and small grain. This soil has good potential for pasture, and this is the main use. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, white clover, sericea lespedeza, and annual lespedeza.

This soil has fair potential for loblolly pine, shortleaf pine, and northern red oak. There are no significant limitations for woodland use or management.

This soil has good potential for most urban uses. Low bearing strength is a moderate limitation for roads and streets, but this can be easily overcome by proper engineering design. Capability unit IIIe-1; woodland suitability group 4o7; pasture and hayland group 8A.

21—Nella-Enders association, rolling. This association consists of deep, well drained soils on rolling hillsides and mountainsides in a regular and repeating pattern. The Nella soils are on foot slopes and benches. They formed in loamy colluvium from acid sandstone and shale. The Enders soils are on side slopes and benches. They formed in acid shale bedrock. Slopes are 8 to 20 percent. Mapped areas are mostly long and narrow and range from 50 to 500 acres in size.

Nella soils make up about 60 percent of the association. Typically, the surface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is yellowish red gravelly sandy clay loam to a depth of 50 inches and yellowish red, mottled gravelly sandy clay loam to a depth of 72 inches. It is underlain by sandstone bedrock.

Nella soils have moderate permeability and medium available water capacity. Natural fertility and organic matter content are low. These soils are strongly acid or very strongly acid throughout the profile, and crops give good response to fertilizer.

Enders soils make up about 30 percent of the association. Typically, the surface layer is dark brown and strong brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated red, yellowish brown, and gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains shale fragments. Acid shale bedrock is at a depth of about 58 inches.

Enders soils have very slow permeability and medium available water capacity. Natural fertility and organic matter content are low. These soils are strongly acid or very strongly acid throughout the profile, and crops give fair response to fertilizer.

Included with these soils in mapping are a few areas of the moderately deep Linker soils and the shallow Mountainburg soils, both of which formed in acid sandstone bedrock. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 10 percent of this association.

This association is not suitable for cultivated crops. The Nella soils have fair potential and the Enders soils have poor potential for pasture if kept in permanent cover and if special erosion control measures are used. The hazard of erosion is very severe. Management concerns include proper stocking, controlled grazing, and weed and brush control. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and sericea lespedeza.

This association is used mainly for woodland. The Nella soils have fair potental for shortleaf pine, loblolly pine, and northern red oak and have no significant management concerns. The Enders soils have fair potential for shortleaf pine and loblolly pine and have no significant management concerns.

This association has poor potential for urban uses. The Nella soils have moderate to severe limitations because of slope. The Enders soils have severe limitations for all uses because of high shrink-swell potential, low bearing strength, and very slow permeability. These limitations can usually be overcome by proper engineering design. Nella soils in capability unit VIe-2; woodland suitability group 4o7; pasture and hayland group 8B. Enders soils in capability unit VIe-1; woodland suitability group 4o1; pasture and hayland group 8D.

22—Nella-Enders association, steep. This association consists of deep, well drained soils on steep hillsides and mountainsides in a regular and repeating pattern. The Nella soils are on foot slopes and benches. They formed in loamy colluvium from acid sandstone and shale. The Enders soils are on side slopes and benches. They formed in acid shale bedrock. Slopes are 20 to 40 percent. Mapped areas are mostly long and narrow and range from 50 to 700 acres in size.

Nella soils make up about 50 percent of the association. Typically, the surface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is yellowish red gravelly sandy clay loam to a depth of 50 inches and yellowish red, mottled gravelly sandy clay loam to a depth of 72 inches or more.

Nella soils have moderate permeability and medium available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile, and crops give fair response to fertilizer.

Enders soils make up about 40 percent of the association. Typically, the surface layer is dark brown and strong brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated

red, yellowish brown, and gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains shale fragments. Acid shale bedrock is at a depth of about 58 inches.

Enders soils have very slow permeability and medium available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile, and crops give poor response to fertilizer.

Included with these soils in mapping are a few small areas of the shallow Mountainburg soils, which formed in acid sandstone bedrock. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 10 percent of this association.

This association is not suitable for cultivated crops. Nella soils have fair potential and Enders soils have poor potential for pasture. The main limitation is slope. The hazard of erosion is very severe. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and sericea lespedeza.

This association is used mainly for woodland. The Nella soils have fair potential for shortleaf pine, loblolly pine, and northern red oak. Steep slopes are a severe limitation for equipment use. The Enders soils have fair potential for shortleaf pine and loblolly pine. Steep slopes are a severe limitation for equipment use.

This association has poor potential for urban uses. The Nella soils have severe limitations for all uses because of steep slopes. The Enders soils have severe limitations for all uses because of steep slopes, high shrink-swell potential, low bearing strength, and very slow permeability. These limitations can usually be overcome by proper engineering design. Nella soils in capability unit VIIe-1; woodland suitability group 4r8; not in a pasture and hayland group. Enders soils in capability unit VIIe-2; woodland suitability 4r3; not in a pasture and hayland group.

23—Nella-Enders association, very steep. This association consists of deep, well drained soils on very steep hillsides and mountainsides in a regular and repeating pattern. The Nella soils are on foot slopes and benches. They formed in loamy colluvium from acid sandstone and shale. The Enders soils are on side slopes and benches. They formed in acid shale bedrock. Slopes are 40 to 50 percent. Mapped areas are mostly long and narrow and range from 50 to 600 acres in size.

Nella soils make up about 50 percent of the association. Typically, the surface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is yellowish red gravelly sandy clay loam to a depth of 50 inches and yellowish red, mottled gravelly sandy clay loam to a depth of 72 inches or more.

Nella soils have moderate permeability and medium available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile, and crops give poor response to fertilizer.

Enders soils make up about 40 percent of the association. Typically, the surface layer is dark brown and strong brown gravelly fine sandy loam about 5 inches thick. The subsoil is strong brown loam to a depth of 13 inches; yellowish red clay to a depth of 26 inches; and variegated red, yellowish brown, and gray clay to a depth of about 48 inches. The underlying material is light gray clay that is mottled with red and yellowish brown and that contains shale fragments. Acid shale bedrock is at a depth of about 58 inches.

Enders soils have very slow permeability and medium available water capacity. Natural fertility and organic matter content are low. These soils are strongly acid or very strongly acid throughout the profile, and crops give poor response to fertilizer.

Included with these soils in mapping are a few small areas of the shallow Mountainburg soils, which formed in acid sandstone bedrock. Also included are a few small areas of soils that have a stony surface layer and a few small areas of rock outcrops. Included soils and rock outcrops make up about 10 percent of this association.

This association is not suitable for cultivated crops or pasture. Because of the very steep slopes, the hazard of erosion is very severe.

This association is used mainly for woodland. The Nella soils have fair potential for shortleaf pine, loblolly pine, and northern red oak. The Enders soils have poor potential for shortleaf pine and loblolly pine. The very steep slopes cause severe problems for woodland use and management.

This association has poor potential for urban uses. The Nella soils have severe limitations for all uses because of the very steep slopes. The Enders soils have severe limitations for all uses because of the very steep slopes, high shrink-swell potential, low bearing strength, and very slow permeability. These limitations can usually be overcome with proper engineering design. Nella soils in capability unit VIIe-1; woodland suitability group 4r9; not in a pasture and hayland group. Enders soils in capability unit VIIe-2; woodland suitability group 5r3; not in a pasture and hayland group.

24—Nella-Mountainburg association, rolling. This association consists of deep and shallow, well drained soils on rolling hillsides and mountainsides in a regular and repeating pattern. The Nella soils are on foot slopes and benches. They formed in loamy colluvium from acid sandstone and shale. The Mountainburg soils are on narrow sandstone ledges, ridgetops, and benches. They formed in acid sandstone bedrock. Slopes are 8 to 20 percent. Mapped areas are mostly long and narrow and range from 50 to 300 acres in size.

The deep Nella soils make up about 55 percent of the association. Typically, the surface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is yellowish red gravelly sandy clay loam to a depth of 50 inches and yellowish red, mottled gravelly sandy clay loam to a depth of 72 inches or more.

Nella soils have moderate permeability and medium available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile, and crops give good response to fertilizer.

The shallow Mountainburg soils make up about 35 percent of the association. Typically, the surface layer is dark brown stony fine sandy loam about 4 inches thick. The subsurface layer is brown stony fine sandy loam about 5 inches thick. The subsoil is strong brown very stony sandy loam that extends to a depth of about 17 inches. Below this is horizontally bedded acid sandstone bedrock.

The well drained Mountainburg soils have moderately rapid permeability and low available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile, and crops give poor response to fertilizer.

Included with this soil in mapping are a few small areas of the well drained Enders soils, which formed in clayey material weathered from shale. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 10 percent of this association.

This association is not suitable for cultivated crops. The Nella soils have fair potential for pasture if kept in permanent cover and if special erosion control measures are used. The hazard of erosion is very severe. Management concerns include proper stocking, controlled grazing, and weed and brush control. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and sericea lespedeza. The Mountainburg soils are not suitable for pasture. Stones on the surface are a severe limitation for use of equipment.

This association is used mainly for woodland. The Nella soils have fair potential for shortleaf pine, loblolly pine, and northern red oak. There are no significant management concerns. The Mountainburg soils have poor potential for shortleaf pine and eastern redcedar. Stones on the surface cause severe limitations for equipment use.

This association has poor potential for urban uses. The Nella soils have moderate to severe limitations because of slopes. The Mountainburg soils have severe limitations for all uses because of stones on the surface and shallow depth to bedrock. All of these limitations, except slope, are difficult to overcome. Nella soils in capability unit VIe-2; woodland suitability group 3o7; pasture and hayland group 8B. Mountainburg soils in capability unit VIIs-2; woodland suitability group 5x3; not in a pasture and hayland group.

25—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. The Nella soils are on foot slopes and benches. They formed in loamy colluvium from acid sandstone and shale. The Mountainburg soils are on narrow sandstone ledges, ridgetops, and benches. They formed in acid sandstone bedrock. Slopes are 20 to 40 percent. Mapped areas are mostly long and narrow and range from 50 to 500 acres in size.

The deep Nella soils make up about 55 percent of the association. Typically, the surface layer is brown gravelly fine sandy loam about 5 inches thick. The subsoil is yellowish red gravelly sandy clay loam to a depth of 50 inches and yellowish red, mottled gravelly sandy clay loam to a depth of 72 inches or more.

Nella soils have moderate permeability and medium available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile, and crops give fair response to fertilizer.

The shallow Mountainburg soils make up about 30 percent of the association. Typically, the surface layer is dark brown stony fine sandy loam about 4 inches thick. The subsurface layer is brown stony fine sandy loam about 5 inches thick. The subsoil is strong brown very stony sandy loam that extends to a depth of about 17 inches. Below this is horizontally bedded acid sandstone bedrock.

The well drained Mountainburg soils have moderately rapid permeability and low available water capacity. Natural fertility and organic matter content are low. Reaction is strongly acid or very strongly acid throughout the profile, and crops give poor response to fertilizer.

Included with these soils in mapping are a few small areas of the well drained Enders soils, which formed in clayey material weathered from shale. Also included are a few small areas of rock outcrops. Included soils and rock outcrops make up about 15 percent of this association.

This association is not suitable for cultivated crops or pasture. The main limitation is steep slopes. The hazard of erosion is very severe. Stones on the surface of the Mountainburg soils severely limit the use of equipment.

This association is used mainly for woodland. The Nella soils have fair potential for shortleaf pine, loblolly pine, and northern red oak. Steep slopes are a severe limitation for equipment use. The Mountainburg soils have poor potential for shortleaf pine and eastern redcedar. Steep slopes and surface stones are severe limitations for equipment use.

This association has poor potential for urban uses. The Nella soils have severe limitations for all uses because of steep slopes. The Mountainburg soils have severe limitations for all uses because of steep slopes, stones on the surface, and shallow depth to bedrock. All of these limitations except for slopes are difficult to overcome. Nella soils in capability unit VIIe-1; woodland suitability group 4r8; not in a pasture and hayland group. Mountainburg soils in capability unit VIIs-2; woodland suitability group 5x3; not in a pasture and hayland group.

26—Roellen silty clay loam. This deep, poorly drained, level soil is in slack water areas on the flood plain of the Arkansas River. Slopes are less than 1 percent. Individual areas range from about 30 to 500 acres in size.

Typically, the surface layer is very dark gray silty clay loam to a depth of 9 inches and very dark gray silty clay to a depth of 18 inches. The subsoil is dark gray, mottled clay to a depth of 36 inches and dark grayish brown, mottled clay to a depth of 53 inches. The underlying material

is brown clay that extends to a depth of 72 inches or more.

This soil is high in natural fertility and organic matter content. The surface layer ranges from medium acid to neutral, and the subsoil and underlying material range from slightly acid to mildly alkaline. Permeability is slow, and available water capacity is high. Some areas are flooded occasionally during winter. Crops on this soil give good response to fertilizer. Tilth is difficult to maintain because of high clay content in the surface layer; clods form if the soil is tilled when wet.

Included with this soil in mapping are a few small areas of Dardanelle and Gallion soils. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops if surface drainage is adequate. Farming operations are commonly delayed several days after a rain because of excess water, and surface drains are needed in some areas. The main crop is soybeans. Other suited crops are cotton, grain sorghum, and rice. This soil has good potential for pasture. Suitable pasture plants are bermudagrass and tall fescue.

This soil has good potential for cottonwood, water oak, and sweetgum. Wetness is the main limitation to equipment use in managing and harvesting the tree crop, but this is usually overcome by logging during the drier seasons.

This soil has poor potential for most urban uses. Wetness and shrink-swell potential are severe limitations for dwellings, streets and roads, and industrial sites. These limitations can usually be overcome by proper engineering design. Slow permeability and the seasonal high water table are severe limitations for septic tank absorption fields and are difficult or impractical to overcome. Capability unit IIIw-1; woodland suitability group 2w6; pasture and hayland group 1A.

27—Roxana silt loam. This deep, well drained, level to nearly level soil is on protected flood plains of the Arkansas River. Levees protect the soil from flooding. Slopes are 0 to 2 percent. Individual areas range from 50 to 1,000 acres in size.

Typically, the surface layer is reddish brown silt loam about 9 inches thick. The underlying layers are stratified brown very fine sandy loam, loamy very fine sand, and loamy fine sand extending to a depth of 72 inches or more.

This soil is high in natural fertility and low in organic matter content. The surface layer ranges from slightly acid to mildly alkaline, and the underlying material ranges from neutral to moderately alkaline. Permeability is moderate, and available water capacity is medium. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Crevasse, Dardanelle, and Gallion soils. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops and pasture. Nearly all of the acreage is cultivated. The principal crops are soybeans and truck crops. Other suited crops include small grain, grain sorghum, and alfalfa. Adapted pasture plants include bermudagrass, tall fescue, and white clover.

This soil has good potential for eastern cottonwood and American sycamore. There are no significant limitations for woodland use or management.

This soil has good potential for most urban uses. Low bearing strength for roads and streets is a moderate limitation. This limitation can be overcome by proper design of roadbeds. Capability unit I-1; woodland suitability group 1o4; pasture and hayland group 2A.

28—Roxana silt loam, occasionally flooded. This deep, well drained, level to nearly level soil is on flood plains of the Arkansas River. This soil is not protected by a levee, and it is flooded less frequently than once every 2 years. Slopes are 0 to 2 percent. Individual areas range from 40 to 250 acres in size.

Typically, the surface layer is reddish brown silt loam about 9 inches thick. The underlying layers are stratified brown very fine sandy loam, loamy very fine sand, and loamy fine sand extending to a depth of 72 inches or more.

This soil is high in natural fertility and low in organic matter content. The surface layer ranges from slightly acid to mildly alkaline, and the underlying material ranges from neutral to moderately alkaline. Permeability is moderate, and available water capacity is medium. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Crevasse, Dardanelle, and Gallion soils. Also included are small, low areas of soils that are flooded for short periods at least once every 2 years. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops and pasture. Nearly all of the acreage is cultivated. The principal crops are soybeans and truck crops. Other suited crops include small grain and alfalfa. Winter small grain may be damaged by occasional flooding in some years. Adapted pasture plants include bermudagrass, tall fescue, and white clover.

This soil has good potential for eastern cottonwood and American sycamore. There are no significant limitations for woodland use or management.

This soil has poor potential for most urban uses. It is subject to occasional flooding mainly between November and June. Flooding is the main limitation and can be overcome only by major flood control measures. Capability unit IIw-1; woodland suitability group 1o4; pasture and hayland group 2A.

29—Spadra fine sandy loam, occasionally flooded. This deep, well drained, nearly level soil is on low stream terraces along the larger streams in the uplands. Slopes are 1 to 3 percent. This soil is flooded less frequently than once every 2 years. Individual areas range from 10 to 500 acres in size.

Typically, the surface layer is brown fine sandy loam about 8 inches thick. The subsoil is reddish brown sandy clay loam to a depth of 26 inches and brown sandy clay loam to a depth of about 54 inches. The underlying material is brown fine sandy loam that extends to a depth of 72 inches or more.

This soil is high in natural fertility and low in organic matter content. Reaction ranges from slightly acid to strongly acid in the surface layer and is strongly acid or very strongly acid in the subsoil. Permeability is moderate, and available water capacity is high. Crops on this soil give good response to fertilizer, and tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Leadvale soils. Included soils make up about 10 percent of this map unit.

This soil has good potential for cultivated crops. Suited crops include soybeans (fig. 5), truck crops, and grain sorghum. Most areas are flooded every 3 to 4 years, but rarely between April and December. With good management that includes contour cultivation, clean-tilled crops that leave large amounts of residue can be safely grown year after year. This soil has good potential for pasture, and this is the main use. Adapted pasture plants include bahiagrass, bermudagrass, tall fescue, and white clover.

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

This soil has poor potential for most urban uses. Occasional flooding is a severe limitation for most urban uses and can be overcome only by major flood control measures. Capability unit IIw-1; woodland suitability group 2o7; pasture and hayland group 2A.

30—Wrightsville silt loam. This deep, poorly drained, level soil is on old stream terraces in broad valleys. Slopes are less than 2 percent. Individual areas range from about 20 to 200 acres in size.

Typically, the surface layer is grayish brown silt loam about 3 inches thick. The subsurface layer is gray, mottled silt loam about 15 inches thick. The upper part of the subsoil is gray, mottled silty clay that extends to a depth of about 53 inches, and the lower part is gray, mottled silty clay loam that extends to a depth of about 70 inches or more.

This soil is low in natural fertility and organic matter content. Reaction is strongly acid or very strongly acid throughout. Permeability is very slow, and available water capacity is high. The water table is seasonally high and is within 12 inches of the surface during winter and early spring. Crops on this soil give good response to fertilizer, but tilth is easy to maintain.

Included with this soil in mapping are a few small areas of Leadvale and Muskogee soils. Included soils make up about 10 percent of this map unit.

This soil has fair potential for cultivated crops. Suited crops include soybeans and grain sorghum. Winter small grain can be grown where surface drainage is adequate. With good management that includes adequate drainage, clean-tilled crops that leave large amounts of residue can be grown year after year. This soil has good potential for pasture, and this is the main use. Adapted pasture plants are bermudagrass, bahiagrass, tall fescue, white clover, annual lespedeza, and sericea lespedeza. Surface drainage is needed in some areas.

This soil has good potential for loblolly pine, sweetgum, and water oak. Wetness is the main limitation to equipment use. This limitation is usually overcome by logging during the drier seasons.

This soil has poor potential for most urban uses. Wetness, low bearing strength, and shrink-swell potential are severe limitations for dwellings, roads and streets, and industrial sites. With proper engineering design, these limitations can usually be overcome. Very slow permeability and wetness are severe limitations for septic tank filter fields. These limitations are difficult or impractical to overcome. Capability unit IIIw-2; woodland suitability group 3w9; pasture and hayland group 8F.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland, as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities, and for wildlife habitat. From the data presented, the potential of each soil for specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops and pasture

W. WILSON FERGUSON, agronomist, Soil Conservation Service, helped prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil are discussed; 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 presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

About 10 percent of the survey area was used for crops and about 24 percent was used for pasture and hayland in 1967. The potential of the soils in Crawford County for increased production of food is good. A considerable acreage of potentially good cropland is currently used as woodland or pasture. In addition to the reserve production capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. The 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. In 1967 there was about 9,000 acres of urban and built-up land in the county. This figure continues to grow at a steady rate. The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General soil map for broad land use planning."

Except for those on the Arkansas River flood plain, the soils in Crawford County are low in content of nitrogen, potassium, phosphorus, calcium, and organic matter. Many of the soils suitable for cultivation are erodible. Poor surface or internal drainage and the susceptibility to flooding are limitations in places. Many soils are poorly suited to crops and pasture because of stony conditions, shallow depth to bedrock, high content of coarse fragments within the soil, or combinations of these.

Contour cultivation, terraces, and vegetated 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 or grasses and legumes should be grown regularly in the cropping system if the hazard of erosion is severe 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 plowpan commonly forms in loamy soils that are improperly tilled or that 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 plowpan.

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.

Soybeans and, to an increasing extent, grain sorghum are the common row crops grown in the county. Wheat and oats are the commonly grown small grains. Major truck crops include beets, cucumbers, kale, spinach, and squash.

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

Coastal 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 production of good quality forage. Johnsongrass is also suited to many of the soils in the county. Tall fescue is the principal winter perennial grass now grown. Annual lespedeza and white clover are the most commonly grown legumes and are usually grown in combination with grass. Alfalfa is also 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, stand survival, and erosion control. This includes maintaining sufficient topgrowth on the plants during the growing season to provide for vigorous healthy growth. It also excludes or restricts grazing of tall fescue in summer. Brush control is essential, and weed control is often needed.

Grass pasture respond well to nitrogen fertilizer. In places, pastures of a grass-legume mixture require phosphate and potash fertilizers and lime at rates based on soil tests.

The soils of Crawford County have been placed in ten pasture and hayland groups. These groups have been prepared to assist land users in the selection and management of suitable forage plants. The soils included in each group support similar kinds of forage plants and require

similar treatment and management. Forage production for one soil in the group is essentially the same as production for other soils in the group when management and treatment are the same. The pasture and hayland groups are identified in the description of each soil map unit in the section "Soil maps for detailed planning."

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. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

The estimated yields were based mainly on the experience and records of farmers, conservationists, and extension agents. Results of field trials and demonstrations and available yield data from nearby counties were also considered.

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 7.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; 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 residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

The estimated yields reflect the productive capacity of the soils 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 included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classification

Capability classification shows, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

Class VIII soils and landforms 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 too cold or too 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, though they have other limitations that restrict their use to pasture, rangeland, woodland, wildlife habitat, or recreation.

The capability unit is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning." Capability units are soil groups within the subclasses. The soils in one capability unit are enough

alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

Rangeland

DARWIN C. HEDGES, range conservationist, Soil Conservation Service, helped prepare this section.

According to a 1969 survey, about 18 percent, or 52,416 acres, of Crawford County is rangeland. Most of the rangeland is on steep slopes and ridgetops. Most of the agricultural income is derived from cattle, principally cow-calf operations.

On most farms, forage produced by rangeland is supplemented with protein when used during the dormant season. Creep feeding of calves to increase market weight is practiced on some farms.

The native vegetation on many farms has been somewhat depleted by excessive use. Much of this depleted acreage is now covered by brush and weeds. Productivity of the range can be increased by using management practices for specific kinds of soils to increase the important forage-producing climax grasses—little bluestem and big bluestem.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 8 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; and the characteristic vegetation. Soils not listed cannot support a natural plant community of predominant grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 8.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The major management concern on rangeland in Crawford County is control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. Controlling weeds and brush are also important management concerns. If sound range management based on soil survey information and rangeland inventories is applied, potential is good for increasing the productivity of range in the survey area. Information concerning range management can be obtained by contacting the Crawford County Conservation District.

Woodland management and productivity

J. T. BEENE, forester, Soil Conservation Service, helped prepare this section.

Trees cover about 56 percent (7) of Crawford County, including about 82,000 acres of public land in the Ozark National Forest. Good to poor stands of commercial trees are produced in the woodlands of the county. Broadleaved tree species are dominant in the Boston Mountains in the northern part of the county, and needle-leaved species are dominant in the Arkansas Valley. Mixed broadleaved and needle-leaved forest types occur in scattered tracts on the uplands.

The value of the wood products is substantial, though it is far below its potential. Other values include grazing, wildlife, recreation, natural beauty, and conservation of soil and water. This section has been provided to explain how soils affect tree growth and management in the county.

Table 9 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols are listed, and the woodland suitability group for each soil is given. All soils in the same woodland suitability group require the same general kinds of woodland 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 insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

The third part of the symbol, a numeral, 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 needle-leaved trees. The numerals 4, 5, and 6 indicate slight, moderate, and severe limitations, respectively, and suitability for broad-leaved trees. The numerals 7, 8, and 9 indicate slight, moderate, and severe limitations, respectively, and suitability for both needle-leaved and broad-leaved trees.

In table 9 the soils are also rated for a number of factors to be considered in management. *Slight*, *moderate*, and *severe* are used to indicate the degree of major soil limitations.

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 some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

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

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

The *potential productivity* of merchantable or *important 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 is calculated at age 30 for eastern cottonwood, age 35 for American sycamore, and age 50 for all other species. The site index applies to fully stocked, even-aged, unmanaged stands. Important 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 suitable for commercial wood production and that are suited to the soils.

Engineering

JAMES E. JANSKI, water management specialist, Soil Conservation Service, helped prepare this section.

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 10 shows, for each kind of soil, the degree and kind of limitations for building site development; table 11, for sanitary facilities; and table 13, for water management. Table 12 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

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

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 10. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

Shallow excavations are made for pipelines, sewerlines, communications and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by soil wetness caused by a seasonal high water table; the texture and consistence of soils; the tendency of soils to cave in or slough; and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is given, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Dwellings and *small commercial buildings* referred to in table 10 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, potential frost action, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 10 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding,

slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 11 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold 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. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 11 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils sur-

rounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 12 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 16 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, low potential frost action, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor.*

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 12 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 16.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 13 the soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Aquifer-fed excavated ponds are bodies of water made by excavating a pit or dugout into a ground-water aquifer. Excluded are ponds that are fed by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Ratings in table 13 are for ponds that are properly designed, located, and constructed. Soil properties and site features that affect aquifer-fed ponds are depth to a permanent water table, permeability of the aquifer, quality of the water, and ease of excavation.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 14 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 14 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 11, and interpretations for dwellings without basements and for local roads and streets, given in table 10.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet 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 camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, 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 will increase the cost of shaping sites or of building access roads and parking areas.

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

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

Wildlife habitat

ROY A. GRIZZELL, biologist, Soil Conservation Service, helped prepare this section.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they af-

fect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 15, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and 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* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, barley, millet, cowpeas, soybeans, and sunflowers.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, bromegrass, clover, bahiagrass, switchgrass, annual lespedeza, bush lespedeza, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, pokeweed, partridgepea, panicgrass, blackberry, and blueberry.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, wild cherry, sweetgum, apple, hawthorn, persimmon, sassafras, sumac, hazelnut, black walnut, grape, blackhaw, viburnum, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are mulberry, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, cypress, and cedar.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are flowering dogwood, buttonbush, beautyberry, sumac, and hawthorn.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, chufa, signalgrass, and rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The kinds of wildlife habitat are briefly described in the following paragraphs.

Openland habitat 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 kinds of wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, dove, killdeer, woodchuck, cottontail rabbit, and red fox.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, wrens, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, rails, kingfishers, muskrat, mink, and beaver.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features.

Engineering properties

Table 16 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 16 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 16 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*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, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The estimated classification, without group index numbers, is given in table 16. Also in table 16 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted.

Physical and chemical properties

Table 17 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 17. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations, basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

Risk of corrosion pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to soil moisture, particle-size distribution, total acidity, and electrical conductivity of the soil material. The rate of corrosion of concrete is based mainly on the sulfate content, texture, and acidity of the soil. Protective measures for steel or more resistant concrete help to avoid or minimize damage resulting from the corrosion. Uncoated steel intersecting soil boundaries or soil horizons is more susceptible to corrosion than an installation that is entirely within one kind of soil or within one soil horizon.

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment. The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Soil and water features

Table 18 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received 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 chiefly of deep, well drained to excessively drained sands or gravels. 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 that have a layer that impedes the downward movement of water or soils that have 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 clay soils 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 is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 18 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Soil series and morphology

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

Characteristics of the soil and the material in which it formed are discussed for each series. The soil is then compared to similar soils and to nearby soils of other series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*6*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or mapping units, of each soil series are described in the section "Soil maps for detailed planning."

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 dominantly less than 3 percent.

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

Typical pedon of Crevasse loamy fine sand in an idle field in the NW1/4NW1/4SW1/4 sec. 32, T. 9 N., R. 31 W.:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) loamy fine sand; single grained; very friable; many fine roots; slightly acid; abrupt smooth boundary.

C1—9 to 21 inches; yellowish brown (10YR 5/4) fine sand; single grained; loose; common thin bedding planes; common fine roots; mildly alkaline; gradual smooth boundary.

C2—21 to 30 inches; yellowish brown (10YR 5/4) loamy fine sand with few dark organic stains; single grained; loose; common thin bedding planes; common fine roots; mildly alkaline; gradual smooth boundary.

C3—30 to 72 inches; light yellowish brown (10YR 6/4) sand; single grained; loose; common thin bedding planes; mildly alkaline.

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

The A horizon ranges from 6 to 12 inches in thickness. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The C horizon is stratified and has hue of 10YR and value of 4 or 5 and chroma of 3 or 4 or value of 6 and chroma of 4. 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 old natural levees along the Arkansas River. The native vegetation was hardwood forest. Slopes are dominantly less than 2 percent.

Dardanelle soils are geographically associated with Roxana, Roellen, and Gallion soils. Roxana soils, on young natural levees, have a coarse-silty control section and do not have an argillic horizon. Roellen soils, in slackwater areas, have a clayey control section and are poorly drained. Gallion soils, in slightly higher positions on the landscape than Dardanelle soils, do not have a mollic epipedon.

Typical pedon of Dardanelle silt loam in a cultivated area in the NE1/4NE1/4NE1/4 sec. 5, T. 8 N., R. 30 W.:

Ap—0 to 10 inches; dark brown (7.5YR 3/2) silt loam; weak fine granular structure; friable; many fine roots; few fine pores; slightly acid; abrupt smooth boundary.

B21t—10 to 30 inches; dark brown (7.5YR 3/2) silt loam; moderate medium subangular blocky structure; friable; many thin patchy clay films on faces of peds; common fine roots; common fine pores; slightly acid; abrupt smooth boundary.

B22t—30 to 55 inches; reddish brown (5YR 4/4) silt loam; moderate medium subangular blocky structure; friable; common thin patchy clay films on faces of peds; common fine pores; slightly acid; clear smooth boundary.

C—55 to 72 inches; reddish brown (5YR 4/4) very fine sandy loam; massive; very friable; slightly acid.

Solum thickness ranges from about 45 to 65 inches. Thickness of the mollic epipedon ranges from 20 to 40 inches. Reaction is medium acid or slightly acid in the A horizon, medium acid to neutral in the B horizon, and slightly acid to mildly alkaline in the C horizon.

The A horizon ranges from 8 to 20 inches in thickness. The Ap horizon has hue of 10YR or 5YR, value of 3, and chroma of 2 or 3; hue of 7.5YR, value of 3, and chroma of 2; or hue of 10YR, value of 2 and chroma of 2.

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

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

Enders series

The Enders series consists of deep, well drained, very slowly permeable, gently sloping to steep soils on crests and sides of hills, mountains, and ridges and on foot slopes. These soils formed in a thin layer of loamy material and in the underlying clayey material that has weathered from acid shale. The native vegetation was hardwood or mixed pine and hardwood forest. Slopes are 3 to 50 percent.

Enders soils are geographically associated with Leadvale, Linker, Mountainburg, and Nella soils. The moderately well drained Leadvale soils, on colluvial foot slopes and old stream terraces in broad valleys, have a fine-silty control section and a fragipan at a depth of about 28 inches. The Linker and Mountainburg soils, on mountaintops, mountainsides, hilltops, hillsides, and benches, are shallower to bedrock than Enders soils. The moderately deep Linker soils have a fine-loamy control section. The shallow Mountainburg soils have a loamy-skeletal control section. Nella soils, on mountainsides, benches, and foot slopes, have a fine-loamy control section.

Typical pedon of Enders stony fine sandy loam, 12 to 45 percent slopes, in a wooded area in the SE1/4SE1/4SW1/4 sec. 16, T. 10 N., R. 29 W.:

A11—0 to 2 inches; dark brown (10YR 4/3) stony fine sandy loam; moderate medium granular structure; friable; about 20 percent of the volume is angular fragments of sandstone as much as 12 inches in diameter; many fine roots; strongly acid; abrupt smooth boundary.

A12—2 to 5 inches; strong brown (7.5YR 5/6) stony fine sandy loam; moderate medium granular structure; friable; about 20 percent of the volume is angular fragments of sandstone as much as 12 inches in diameter; many fine roots; very strongly acid; clear smooth boundary.

B1—5 to 13 inches; strong brown (7.5YR 5/8) stony loam; moderate fine and medium subangular blocky structure; firm; many fine roots; very strongly acid; abrupt smooth boundary.

B21t—13 to 26 inches; yellowish red (5YR 5/6) clay; moderate fine and medium subangular blocky structure; continuous clay films on faces of peds; very firm; common fine roots; very strongly acid; clear smooth boundary.

B22t—26 to 37 inches; variegated red (2.5YR 4/6) and yellowish brown (10YR 5/6) clay; moderate fine and medium subangular blocky structure; very firm; common fine roots; continuous clay films on faces of peds; very strongly acid; abrupt smooth boundary.

B23t—37 to 48 inches; variegated red (2.5YR 4/6), light gray (10YR 7/1), and yellowish brown (10YR 5/6) clay; strong fine and medium subangular blocky structure; very firm; continuous clay films on faces of peds; about 10 percent of the volume is light gray (10YR 7/1) relict fragments of shale; very strongly acid; gradual smooth boundary.

C—48 to 58 inches; light gray (10YR 7/1) clay; common medium prominent red (2.5YR 4/6) and common fine distinct yellowish brown (10YR 5/8) mottles; massive; about 20 percent of the volume is light gray (10YR 7/1) relict fragments of shale; very strongly acid; abrupt wavy boundary.

R—58 to 69 inches; acid shale bedrock.

Solum thickness ranges from 40 to 59 inches. Depth to bedrock ranges from 40 to more than 62 inches. Reaction is strongly acid or very strongly acid throughout the profile.

The A horizon ranges from 4 to 8 inches in thickness. 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. The A horizon has texture of fine sandy loam, gravelly fine sandy loam, or stony fine sandy loam. Gravel content ranges from 0 to 20 percent. Sandstone fragments as much as 12 inches in diameter make up from 0 to 20 percent of the 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. Texture is silty clay or clay. The B22t and B23t horizons are variegated and have hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8; hue of 10YR, value of 6 or 7, and chroma of 1; and hue of 10YR, value of 5, and chroma of 6. Sandstone fragments make up from 0 to 10 percent of the B1 and B2t horizons. Relict shale fragments make up from 10 to 25 percent of the B23t and C horizons.

Gallion series

The Gallion series consists of deep, well drained, moderately permeable soils that formed in loamy alluvium on old natural levees along the Arkansas River. The native vegetation was hardwood forest. Slopes are dominantly less than 2 percent.

Gallion soils are geographically associated with Dardanelle, Roellen, and Roxana soils. Dardanelle soils, in slightly lower positions on the landscape than Gallion soils, have a mollic epipedon. Roellen soils, in slack water areas, have a clayey control section and are poorly drained. Roxana soils, on young natural levees, have a coarse-silty control section and do not have an argillic horizon.

Typical pedon of Gallion silt loam in a cultivated area in the SW1/4SW1/4NE1/4 sec. 5, T. 8 N., R. 31 W.:

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

B2t—10 to 31 inches; reddish brown (5YR 4/3) silty clay loam; moderate medium subangular blocky structure; firm; common medium clay films on faces of peds; common fine roots; few fine pores; mildly alkaline; clear smooth boundary.

B3—31 to 42 inches; reddish brown (5YR 4/4) silt loam; weak medium subangular blocky structure; friable; few fine roots; few fine pores; moderately alkaline; clear smooth boundary.

C—42 to 72 inches; brown (7.5YR 4/4) very fine sandy loam; massive; friable; moderately alkaline.

Solum thickness ranges from about 40 to 60 inches. Reaction is medium acid to neutral in the A horizon, medium acid to moderately alkaline in the B horizon, and slightly acid to moderately alkaline in the C horizon.

The A horizon ranges from 6 to 12 inches in thickness. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3 or hue of 7.5YR, value of 4 or 5, and chroma of 2.

The B2t horizon has hue of 5YR, value of 3 or 4, and chroma of 3 or 4; hue of 5YR, value of 4 or 5, and chroma of 6; or hue of 7.5YR, value of 4 or 5, and chroma of 4. Texture is silt loam or silty clay loam.

The B3 horizon has the same color range as the B2t horizon. Texture is silt loam or very fine sandy loam.

The C horizon has the same color range as the B horizon. Texture is very fine sandy loam or silt loam.

Leadvale series

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

Leadvale soils are geographically associated with Enders, Muskogee, Spadra, and Wrightsville soils. None of the associated soils has the fragipan charateristic of Leadvale soils. Enders soils, in higher posisions on the landscape, have a clayey control section and are well drained. Muskogee soils, on high terraces near the Arkansas River, contain more clay in the lower part of the argillic horizon. Spadra soils, on younger stream terraces nearer the larger streams, have a fine-loamy control section and are well drained. Wrightsville soils, on low terraces, have a fine control section and are poorly drained.

Typical pedon of Leadvale silt loam, 3 to 8 percent slopes, in a field in the SE1/4SE14SW1/4 sec. 30, T. 10 N., R. 29 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 12 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; common fine roots; few fine pores; strongly acid; clear smooth boundary.

B21t—12 to 23 inches; yellowish brown (10YR 5/8) silty clay loam; moderate medium subangular blocky stucture; firm; common patchy clay films on faces of peds; few fine roots; few fine pores; very strongly acid; gradual smooth boundary.

B22t—23 to 28 inches; yellowish brown (10YR 5/8) silty clay loam; common fine distinct light gray and strong brown mottles; moderate medium subangular blocky structure; firm; common patchy clay films on faces of peds; few fine roots; few fine pores; very strongly acid; clear wavy boundary.

Bx—28 to 56 inches; mottled yellowish brown (10YR 5/8) and light gray (10YR 7/1) silty clay loam; weak medium 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; very strongly acid; gradual wavy boundary.

B3—56 to 77 inches; mottled yellowish brown (10YR 5/8) and light gray (10YR 7/1) silty clay loam that has thin layers of relict fragments of shale; weak coarse platy structure parting to weak medium subangular blocky; firm; very strongly acid.

Solum thickness ranges from about 48 inches to more than 80 inches. Reaction is slightly acid to strongly acid in the A horizon and strongly acid or very strongly acid in the B horizon. Depth to the fragipan ranges from 16 to 38 inches. Depth to bedrock ranges from 48 inches to more than 96 inches.

The Ap horizon ranges from 5 to 8 inches in thickness. 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.

The B2t horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 6 or 8. Few to common fine and medium light gray mottles are in the lower part of the horizon in many pedons. Texture 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, and it has common to many medium and coarse light gray and light brownish gray mottles. Some pedons do not have a dominant matrix color and are mottled or variegated with these colors. Texture is silt loam or silty clay loam.

The B3 horizon has the same color range as the Bx horizon. Texture is silty clay loam or silty clay.

Linker series

The Linker series consists of moderately deep, well drained, moderately permeable, nearly level and gently sloping soils on hilltops and mountaintops. These soils formed in acid sandstone bedrock. The native vegetation was mixed pine and hardwood trees. Slopes are 1 to 8 percent.

Linker soils are geographically associated with Enders, Mountainburg, and Nella soils. The deep Enders soils, on crests and sides of hills, mountains, and ridges, have a clayey control section. The shallow Mountainburg soils, in similar positions to those of Linker soils on the landscape, have a loamy-skeletal control section and are 12 to 20 inches deep over sandstone bedrock. The deep Nella soils, on hillsides, mountainsides, foot slopes, and benches, have a solum deeper than 60 inches.

Typical pedon of Linker fine sandy loan, 3 to 8 percent slopes, in a pasture in the SW1/4NW1/4NE1/4 sec. 19, T. 10 N., R. 29 W.:

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

A2—6 to 11 inches; yellowish brown (10YR 5/4) fine sandy loam; weak fine subangular blocky structure; friable; common fine roots; few fine pores; very strongly acid; clear smooth boundary.

B1—11 to 17 inches; strong brown (7.5YR 5/6) loam; weak fine subangular blocky structure; friable; few fine roots; few fine pores; very strongly acid; clear smooth boundary.

B2t—17 to 29 inches; yellowish red (5YR 5/8) clay loam; moderate medium subangular blocky structure; firm; common patchy clay films on faces of peds; few fine pores; very strongly acid; abrupt wavy boundary.

B3—29 to 37 inches; variegated yellowish red (5YR 5/8), red (2.5YR 4/6), and pale brown (10YR 6/3) sandy clay loam; weak fine subangular blocky structure; friable; about 5 percent of the volume is angular fragments of sandstone as much as 12 inches in diameter; few fine pores; gray sand grains on faces of some peds; very strongly acid; abrupt wavy boundary.

R—37 to 40 inches; acid sandstone bedrock.

Solum thickness ranges from 20 to 40 inches over acid sandstone bedrock. Reaction of the A horizon is medium acid or strongly acid, and reaction of the B horizon is strongly acid or very strongly acid.

The Ap horizon ranges from 4 to 7 inches in thickness. It has hue of 10YR or 7.5YR, value of 4, and chroma of 2 to 4. The A2 horizon has hue of 10YR or 7.5YR, value of 5, and chroma of 3 or 4. The content of sandstone fragments 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. Texture is fine sandy loam, sandy clay loam, or loam. The content of sandstone fragments 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. Texture is sandy clay loam, clay loam, or loam. The content of sandstone fragments 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 with shades of brown. Texture is sandy loam or sandy clay loam, and the content of sandstone fragments as much as 12 inches in diameter ranges from 0 to 25 percent.

Mountainburg series

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

Mountainburg soils are geographically associated with Enders, Linker, and Nella soils. The deep Enders soils, in similar positions on the landscape, have a clayey control section. Linker soils, on hilltops and mountaintops, have a fine-loamy control section and are 20 to 40 inches deep over sandstone bedrock. The deep Nella soils, on hillsides, mountainsides, foot slopes, and benches, have a fine-loamy control section.

Typical pedon of Mountainburg stony fine sandy loam, 3 to 12 percent slopes, in a wooded area in the SW1/4SE1/4SW1/4 sec. 16, T. 10 N., R. 29 W.:

A1—0 to 4 inches; dark brown (10YR 3/3) stony fine sandy loam; weak fine granular structure; friable; many fine and medium roots; few fine pores; about 25 percent of the volume is fragments of sandstone 3 to 12 inches in diameter; strongly acid; abrupt wavy boundary.

A2—4 to 9 inches; brown (7.5YR 5/4) stony fine sandy loam; weak fine subangular blocky structure; friable; many fine and medium roots; few fine pores; about 30 percent of the volume is fragments of sandstone 3 to 12 inches in diameter; very strongly acid; clear smooth boundary.

B2t—9 to 17 inches; strong brown (7.5YR 5/6) very stony sandy loam; moderate fine and medium subangular blocky structure; friable; many fine and medium roots; few fine pores; thin patchy clay films on faces of some peds; sand grains coated and bridged; about 40 percent of the volume is fragments of sandstone 3 to 12 inches in diameter; very strongly acid; abrupt wavy boundary.

R—17 to 29 inches; horizontally bedded acid sandstone bedrock.

Solum thickness ranges from 12 to 20 inches over acid sandstone bedrock. Reaction is strongly acid or very strongly acid throughout.

The A horizon ranges from 3 to 10 inches in thickness. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3 or hue of 10YR, value of 5, and chroma of 3. The A2 horizon has hue of 7.5YR, value of 5, and chroma of 4 or 6. Texture is gravelly fine sandy loam or stony fine sandy loam. The content of sandstone fragments as much as 12 inches in diameter ranges from 15 to 35 percent.

The B2t horizon has hue of 7.5YR, value of 5, and chroma of 6 or hue of 5YR, value of 4, and chroma of 8. Content of sandstone gravel and stones is 35 to 65 percent, and the fine earth texture is sandy loam, loam, or sandy clay loam.

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 hardwood and pine forest. Slopes are 3 to 8 percent.

Muskogee soils are geographically associated with Leadvale and Wrightsville soils. Leadvale soils, on slightly higher terraces and on foot slopes, have a fine-silty control section and a fragipan at a depth of about 28 inches. Wrightsville soils, on low terraces, have a fine control section and are poorly drained.

Typical pedon of Muskogee silt loam, 3 to 8 percent slopes, in a field, NW1/4NE1/4NW1/4 sec. 8, T. 9 N., R. 29 W.:

Ap—0 to 5 inches; brown (10YR 4/3) silt loam; weak fine granular structure; very friable; many fine roots; many fine pores; strongly acid; gradual smooth boundary.

B1—5 to 10 inches; yellowish brown (10YR 5/6) silt loam; weak fine subangular blocky structure; friable; many fine roots; many fine pores; very strongly acid; abrupt wavy boundary.

B21t—10 to 29 inches; yellowish brown (10YR 5/6) silty clay loam; few fine distinct grayish brown mottles; moderate medium subangular blocky structure; firm; many fine roots; many fine pores; common thin patchy clay films on faces of peds; very strongly acid; gradual wavy boundary.

B22t—29 to 51 inches; mottled red (2.5YR 4/6), light gray (10YR 7/1), and yellowish brown (10YR 5/6) clay; strong medium blocky structure; very firm, hard, very plastic and sticky; continuous clay films on faces of peds; common fine pores; few fine roots; very strongly acid; gradual smooth boundary.

B23t—51 to 72 inches; mottled light gray (10YR 7/1) and yellowish brown (10YR 5/6) clay; moderate medium blocky structure; very firm, plastic; thin patchy clay films on faces of many peds; strongly acid.

Solum thickness ranges from 60 to 72 inches or more. Reaction is strongly acid or very strongly acid throughout the profile.

The A horizon ranges from 4 to 7 inches in thickness. 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, and chroma of 4 or 6. Texture 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. Few to common fine or medium grayish brown or light gray mottles are in this horizon in many pedons. Texture is silt loam or silty clay loam. The B22t and B23t horizons are mottled with hue of 10YR, value of 6 or 7, and chroma of 1 or 2; hue of 10YR, 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.

Nella series

The Nella series consists of deep, well drained, moderately permeable, gently sloping to very steep soils on hillsides, mountainsides, foot slopes, and benches. These soils formed in loamy colluvium from acid sandstone and shale. The native vegetation was hardwood or mixed pine and hardwood forest. Slopes are 3 to 50 percent.

Nella soils are geographically associated with Enders, Linker, and Mountainburg soils. Enders soils, in similar positions to those of Nella soils on the landscape, have a clayey control section. Linker soils, on hilltops and mountaintops, have a fine-loamy control section and are 20 to 40 inches deep over sandstone bedrock. Mountainburg soils, on tops and sides of hills, mountains, and ridges, have a loamy-skeletal control section and 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, NE1/4NW1/4SE1/4 sec. 6, T. 12 N., R. 31 W.:

O1—1 inch to 0; forest litter.

A1—0 to 5 inches; brown (10YR 4/3) gravelly fine sandy loam; weak medium granular structure; very friable; many fine and medium roots; few fine pores, about 25 percent of the volume is fragments of sandstone 1/4 inch to 3 inches in diameter; strongly acid; clear, smooth boundary.

B21t—5 to 26 inches; yellowish red (5YR 4/8) gravelly sandy clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; common fine roots; few fine pores; about 15 percent of the volume is fragments of sandstone 1/4 inch to 3 inches in diameter; very strongly acid; gradual smooth boundary.

B22t—26 to 50 inches; yellowish red (5YR 4/6) gravelly sandy clay loam; moderate medium subangular blocky structure; friable; common patchy clay films on faces of peds; few fine roots; few fine pores; about 15 percent of the volume is fragments of sandstone 1/4 inch to 3 inches in diameter; very strongly acid; gradual smooth boundary.

B23t—50 to 72 inches; yellowish red (5YR 4/6) gravelly sandy clay loam; common medium distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; many thin clay films on faces of peds and in voids; few fine gray relict fragments of shale; few fine pores; about 20 percent of the volume is fragments of sandstone 1/4 inch to 3 inches in diameter; very strongly acid; abrupt wavy boundary.

R—72 to 75 inches; sandstone bedrock.

Solum thickness ranges from 60 to 80 inches or more. Reaction is strongly acid or very strongly acid throughout the profile. Content of coarse fragments ranges from about 10 to about 35 percent in each horizon.

The A horizon ranges from 4 to 8 inches in thickness. It has hue of 10YR, value of 4 or 5, and chroma of 2 or 3.

The B2t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 or 8. Texture is sandy clay loam, clay loam, gravelly sandy clay loam, or gravelly clay loam. Few to common fine or medium brown mottles are in the lower part of the horizon in many places.

Roellen series

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

Roellen soils are geographically associated with Dardanelle and Gallion soils. Dardanelle and Gallion soils, on natural levees, have a fine-silty control section and are better drained. In addition, Gallion soils do not have a mollic epipedon.

Typical pedon of Roellen silty clay loam in a cultivated field in the NE1/4NW1/4SW1/4 sec. 3, T. 9 N., R. 29 W.:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silty clay loam; moderate medium granular structure; firm, plastic; many fine roots; few fine pores; slightly acid; clear smooth boundary.

A12—9 to 18 inches; very dark gray (10YR 3/1) silty clay; common fine distinct brown mottles; moderate medium blocky structure; firm, very plastic; many slickensides; common fine roots; few fine pores; neutral; gradual smooth boundary.

B21g—18 to 36 inches; dark gray (10YR 4/1) clay; common fine and medium distinct brown (7.5YR 4/4) mottles; moderate medium blocky structure; firm, very plastic; many slickensides that do not intersect; few fine roots; few fine pores; mildly alkaline; gradual smooth boundary.

B22g—36 to 53 inches; dark grayish brown (10YR 4/2) clay; common fine and medium distinct brown (7.5YR 4/4) mottles; moderate medium blocky structure; very plastic, firm; many slickensides that do not intersect; mildly alkaline; gradual smooth boundary.

C—53 to 72 inches; brown (7.5YR 4/4) clay; massive; very firm, very plastic; many slickensides that do not intersect; mildly alkaline.

Solum thickness ranges from about 40 to 65 inches. Reaction ranges from medium acid to neutral in the A horizon and from slightly acid to mildly alkaline in the subsoil and underlying material.

The A horizon ranges from 10 to 20 inches in thickness. It has hue of 10YR, value of 3, and chroma of 1 or 2.

The B2g horizon has hue of 10YR, value of 3 or 4, and chroma of 1 or 2. Few to common fine and medium brown mottles are throughout the B2g horizon. Texture is silty clay or clay.

The C horizon has hue of 7.5YR, value of 3 or 4, and chroma of 2 or 4. Texture is silty clay or clay.

This soil is a taxadjunct to the Roellen series in that the matrix colors of the C horizon have higher chroma than allowed in the official range of the series. This does not alter the use, behavior, and management of these soils.

Roxana series

The Roxana series consists of deep, well drained, moderately permeable soils that formed in stratified, loamy alluvium on level to nearly level, young natural levees along the Arkansas River. The native vegetation was pecan, cottonwood, and willow trees. Slopes are less than 2 percent.

Roxana soils are geographically associated with Crevasse, Dardanelle, and Gallion soils. Crevasse soils, on younger natural levees, are sandier than Roxana soils throughout. Dardanelle and Gallion soils, in slightly lower positions on the landscape than Roxana soils, have a fine-silty control section. In addition, Dardanelle soils have a mollic epipedon.

Typical pedon of Roxana silt loam in a cultivated area in the NE1/4NE1/4SW1/4 sec. 8, T. 8 N., R. 31 W.:

Ap—0 to 9 inches; reddish brown (5YR 4/3) silt loam; weak fine granular structure; very friable; common fine roots; few fine pores; neutral; clear smooth boundary.

C1—9 to 24 inches; brown (7.5YR 5/4) very fine sandy loam; weak medium granular structure; very friable; few fine roots; few fine pores; mildly alkaline; gradual smooth boundary.

C2—24 to 38 inches; brown (7.5YR 4/4) very fine sandy loam; weak medium granular structure; very friable; few distinct bedding planes; mildly alkaline; gradual smooth boundary.

C3—38 to 56 inches; brown (7.5YR 5/4) loamy very fine sand; weak medium granular structure; very friable; few distinct bedding planes; mildly alkaline; gradual smooth boundary.

C4—56 to 72 inches; brown (7.5YR 5/4) loamy fine sand; single grained; very friable; mildly alkaline.

Bedding planes are evident in the 10- to 40-inch control section. Reaction ranges from slightly acid to mildly alkaline in the surface layer and from neutral to moderately alkaline in the underlying layers.

The A horizon ranges from 6 to 10 inches in thickness. It has hue of 5YR, value of 4, and chroma of 3 or 4.

The C horizon is stratified and has hue of 5YR, value of 4 or 5, and chroma of 6 or 8 or hue of 7.5YR, value of 4 or 5, and chroma of 4. Textures are 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 in the uplands. These soils formed in alluvium from uplands of weathered sandstone and shale. The native vegetation was mixed hardwoods and pines. Slopes are 1 to 3 percent.

Spadra soils are geographically associated with Leadvale soils. Leadvale soils, on older terraces, have a fine-silty control section and a fragipan.

Typical pedon of Spadra fine sandy loam, occasionally flooded, in a field in the NW1/4NW1/4NW1/4 sec. 18, T. 9 N., R. 30 W.:

Ap—0 to 8 inches; brown (7.5YR 4/4) fine sandy loam; weak fine granular structure; very friable; common fine roots; few fine pores; slightly acid; abrupt smooth boundary.

B21t—8 to 26 inches; reddish brown (5YR 4/4) sandy clay loam; weak fine subangular blocky structure; friable; common patchy clay films on faces of peds; few fine roots; common fine pores; strongly acid; gradual smooth boundary.

B22t—26 to 54 inches; brown (7.5YR 4/4) sandy clay loam; weak fine subangular blocky structure; friable; common patchy clay films on faces of peds; common fine pores; strongly acid; gradual smooth boundary.

C—54 to 72 inches; brown (7.5YR 4/4) fine sandy loam; massive; very friable; very strongly acid.

Solum thickness ranges from 40 to 60 inches. Reaction ranges from slightly acid to strongly acid in the A horizon and is strongly acid or very strongly acid in the B and C horizons.

The A horizon ranges from 6 to 10 inches in thickness. It has hue of 10YR, value of 4, and chroma of 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 3 or 4, and chroma of 4 or hue of 7.5YR, value of 4, and chroma of 4. Texture is loam or sandy clay loam.

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

Wrightsville series

The Wrightsville series consists of deep, poorly drained, very slowly permeable soils on old stream terraces in broad valleys. These soils formed in loamy and clayey alluvium deposited by the Arkansas River. The native vegetation was hardwoods and tall grasses. Slopes are less than 2 percent.

Wrightsville soils are geographically associated with Leadvale and Muskogee soils. Leadvale and Muskogee soils, on higher landscapes, are better drained and have a fine-silty control section. Leadvale soils also have a fragipan at a depth of about 28 inches.

Typical pedon of Wrightsville silt loam, in an idle field in the NW1/4NW1/4NW1/4 sec. 13, T. 9 N., R. 31 W.:

A1—0 to 3 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; common fine roots; strongly acid; abrupt wavy boundary.

A2g—3 to 18 inches; gray (10YR 6/1) silt loam; common fine distinct yellowish brown (10YR 5/6) mottles; common medium faint light gray (10YR 7/1) silt coatings on ped faces; weak fine subangular blocky structure; friable; common fine roots; common fine pores; very strongly acid; abrupt irregular boundary.

B&Ag—18 to 33 inches; gray (10YR 6/1) silty clay; 20 percent of horizon is tongues, 1 to 4 inches wide, of light gray (10YR 7/1) silt loam tapering with depth and extending through the horizon; common medium distinct strong brown (7.5YR 5/8) mottles; silty clay part has moderate medium subangular blocky structure, is firm; silt loam part is massive, friable; common medium dark gray (10YR 4/1) clay films on faces of peds and in pores; few thin distinct yellowish red

(5YR 4/6) oxide stains on faces of some peds and in cracks; few fine roots; very strongly acid; gradual wavy boundary.

B2tg—33 to 53 inches; gray (10YR 6/1) silty clay; common medium yellowish brown (10YR 5/8) and strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; firm; continuous dark gray (10YR 4/1) clay films on faces of peds; about 5 percent of the volume is light gray (10YR 7/1) silt tongues tapering with depth; very strongly acid; gradual wavy boundary.

B3g—53 to 70 inches; gray (10YR 6/1) silty clay loam; many coarse distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; firm; very strongly acid.

Solum thickness ranges from about 50 to 70 inches. Reaction is strongly acid or very strongly acid throughout the profile.

The A horizon ranges from 10 to 20 inches in thickness. The A1 horizon has hue of 10YR, value of 3 to 5, and chroma of 2. The A2 horizon has hue of 10YR, value of 5 to 7, and chroma of 1. There are few to common fine and medium brown mottles.

The B horizon has hue of 10YR, value of 6 or 7, and chroma of 1 or 2. There are few to common fine and medium brown mottles. Texture is silty clay loam, silty clay, or clay. Tongues of silt loam, 1 to 6 inches wide, extend into or through the B2t horizon.

The C horizon has hue of 10YR, value of 5 to 7, and chroma of 1 or 2. There are few to common fine and medium brown mottles. Texture is silty clay loam, silty clay, or clay.

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*8*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is 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 expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Haplaquolls (*Hapl*, meaning simple horizons, plus *aquoll*, the suborder of Mollisols that have an aquic moisture regime).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceeding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Haplaquolls.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is fine-loamy, mixed, thermic Typic Haplaquolls.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Formation of the soils

In this section the factors that affect soil formation in Crawford County and the processes of horizon differentiation are discussed. The soil series in the county, including a profile representative of each series, are described in the section "Soil series and morphology."

Factors of soil formation

Soil is formed by weathering and other processes that act upon the soil. The characteristics of the soil at any given point depend upon climate, living organisms, parent material, relief, and time. Each factor acts on the soil and modifies the effect of the other four. When climate, living organisms, or any other one of the five factors is varied to a significant extent, a different soil may be formed (*5*).

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. Because climate, vegetation, parent material, and relief interact over a period of time, time is the fifth factor of soil formation. Thus, the effect of time is also reflected in the characteristics of the soil.

The interaction of the five factors of soil formation is more complex for some soils than for others. The five factors and how they interacted to form some of the soils in the county are discussed in the following paragraphs.

Climate

The climate of Crawford County is characterized by warm summers, mild winters, and fairly abundant rainfall. The present climate is probably similar to the climate under which the soils in the county formed. The average daily temperature is about 82 degrees in July and about 39 degrees in January. The total annual rainfall is about 41 inches and is well distributed throughout the year. Additional information about the climate is given in 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 shallow depths and for relatively short periods, soil formation continues almost the year round. The climate throughout the county is relatively uniform, but its effect is modified locally by runoff and slope aspect. 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. Among the changes they cause are gains in content of organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity.

Before Crawford County was settled, the native vegetation had more influence on soil formation than did animal activity. Hardwood forests covered the bottom lands. Crevasse, Dardanelle, Gallion, Roellen, and Roxana soils formed in these areas. They differ from each other chiefly because of the effects of parent material and age.

The upland part of the county had about three different types of native vegetation. The level and nearly level areas in the broad valleys in the southern and eastern parts of the county supported a luxuriant growth of tall bunchgrasses and scattered hardwood trees. The soils, mainly the Leadvale, Muskogee, and Wrightsville soils, do not have the thick, dark-colored surface layer commonly associated with soils that formed under this type of vegetation. Apparently, their characteristics were influenced more by parent material, climate, and relief than by vegetation. The deeper soils in the more sloping and hilly parts of these valleys supported mixed pines and hardwoods, and Leadvale and Spadra soils formed. These soils differ chiefly in age, relief, and degree of weathering. On the shallower parts, chiefly on low hills, were savannas of scattered, stunted hardwoods, cedars, and pines, with an understory of tall grasses. Linker and Mountainburg soils formed here. They differ chiefly in age and degree of weathering.

The native vegetation in most of the mountainous area in the central and northern parts of the county consisted of forests of upland oaks, hickory, redcedar, and shortleaf pine. Only the upper few inches of the soils in these areas have a significant accumulation of organic matter, and this layer is dark colored. Enders and Nella soils formed on these uplands. They differ chiefly in age and degree of weathering, in relief, and in the kind of parent material.

The differences in native vegetation on the uplands seem to be related mainly to variations in the available water capacity of the soils; on the lowlands, the differences seem to be related mainly to variations in drainage. For example, Roellen soils formed in swampy places and have a thick, dark surface layer caused by an accumulation of organic debris in the swamps. Adjacent well drained soils do not have a dark surface layer. Only the major differences in the original vegetation are reflected to any extent by the characteristics of the soils.

Man is important to the future rate and direction of soil formation. He clears the forest, cultivates the soils, and introduces new kinds of plants. He adds fertilizer, lime, and chemicals for insect, disease, and weed control. In building levees and dams for flood control, improving drainage, and grading the soil surface, he also affects the future of development of soils. Some results of these changes will not be evident for many centuries; nevertheless, the complex of living organisms affecting soil formation in this county has been drastically changed by man. Thus man has become the most important organism affecting soil formation.

Parent material

The acid sandstones and shales which cover most of Crawford County were deposited in marine waters during the Pennsylvanian Period (*3*, *4*). These sedimentary rocks are of various textures. They range from rather coarse grained sandstones to shaly sandstones and from sandy shales to clayey shales. There are four different formations in the county.

The Atoka Formation is the oldest and also the most extensive and thickest. It is composed of interbedded shales and thin-bedded sandstones, with shale predominating. It weathers into materials in which formed such residual soils as Enders soils. Where the sandstone caps the ridges, Mountainburg and Linker soils formed.

The Hartshorne Formation rests on the Atoka Formation in the areas of its occurrence. It is composed of sandstone and sandy shales. It weathers into material in which Mountainburg and Linker soils formed. The sandstone is

generally brown or yellowish brown, and in some places it is almost white. It is mostly medium grained and well cemented, but locally it is sacchariodal and poorly cemented.

The Spadra Shale rests on the Hartshorne Formation. It consists of fine grained, blue-black or gray clay shale, but contains some sandstone lenses. It crops out on the sides of some of the hills and on some of the valley floors. Where the Spadra Shale crops out on hillsides, Enders soils formed in its weathered material.

The Fort Smith Formation overlies the Spadra Shale and consists principally of sandstone and sandy shale. Most of the beds are ripple marked. The weathered material is usually sandy and is yellowish to reddish in color. Mountainburg and Linker soils are the principal residual soils formed in material from the Fort Smith Formation.

Soils on the flood plains of upland drainageways are mainly of the Spadra series. These soils formed in loamy sediments washed from local uplands.

Soils that formed on the valley terraces include Leadvale and Wrightsville soils. These soils have well developed horizons that formed in loamy local sediments. The soils on benches along the mountainsides formed in friable, loamy and silty material that washed or rolled down from above. These are soils of the Nella series. They are deep, medium textured, acid, and well drained. 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 Arkanasas River formed in poorly graded, well sorted alluvial sediments deposited by floodwaters. Crevasse soils formed in sandy sediments deposited along or near the river as natural levees (*10*). Muskogee and Roellen soils formed in predominantly clayey sediments deposited by slack water on flats and flood bays at places farther from the river. Dardanelle, Gallion, and Roxana soils formed in the loamy sediment deposited between areas of sandy sediment and clayey sediment.

Relief

Relief, or differences in elevation, in Crawford County has been brought about chiefly by faulting and folding and the subsequent entrenchment of drainage channels into the land surface. The highest elevation in the county, 2,381 feet above sea level, is in the northeast part of the county within the boundary of the Ozark National Forest. The lowest elevation, about 370 feet above sea level, is in the southeast part of the county at Ozark Lake.

Some of the greatest differences in the soil of Crawford County are caused by differences in relief through its effect on drainage, runoff, erosion, and percolation of water through the soil. Relief ranges from nearly vertical on bluffs to level in broad, flat areas.

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 Mountainburg soils. In contrast, broad areas of the nearly level or gently sloping soils have lost little soil material, and the soils are moderately deep or deep. Examples are Linker and Leadvale soils.

In coves and on foot slopes are deep accumulations of material that washed or slid down from adjoining steep slopes. Nella soils are in such spots. In places where rocks have broken off and rolled downslope, these soils are stony.

Wrightsville soils are in level to depressional areas in the broad valleys. Surface drainage is slow or ponded, the soils are poorly drained, and permeability is slow. The soils are gray or have gray mottles because of the reduction of iron and a seasonal high or perched water table.

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, loaded with soil particles, moved at different speeds, depending partly on the topography. Rapidly moving water deposited the sandy sediment in which the Crevasse soils formed. The less rapidly moving water deposited the mixed sediment that was high in silt content and in which Dardanelle, Gallion, and Roxana soils formed. The slack or still water trapped in flood bays and on broad flats deposited the clayey sediment in which Roellen soils formed.

Time

The length of time required for soil formation depends largely on other factors of soil formation. Less time generally is required if the climate is warm and humid and the vegetation luxuriant. If other factors are equal, less time is also required if the parent material is loamy than if it is clayey.

In terms of geological time, most of the soils of Crawford County are old regardless of whether they are on mountaintops, mountainsides, or stream terraces. The young soils formed in alluvium along streams.

Some of the soils on the uplands are examples of old soils. They formed in material weathered from rocks and shale of Pennsylvanian age. Most are old enough that nearly all of the cations have been leached out, reaction is 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. Enders and Linker soils clearly show the impact of time, acting with the other soil-forming factors, on parent material.

Crevasse and Roxana soils are examples of very young soils. They formed in recent alluvium on the flood plain of the Arkansas River. No definite horizons have formed below the A horizon. Instead, these soils still have the original depositional structure, or bedding planes, and little or no soil structure. Base saturation is high, and reaction is slightly acid to moderately alkaline, which indicates

that leaching has been slight. Except for the slight mechanical changes caused by worms and roots, there is little evidence of soil forming activity.

Processes of soil formation

The marks that the soil-forming factors leave on the soil 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, consistence, and porosity.

Most soil profiles contain three major horizons called A, B, and C. Very young soils do not have a B horizon.

The A horizon is the horizon of maximum accumulation of organic matter, called the A1 horizon or the surface layer, or it is 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 (*9*). It is a 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.

Beneath the B horizon is the C horizon. It has been little affected by the soil-forming processes, but the C horizon can be materially 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 Crawford County. Among these processes are the accumulation of organic matter, the leaching of bases, the oxidation or reduction and transfer or iron, and the formation and translocation of silicate clay minerals. In most of the soils of the county, more than one of these processes has been active in soil formation.

Physical weathering of rocks, through heating and cooling and wetting and drying, slowly breaks them into small pieces. These pieces form the parent material for the residual soils in the county. This is most evident in Linker and Mountainburg soils.

Accumulation of organic matter in the upper part of the profile to form an A1 horizon has been an important process of soil formation.

Leaching of bases has occurred to some degree in nearly all of the soils of Crawford County. Bases are leached downward in soils before silicate clay minerals begin to move. Most of the soils in the county are moderately leached, and this is an important factor in horizon development. Some soils, 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. Oxidation of iron is indicated by the red and brown colors in the B horizon of such soils as Linker, Mountainburg, and Enders soils on uplands and of such soils as Leadvale soils on lowlands.

Reduction and transfer of iron has occurred to a significant degree in the poorly drained and somewhat poorly drained soils of the lowlands. In the naturally wet soils, this process is called gleying. Gray colors in the horizons below the surface 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 Wrightsville and Roellen 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 an A2 horizon occurs, the structure is blocky, clay content is less than in the lower horizons where the clay has accumulated, and the horizon is lighter in color. Clay films generally have accumulated in pores and on the surfaces of peds in the B horizon. The soils were probably leached of carbonates and soluble salts to a great extent before translocation of silicate clay occurred even though the content of bases is still high in some of the soils on lowlands.

Leaching of bases and translocation of silicate clay are among the most important processes in horizon differentiation in the soils of Crawford County.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Area reclaim. An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping 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	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

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.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

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.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Coarse textured (light textured) soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.5 to 25 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

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. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

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

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

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

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

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by running 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 a bare surface.

Excess alkali. Excess exchangeable sodium. The resulting poor physical properties restrict the growth of plants.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Excess salts. Excess water soluble salts. Excessive salts restrict the growth of most plants.

Fast intake. The rapid movement of water into the soil.

Favorable. Favorable soil features for the specified use.

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

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured (heavy textured) soil. Sandy clay, silty clay, and clay.

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

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as *none, rare, occasional,* and *frequent. None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *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. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered 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.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Fragipan. A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

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 from 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Green manure (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

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.

Gypsum. Hydrous calcium sulphate.

Habitat. The natural abode of a plant or animal; refers to the kind of environment in which a plant or animal normally lives, as opposed to the range or geographical distribution.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

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.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Landslide. The rapid downhill movement of a mass of soil and loose rock generally when wet or saturated. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

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. Inadequate strength for supporting loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Metamorphic rock. Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement. Nearly all such rocks are crystalline.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is greater than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Moderately coarse textured (moderately light textured) soil. Sandy loam and fine sandy loam.

Moderately fine textured (moderately heavy 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.

Nutrient, plant. Any element taken in by a plant, essential to its growth, and used by it in the production of food and tissue. Plant nutrients are nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil; and carbon, hydrogen, and oxygen obtained largely from the air and water.

Pan. A compact, dense layer in a soil. A pan impedes the movement of water and the growth of roots. The word "pan" is commonly combined with other words that more explicitly indicate the nature of the layer; for example, *hardpan*, *fragipan*, *claypan*, *plowpan*, and *traffic pan*.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

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. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characteristic that affects management. These differences are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Formation by moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents that commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on exposure to repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade, whereas ironstone cannot be cut but can be broken or shattered with a spade. Plinthite is one form of the material that has been called laterite.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Polypedon. A volume of soil having properties within the limits of a soil series, the lowest and most homogeneous category of soil taxonomy. A "soil individual."

Poorly graded. Refers to soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Poor outlets. Surface or subsurface drainage outlets difficult or expensive to install.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under a specified system of management. Productivity is measured in terms of output, or harvest, in relation to input.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range (or rangeland). Land that, for the most part, produces native plants suitable for grazing by livestock; includes land supporting some forest trees.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are *excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or assumed, climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
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. Soil scientists regard as soil only the part of the regolith that is modified by organisms and other soil-building forces. Most engineers describe the whole regolith, even to a great depth, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered, or partly weathered mineral material that accumulates over disintegrating rock.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline-alkali soil. A soil that contains a harmful concentration of salts and exchangeable sodium; contains harmful salts and is strongly alkaline; or contains harmful salts and exchangeable sodium and is very strongly alkaline. The salts, exchangeable sodium, and alkaline reaction are in the soil in such location that growth of most crop plants is less than normal.

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

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.

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. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil 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.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Stripcropping. Growing crops in a systematic arrangement of strips or bands which provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil, or partly worked into the soil, to provide protection from soil blowing and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

Substratum. The part of the soil below the solum.

Subsurface layer. 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.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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 or management.

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. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but the limited geographic soil area does not justify creation of a new series.

Variegation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

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 a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction.

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.

Illustrations

Figure 1.—Kale on Spadra fine sandy loam, occasionally flooded.

Figure 2.—Tall fescue pasture on Leadvale silt loam, 1 to 3 percent slopes.

Figure 3.—Bermudagrass pasture and a pond on Leadvale silt loam, 3 to 8 percent slopes. Because this soil has a slowly permeable subsoil, there is very little seepage loss from the pond in the background.

Figure 4.—Bermudagrass pasture and a homestead on Linker fine sandy loam, 3 to 8 percent slopes.

Figure 5.—Soybeans on Spadra fine sandy loam, occasionally flooded.

Tables

TABLE 1.--ACREAGE OF PRINCIPAL CROPS IN STATED YEARS

Crops	1964	1959
	Acres	Acres
Cropland pastured	21,767	37,593
Woodland, including wooded pasture	54,220	27,776
Hay crops	11,163	10,586
Soybeans (for beans)	15,086	19,389
Cotton	246	82
Field corn (for all purposes)	627	36
Wheat	4,627	1,764
Truck crops (including potatoes)	5,641	6,611
Orchards and vineyards	248	132

TABLE 2.--NUMBERS OF LIVESTOCK IN STATED YEARS

Livestock	1964	1969
All cattle and calves on farms and sold	36,716	36,119
Milk cows	1,229	642
Hogs and pigs on farms and sold	7,659	6,800
Chickens more than 3 months old on farms and sold	105,742	482,794
Broilers sold	5,554,250	7,473,846

TABLE 3.--TEMPERATURE AND PRECIPITATION DATA

[Recorded in the period 1951-74 at Fort Smith, Ark.]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	49.7	27.5	38.6	77	5	8	1.90	.89	2.71	4	2.0
February	54.6	31.4	43.0	78	10	24	2.59	1.18	3.74	5	1.5
March	62.5	38.6	50.6	88	18	151	3.59	1.61	5.19	6	.7
April	73.7	49.3	61.5	90	28	350	4.59	2.28	6.47	7	0
May	81.5	58.3	70.0	94	39	620	4.67	2.25	6.63	6	0
June	88.9	66.4	77.7	99	51	831	3.52	1.30	5.30	5	0
July	93.6	70.5	82.1	105	56	995	3.39	1.14	5.12	5	0
August	93.0	68.8	80.9	105	55	958	3.11	1.52	4.39	5	0
September	85.9	61.9	73.9	100	42	717	3.42	1.30	5.12	5	0
October	76.0	49.7	62.9	93	30	405	3.48	.78	5.62	4	0
November	62.1	37.9	50.0	83	18	94	3.62	1.31	5.46	5	.6
December	52.1	30.6	41.4	77	9	17	2.98	1.30	4.34	5	.8
Year	72.8	49.2	61.1	106	2	5,170	40.82	33.02	48.20	62	5.6

[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 1951-74 at Fort Smith, 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 27	April 6	April 14
2 years in 10 later than--	March 19	April 1	April 10
5 years in 10 later than--	March 3	March 22	April 3
First freezing temperature in fall:			
1 year in 10 earlier than--	October 30	October 27	October 20
2 years in 10 earlier than--	November 6	November 1	October 24
5 years in 10 earlier than--	November 20	November 10	November 1

TABLE 5.--GROWING SEASON LENGTH

[Recorded in the period 1951-74 at Fort Smith, Ark.]

Probability	Daily minimum temperature during growing season		
	Higher than 24°F	Higher than 28°F	Higher than 32°F
	Days	Days	Days
9 years in 10	227	212	195
8 years in 10	239	219	200
5 years in 10	261	232	211
2 years in 10	282	245	222
1 year in 10	294	252	228

TABLE 6.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Crevasse loamy fine sand	1,335	0.3
2	Crevasse soils, frequently flooded	2,632	0.7
3	Dardanelle silt loam	5,082	1.3
4	Dardanelle silt loam, overwash	4,047	1.1
5	Enders fine sandy loam, 3 to 8 percent slopes	2,975	0.8
6	Enders gravelly fine sandy loam, 8 to 20 percent slopes	31,583	8.3
7	Enders stony fine sandy loam, 12 to 45 percent slopes	42,569	11.2
8	Enders-Mountainburg association, rolling	7,972	2.1
9	Enders-Mountainburg association, steep	5,645	1.5
10	Gallion silt loam	2,851	0.7
11	Gallion silt loam, occasionally flooded	1,678	0.4
12	Leadvale silt loam, 1 to 3 percent slopes	12,397	3.2
13	Leadvale silt loam, 3 to 8 percent slopes	24,030	6.3
14	Linker fine sandy loam, 3 to 8 percent slopes	21,399	5.6
15	Linker-Mountainburg association, undulating	4,921	1.3
16	Mountainburg gravelly fine sandy loam, 3 to 8 percent slopes	20,064	5.3
17	Mountainburg gravelly fine sandy loam, 8 to 12 percent slopes	343	0.1
18	Mountainburg stony fine sandy loam, 3 to 12 percent slopes	9,879	2.6
19	Muskogee silt loam, 3 to 8 percent slopes	2,785	0.7
20	Nella gravelly fine sandy loam, 3 to 8 percent slopes	992	0.3
21	Nella-Enders association, rolling	725	0.2
22	Nella-Enders association, steep	114,442	30.0
23	Nella-Enders association, very steep	10,032	2.6
24	Nella-Mountainburg association, rolling	801	0.2
25	Nella-Mountainburg association, steep	1,373	0.4
26	Roellen silty clay loam	6,407	1.7
27	Roxana silt loam	6,784	1.8
28	Roxana silt loam, occasionally flooded	2,016	0.5
29	Spadra fine sandy loam, occasionally flooded	22,124	5.8
30	Wrightsville silt loam	9,116	2.4
	Total	381,440	100.0

TABLE 7.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Cotton lint	Soybeans	Corn	Wheat	Common bermudagrass	Improved bermudagrass	Tall fescue
	Lb	Bu	Bu	Bu	AUM[1]	AUM[1]	AUM[1]
Crevasse:							
2-----	---	---	---	---	---	6.0	---
3-----	---	---	---	---	---	---	---
Dardanelle:							
3, 4-----	850	40	90	40	8.0	13.0	8.5
Enders:							
5-----	---	---	---	25	5.0	---	5.0
6-----	---	---	---	---	5.0	---	5.0
7-----	---	---	---	---	3.0	---	---
38:							
Enders part-----	---	---	---	---	5.0	---	5.0
Mountainburg part-----	---	---	---	---	3.0	---	3.0
39:							
Enders part-----	---	---	---	---	3.0	---	---
Mountainburg part-----	---	---	---	---	3.0	---	3.0
Gallion:							
10-----	875	40	90	40	8.0	13.0	8.5
11-----	825	40	85	40	8.0	13.0	8.5
Leadvale:							
12-----	---	32	65	46	7.0	9.0	7.0
13-----	---	30	62	44	7.0	8.0	7.0
Linker:							
14-----	---	25	60	30	7.0	9.0	7.0
315:							
Linker part-----	---	---	---	---	6.0	---	6.0
Mountainburg part-----	---	---	---	---	4.0	---	3.0
Mountainburg:							
16-----	---	---	---	20	4.0	5.0	4.0
17-----	---	---	---	---	4.0	---	3.0
18-----	---	---	---	---	4.0	---	3.0
Muskogee:							
19-----	---	25	55	30	7.0	10.0	6.0
Nella:							
20-----	---	---	60	30	7.0	10.0	6.5
321:							
Nella part-----	---	---	---	---	5.0	---	5.0
Enders part-----	---	---	---	---	5.0	---	5.0
322:							
Nella part-----	---	---	---	---	---	---	---
Enders part-----	---	---	---	---	5.0	---	5.0

See footnotes at end of table.

TABLE 7.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Cotton lint	Soybeans	Corn	Wheat	Common bermuda-grass	Improved bermuda-grass	Tall fescue
	Lb	Bu	Bu	Bu	AUM[1]	AUM[1]	AUM[1]
Nella:							
323:							
Nella part	---	---	---	---	---	---	---
Enders part	---	---	---	---	---	---	---
324:							
Nella part	---	---	---	---	5.0	---	5.0
Mountainburg part	---	---	---	---	4.0	---	3.0
325:							
Nella part	---	---	---	---	---	---	---
Mountainburg part	---	---	---	---	---	---	---
Roellen:							
26	500	35	62	32	6.0	---	6.0
Roxana:							
27	850	35	80	40	8.0	15.0	9.0
28	800	35	80	40	8.0	15.0	9.0
Spadra:							
29	---	30	70	30	7.0	10.0	9.0
Wrightsville:							
30	---	25	---	25	6.0	---	6.0

[1]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 a period of 30 days.

[2]Yields are for areas protected from flooding.

[3]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site	Total Production		Characteristic species
		Kind of year	Dry weight	
			Lb/acre	
Enders:				
6, 7	Clay Break Shale	Favorable	5,000	Little bluestem, indiangrass, Canada wildrye, big bluestem, Virginia tephrosia, native lespedeza, catclaw sensitivebriar, broomsedge, ragweed.
		Normal	3,750	
		Unfavorable	2,500	
18, 19:				
Enders part	Clay Break Shale	Favorable	5,000	Little bluestem, indiangrass, Canada wildrye, big bluestem, Virginia tephrosia, native lespedeza, catclaw sensitivebriar, broomsedge, ragweed.
		Normal	3,750	
		Unfavorable	2,500	
Mountainburg part	Sandstone Ridge	Favorable	4,800	Little bluestem, indiangrass, big bluestem, Canada wildrye, switchgrass, sunflower, native lespedeza, Virginia tephrosia, tickclovers, New Jersey tea, skunkbush sumac, hidden dropseed, Carolina jointtail, ragweed.
		Normal	3,400	
		Unfavorable	2,000	
Linker:				
14	Loamy Upland	Favorable	5,000	Little bluestem, big bluestem, indiangrass, beaked panicum, native lespedeza, perennial sunflower, broomsedge, ragweed.
		Normal	4,000	
		Unfavorable	3,000	
15:				
Linker part	Loamy Upland	Favorable	5,000	Little bluestem, big bluestem, indiangrass, beaked panicum, native lespedeza, perennial sunflower, broomsedge, ragweed.
		Normal	4,000	
		Unfavorable	3,000	
Mountainburg part	Sandstone Ridge	Favorable	4,800	Little bluestem, indiangrass, big bluestem, Canada wildrye, switchgrass, sunflower, native lespedeza, Virginia tephrosia, tickclovers, New Jersey tea, skunkbush sumac, hidden dropseed, Carolina jointtail, ragweed.
		Normal	3,400	
		Unfavorable	2,000	

See footnote at end of table.

TABLE 8.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total Production		Characteristic species
		Kind of year	Dry weight	
			Lb/acre	
Mountainburg:				
16, 17, 18	Sandstone Ridge	Favorable	4,800	Little bluestem, indiangrass, big bluestem, Canada wildrye, switchgrass, sunflower, native lespedeza, Virginia tephrosia, tickclovers, New Jersey tea, skunkbush sumac, hidden dropseed, Carolina jointtail, ragweed.
		Normal	3,400	
		Unfavorable	2,000	
Nella:				
[1]21, [1]22, [1]23:				
Nella part	---	---	---	---
Enders part	Clay Break Shale	Favorable	5,000	Little bluestem, indiangrass, Canada wildrye, big bluestem, Virginia tephrosia, native lespedeza, catclaw sensitivebriar, broomsedge, ragweed.
		Normal	3,750	
		Unfavorable	2,500	
[1]24, [1]25:				
Nella part	---	---	---	---
Mountainburg part	Sandstone Ridge	Favorable	4,800	Little bluestem, indiangrass, big bluestem, Canada wildrye, switchgrass, sunflower, native lespedeza, Virginia tephrosia, tickclovers, New Jersey tea, skunkbush sumac, hidden dropseed, Carolina jointtail, ragweed.
		Normal	3,400	
		Unfavorable	2,000	

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available]

Soil name and map symbol	Woodland suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Important trees	Site index	
Crevasse:							
1, 2	2s6	Slight	Moderate	Severe	Sugarberry	---	American sycamore, eastern cottonwood.
					Sweetgum	90	
					White oak	90	
					Eastern cottonwood	100	
Dardanelle:							
3, 4	1o4	Slight	Slight	Slight	Green ash	75	Eastern cottonwood, sweetgum, American sycamore, black walnut.
					Eastern cottonwood	105	
					Cherrybark oak	100	
					Sweetgum	100	
					American sycamore	---	
Enders:							
5, 6	4o1	Slight	Slight	Slight	Southern red oak	60	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak	55	
					Shortleaf pine	60	
					Northern red oak	60	
					Black oak	60	
7	4x2	Slight	Moderate	Slight	Southern red oak	60	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak	55	
					Eastern redcedar	40	
					Shortleaf pine	60	
8:							
Enders part	4o1	Slight	Slight	Slight	Southern red oak	60	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak	55	
					Shortleaf pine	60	
					Northern red oak	60	
					Black oak	60	
Mountainburg part	5x3	Severe	Severe	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
9:							
Enders part	4x2	Slight	Moderate	Slight	Southern red oak	60	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak	55	
					Eastern redcedar	40	
					Shortleaf pine	60	
Mountainburg part	5x3	Severe	Severe	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
Gallion:							
10, 11	2o4	Slight	Slight	Slight	Green ash	80	Eastern cottonwood, American sycamore, cherrybark oak, sweetgum.
					Cherrybark oak	95	
					Sweetgum	90	
					Water oak	95	
					Pecan	---	
					American sycamore	---	
					Eastern cottonwood	100	
Leadvale:							
12, 13	3o7	Slight	Slight	Slight	White oak	70	Loblolly pine, shortleaf pine.
					Shortleaf pine	70	
Linker:							
14	4o1	Slight	Slight	Slight	Shortleaf pine	60	Loblolly pine, shortleaf pine.
					Northern red oak	55	
					Black oak	55	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Woodland suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Important trees	Site index	
Linker:							
15:							
Linker part	4o1	Slight	Slight	Slight	Shortleaf pine	60	Loblolly pine, shortleaf pine.
					Northern red oak	55	
					Black oak	55	
Mountainburg part	5x3	Slight	Severe	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
Mountainburg:							
16, 17	5d2	Slight	Slight	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
18	5x3	Slight	Severe	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
Muskogee:							
19	3o7	Slight	Slight	Slight	Shortleaf pine	70	Loblolly pine, shortleaf pine, eastern redcedar, Shumard oak, sweetgum.
					Sweetgum	80	
					Loblolly pine	---	
					Water oak	---	
					Southern red oak	---	
Nella:							
20	4o7	Slight	Slight	Slight	Northern red oak	70	Shortleaf pine, loblolly pine, black walnut.[2]
					Shortleaf pine	76	
					Black oak	70	
					Southern red oak	60	
					Eastern redcedar	61	
					Black walnut	---	
21:							
Nella part	4o7	Slight	Moderate	Slight	Black oak	70	Shortleaf pine, loblolly pine, black walnut.[2]
					Shortleaf pine	71	
					Southern red oak	60	
					Eastern redcedar	61	
					Northern red oak	70	
					Black walnut	---	
Enders part	4o1	Slight	Slight	Slight	Southern red oak	60	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak	55	
					Northern red oak	60	
					Shortleaf pine	60	
					Black oak	60	
22:							
Nella part	4r6	Moderate	Moderate	Slight	Southern red oak	60	Shortleaf pine, loblolly pine, black walnut.[2]
					Shortleaf pine	60	
					Northern red oak	70	
					Eastern redcedar	61	
					Black oak	70	
					Black walnut	---	
Enders part	4r3	Slight	Severe	Moderate	Southern red oak	60	Loblolly pine, shortleaf pine.
					White oak	55	
					Shortleaf pine	60	
					Northern red oak	60	
					Black oak	60	

See footnotes at end of table.

TABLE 9.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Woodland suitability group	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Important trees	Site index	
Nella:							
[1]23:							
Nella part	4r9	Severe	Severe	Slight	Southern red oak	60	Shortleaf pine, loblolly pine, black walnut.[2]
					Shortleaf pine	60	
					Northern red oak	70	
					Eastern redcedar	61	
					Black oak	70	
					Black walnut	---	
Enders part	5r3	Severe	Severe	Moderate	Southern red oak	50	Loblolly pine, shortleaf pine, eastern redcedar.
					White oak	50	
					Eastern redcedar	35	
					Shortleaf pine	50	
					Northern red oak	50	
					Black oak	50	
[1]24:							
Nella part	3o7	Slight	Moderate	Slight	Southern red oak	60	Shortleaf pine, loblolly pine, black walnut.[2]
					Shortleaf pine	71	
					Northern red oak	70	
					Eastern redcedar	61	
					Black oak	70	
					Black walnut	---	
Mountainburg part	5x3	Slight	Severe	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
					Loblolly pine	---	
[1]25:							
Nella part	4r8	Severe	Severe	Slight	Southern red oak	60	Shortleaf pine, loblolly pine, black walnut.[2]
					Shortleaf pine	71	
					Northern red oak	70	
					Eastern redcedar	61	
					Black oak	---	
					Black walnut	---	
Mountainburg part	5x3	Severe	Severe	Moderate	Shortleaf pine	50	Shortleaf pine, eastern redcedar, loblolly pine.
					Eastern redcedar	30	
Roellen:							
26	2w6	Slight	Severe	Moderate	Cherrybark oak	90	American sycamore, sweetgum, nuttall oak.
					Sweetgum	90	
					Water oak	90	
Roxana:							
27, 28	1o4	Slight	Slight	Slight	Eastern cottonwood	115	Eastern cottonwood, American sycamore, cherrybark oak.
					Sweetgum	100	
					Pecan	---	
					American sycamore	---	
					Water oak	---	
					Cherrybark oak	---	
Spadra:							
29	2o7	Slight	Slight	Slight	Shortleaf pine	80	Loblolly pine, shortleaf pine, black walnut, black locust, southern red oak, eastern redcedar.
					Southern red oak	80	
					Sweetgum	90	
Wrightsville:							
30	3w9	Slight	Severe	Moderate	Loblolly pine	80	Loblolly pine, sweetgum, water oak, willow oak.
					Sweetgum	80	
					Water oak	80	

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

[2]This tree grows only on lower parts of slopes, in coves, and on north-facing slopes.

TABLE 10.--BUILDING SITE DEVELOPMENT

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Crevasse:					
1	Severe: too sandy.	Slight	Slight	Slight	Slight
2	Severe: floods, too sandy.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Dardanelle:					
3, 4	Slight	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength.
Enders:					
5	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
6	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, shrink-swell.
7	Severe: slope, too clayey, large stones.	Severe: low strength, shrink-swell, large stones.	Severe: slope, large stones, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, large stones.
8:					
Enders part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, shrink-swell.
Mountainburg part	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.
9:					
Enders part	Severe: slope, too clayey, large stones.	Severe: low strength, large stones, shrink-swell.	Severe: slope, large stones, depth to rock.	Severe: slope, shrink-swell, low strength.	Severe: slope, shrink-swell, large stones.
Mountainburg part	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.
Gullion:					
10	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
11	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Leadvale:					
12	Moderate: wetness.	Slight	Moderate: wetness.	Moderate: low strength.	Moderate: low strength.
13	Moderate: wetness.	Slight	Moderate: wetness.	Moderate: slope, low strength.	Moderate: low strength.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Linker:					
14	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
15:					
Linker part	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: slope, depth to rock.
Mountainburg part	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.
Mountainburg:					
16	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
17	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
18	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.
Muskogee:					
19	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Nella:					
20	Moderate: small stones.	Slight	Slight	Slight	Moderate: low strength.
21:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Enders part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, shrink-swell.
22:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Enders part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, shrink-swell.
23:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Enders part	Severe: slope, too clayey.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.
24:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mountainburg part	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.

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Nella: [1] 25:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Mountainburg part	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.
Roellen: 26	Severe: wetness, too clayey.	Severe: wetness, shrink-swell.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.
Roxana: 27	Slight	Slight	Moderate: wetness.	Slight	Moderate: low strength.
28	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Spadra: 29	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Wrightsville: 30	Severe: wetness, too clayey.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.

[1] This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 11.--SANITARY FACILITIES

["Depth to rock" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Crevasse:					
1	Slight	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
2	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Poor: seepage, too sandy.
Dardanelle:					
3, 4	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Good.
Enders:					
5	Severe: percs slowly.	Moderate: slope, depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
6	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
7	Severe: percs slowly, large stones.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: too clayey, area reclaim, large stones.
8:					
Enders part	Severe: percs slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
Mountainburg part	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.
9:					
Enders part	Severe: percs slowly, large stones.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: too clayey, area reclaim, large stones.
Mountainburg part	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.
Gallion:					
10	Moderate: percs slowly.	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
11	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Leadvale:					
12, 13	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey, wetness.	Slight	Fair: too clayey, hard to pack.
Linker:					
14	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Linker:					
†15:					
Linker part	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Moderate: slope.	Fair: slope, thin layer.
Mountainburg part	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: seepage.	Poor: thin layer, large stones.
Mountainburg:					
16	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
17	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
18	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: seepage.	Poor: thin layer, large stones.
Muskogee:					
19	Severe: perco slowly.	Moderate: slope.	Severe: too clayey.	Slight	Fair: thin layer, too clayey.
Nella:					
20	Slight	Moderate: slope, seepage, small stones.	Slight	Slight	Fair: small stones.
†21:					
Nella part	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Enders part	Severe: perco slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
†22:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Enders part	Severe: perco slowly.	Severe: slope.	Severe: depth to rock, too clayey.	Moderate: slope.	Poor: too clayey.
†23:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.
Enders part	Severe: slope, perco slowly.	Severe: slope.	Severe: slope, depth to rock, too clayey.	Severe: slope.	Poor: slope, too clayey.
†24:					
Nella part	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Mountainburg part	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: seepage.	Poor: thin layer, large stones.
†25:					
Nella part	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Poor: slope.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Nella:					
Mountainburg part	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.
Roellen:					
26	Severe: perco slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.
Roxana:					
27	Slight	Moderate:	Slight	Slight	Good.
28	Severe: floods.	Severe: floods. seepage.	Severe: floods.	Severe: floods.	Good.
Spadra:					
29	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Wrightsville:					
30	Severe: wetness, perco slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 12.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Crevasse:				
1, 2	Good	Good	Unsuited: excess fines.	Poor: too sandy.
Dardanelle:				
3, 4	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Enders:				
5, 6	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
7	Poor: shrink-swell, low strength, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim, large stones.
18:				
Enders part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Mountainburg part	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, large stones, thin layer.
19:				
Enders part	Poor: shrink-swell, low strength, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, area reclaim, large stones.
Mountainburg part	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, large stones, thin layer.
Gallion:				
10, 11	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Leadvale:				
12, 13	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, area reclaim.
Linker:				
14	Fair: low strength, thin layer.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
15:				
Linker part	Fair: low strength, thin layer.	Poor: excess fines.	Unsuited: excess fines.	Fair: slope, thin layer.
Mountainburg part	Poor: thin layer, large stones.	Unsuited: excess fines.	Poor: excess fines.	Poor: large stones, thin layer.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Mountainburg:				
16, 17	Poor: thin layer.	Unsuited: excess fines.	Poor: excess fines.	Poor: thin layer, small stones.
18	Poor: thin layer, large stones.	Unsuited: excess fines.	Poor: excess fines.	Poor: large stones, thin layer.
Muskogee:				
19	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Nella:				
20	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
[1]21:				
Nella part	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Enders part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
[1]22:				
Nella part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Enders part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
[1]23:				
Nella part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Enders part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
[1]24:				
Nella part	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Mountainburg part	Poor: thin layer, large stones.	Unsuited: excess fines.	Poor: excess fines.	Poor: large stones, thin layer.
[1]25:				
Nella part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, small stones.
Mountainburg part	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Poor: excess fines.	Poor: slope, large stones, thin layer.
Roellen:				
26	Poor: shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Roxana: 27, 28	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Spadra: 29	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: small stones.
Wrightsville: 30	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 13.--WATER MANAGEMENT

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Crevasse:							
1, 2	Severe: seepage.	Severe: compressible, seepage, piping.	Severe: deep to water.	Not needed	Fast intake, seepage.	Not needed	Erodes easily, droughty.
Dardanelle:							
3, 4	Moderate: seepage.	Moderate: seepage.	Severe: deep to water.	Not needed	Favorable	Not needed	Favorable.
Enders:							
5, 6	Moderate: depth to rock.	Severe: low strength, compressible.	Severe: deep to water, large stones.	Not needed	Slope, erodes easily, slow intake.	Slope, depth to rock, erodes easily.	Erodes easily, percs slowly, slope.
7	Moderate: depth to rock.	Severe: large stones, shrink-swell, low strength.	Severe: deep to water, large stones.	Not needed	Slope, erodes easily.	Large stones, slope, depth to rock.	Slope, large stones, erodes easily.
8:							
Enders part	Moderate: depth to rock.	Severe: low strength, compressible.	Severe: deep to water, large stones.	Not needed	Slope, erodes easily, slow intake.	Slope, depth to rock, erodes easily.	Erodes easily, percs slowly, slope.
Mountainburg part	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Severe: deep to water.	Not needed	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
9:							
Enders part	Moderate: depth to rock.	Severe: large stones, shrink-swell, low strength.	Severe: deep to water, large stones.	Not needed	Slope, erodes easily.	Large stones, slope, depth to rock.	Slope, large stones, erodes easily.
Mountainburg part	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Severe: deep to water.	Not needed	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
Gallion:							
10	Moderate: seepage.	Slight	Severe: no water.	Favorable	Favorable	Not needed	Favorable.
11	Moderate: seepage.	Slight	Severe: no water.	Favorable	Floods	Not needed	Favorable.
Leadvale:							
12, 13	Slight	Moderate: piping.	Severe: no water.	Percs slowly	Favorable	Favorable	Favorable.
Linker:							
14	Severe: depth to rock.	Moderate: thin layer, compressible.	Severe: no water.	Not needed	Slope, erodes easily.	Slope, depth to rock, erodes easily.	Erodes easily, slope.
15:							
Linker part	Severe: depth to rock.	Moderate: thin layer, compressible.	Severe: no water.	Not needed	Slope, erodes easily.	Slope, depth to rock, erodes easily.	Erodes easily, slope.
Mountainburg part	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Severe: deep to water.	Not needed	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Mountainburg:							
16, 17	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed	Slope, fast intake, rooting depth.	Slope, depth to rock, rooting depth.	Rooting depth, slope.
18	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Severe: deep to water.	Not needed	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
Muskogee:							
19	Slight	Moderate: compressible, low strength.	Severe: no water.	Not needed	Erodes easily, slope, slow intake.	Favorable	Erodes easily, percs slowly, slope.
Nella:							
20	Moderate: seepage.	Slight	Severe: no water.	Not needed	Favorable	Favorable	Favorable.
†21:							
Nella part	Moderate: seepage.	Slight	Severe: no water.	Not needed	Slope	Slope	Slope.
Enders part	Moderate: depth to rock.	Severe: low strength, compressible.	Severe: deep to water, large stones.	Not needed	Slope, erodes easily, slow intake.	Slope, depth to rock, erodes easily.	Erodes easily, percs slowly, slope.
†22:							
Nella part	Moderate: seepage.	Slight	Severe: no water.	Not needed	Slope	Slope	Slope.
Enders part	Moderate: depth to rock.	Severe: low strength, compressible.	Severe: deep to water, large stones.	Not needed	Slope, erodes easily, slow intake.	Slope, depth to rock, erodes easily.	Erodes easily, percs slowly, slope.
†23:							
Nella part	Moderate: seepage.	Slight	Severe: no water.	Not needed	Slope	Slope	Slope.
Enders part	Moderate: depth to rock.	Severe: low strength, compressible.	Severe: deep to water, large stones.	Not needed	Slope, erodes easily, slow intake.	Slope, depth to rock, erodes easily.	Erodes easily, percs slowly, slope.
†24:							
Nella part	Moderate: seepage.	Slight	Severe: no water.	Not needed	Slope	Slope	Slope.
Mountainburg part	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Severe: deep to water.	Not needed	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
†25:							
Nella part	Moderate: seepage.	Slight	Severe: no water.	Not needed	Slope	Slope	Slope.
Mountainburg part	Severe: seepage, depth to rock.	Severe: thin layer, large stones.	Severe: deep to water.	Not needed	Slope, droughty, large stones.	Large stones, depth to rock.	Large stones, depth to rock, rooting depth.
Roellen:							
26	Slight	Moderate: compressible.	Severe: no water.	Percs slowly, poor outlets.	Slow intake, wetness.	Not needed	Not needed.
Roxana:							
27	Moderate: seepage.	Moderate: erodes easily, seepage, piping.	Severe: no water.	Not needed	Favorable	Not needed	Erodes easily.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Roxana: 28	Moderate: seepage.	Moderate: erodes easily, seepage, piping.	Severe: no water.	Not needed	Slope, erodes easily.	Not needed	Erodes easily.
Spadra: 29	Moderate: seepage.	Moderate: piping, compressible.	Severe: no water.	Not needed	Slope	Slope	Slope.
Wrightsville: 30	Slight	Severe: unstable fill, compressible.	Severe: no water.	Favorable, wetness, perco slowly.	Favorable, wetness, slow intake.	Not needed	Not needed.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 14.--RECREATIONAL DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Crevasse:				
1	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
†2	Severe: floods, too sandy.	Severe: too sandy.	Severe: floods, too sandy.	Severe: floods, too sandy.
Dardanelle:				
3, 4	Slight	Slight	Slight	Slight.
Enders:				
5	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
6	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
7	Severe: slope, percs slowly, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
†8:				
Enders part	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
Mountainburg part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.
†9:				
Enders part	Severe: slope, percs slowly, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.
Mountainburg part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, large stones.
Gallion:				
10	Slight	Slight	Slight	Slight.
†11	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: floods.
Leadvale:				
12, 13	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Linker:				
14	Slight	Slight	Moderate: slope.	Slight.
†15:				
Linker part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Mountainburg part	Severe: large stones.	Severe: large stones.	Severe: slope, depth to rock, large stones.	Severe: large stones.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Mountainburg:				
16	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: depth to rock, small stones.	Moderate: small stones, slope.
17	Moderate: small stones, slope.	Moderate: small stones, slope.	Severe: slope, depth to rock, small stones.	Moderate: small stones, slope.
18	Severe: large stones.	Severe: large stones.	Severe: slope, depth to rock, large stones.	Severe: large stones.
Muskogee:				
19	Moderate: percs slowly.	Slight	Moderate: slope, percs slowly.	Slight.
Nella:				
20	Moderate: small stones.	Moderate: small stones.	Severe: small stones.	Moderate: small stones.
[1]21:				
Nella part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Enders part	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
[1]22:				
Nella part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Enders part	Severe: percs slowly.	Moderate: slope.	Severe: slope, percs slowly.	Slight.
[1]23:				
Nella part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Enders part	Severe: slope, percs slowly.	Severe: slope.	Severe: slope, percs slowly.	Severe: slope.
[1]24:				
Nella part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: slope, small stones.
Mountainburg part	Severe: large stones.	Severe: large stones.	Severe: slope, depth to rock, large stones.	Severe: large stones.
[1]25:				
Nella part	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Severe: slope.
Mountainburg part	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 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Roellen: 26	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Roxana: 27	Slight	Slight	Slight	Slight
28	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: floods.
Spadra: 29	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Wrightsville: 30	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 15.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Cravasse:												
1, 2	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Very poor.	Fair	Poor	Very poor.	---
Dardanelle:												
3, 4	Good	Good	Good	Good	Fair	Good	Poor	Fair	Good	Good	Poor	---
Enders:												
5, 6	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
7	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
8:												
Enders part	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Mountainburg part	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.	---
9:												
Enders part	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
Mountainburg part	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.	---
Gallion:												
10, 11	Good	Good	Good	Good	Fair	Good	Poor	Very poor.	Good	Good	Very poor.	---
Leadvale:												
12	Fair	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor	---
13	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
Linker:												
14	Fair	Good	Good	Fair	Fair	Fair	Poor	Very poor.	Good	Good	Very poor.	---
15:												
Linker part	Fair	Good	Good	Fair	Fair	Fair	Very poor.	Very poor.	Good	Good	Very poor.	---
Mountainburg part	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.	---
Mountainburg:												
16	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Poor	Very poor.	Very poor.	---
17	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	---
18	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.	---
Muskogee:												
19	Fair	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Nella:												
20	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
[1]21:												
Nella part	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Enders part	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
[1]22:												
Nella part	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
Enders part	Fair	Good	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.	---
[1]23:												
Nella part	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
Enders part	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
[1]24:												
Nella part	Poor	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.	---
Mountainburg part	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.	---
[1]25:												
Nella part	Very poor.	Poor	Good	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.	---
Mountainburg part	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.	---
Roellen:												
26	Poor	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	---
Roxana:												
27.												
28	Good	Good	Good	Good	Fair	Good	Poor	Very poor.	Good	Good	Very poor.	---
Spadra:												
29	Good	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.	---
Wrightsville:												
30	Fair	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good	---

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Crevasse:											
1, 2	0-9	Loamy fine sand	SM	A-2	0	100	95-100	60-100	15-30	---	NP
	9-72	Sand, loamy sand, fine sand, loamy fine sand.	SP-SM, SM	A-2, A-3	0	100	95-100	50-80	5-35	---	NP
Dardanelle:											
3, 4	0-30	Silt loam	ML, CL, CL-ML	A-4, A-6	0	100	100	100	85-100	16-30	3-11
	30-55	Silt loam, silty clay loam, clay loam.	CL-ML, CL	A-4, A-6	0	100	100	100	80-100	23-38	6-15
	55-72	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
Enders:											
5	0-5	Fine sandy loam	SM,SC,ML, CL	A-4	0	100	100	70-85	40-55	16-25	3-8
	5-13	Clay loam, silty clay loam, loam.	CL, ML	A-6	0	80-100	80-100	80-100	75-95	30-40	11-15
	13-58	Silty clay, clay	MH, CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
6	0-5	Gravelly fine sandy loam.	ML, SM, CL-ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	25-35	4-10
	5-13	Clay loam, silty clay loam, loam.	CL, ML	A-6	0	80-100	80-100	80-100	75-95	30-40	11-15
	13-58	Silty clay, clay	MH, CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
7	0-13	Stony fine sandy loam, stony loam.	SM, ML, CL-ML	A-4,	20-40	60-90	70-80	65-75	40-60	20-35	4-10
	13-58	Silty clay, clay	CH,MH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Enders: 8:											
Enders part	0-5	Gravelly fine sandy loam.	ML, SM, CL-ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	25-35	4-10
	5-13	Clay loam, silty clay loam, loam.	CL, ML	A-6	0	80-100	80-100	80-100	75-95	30-40	11-15
	13-58	Silty clay, clay	MH, CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Mountainburg part	0-9	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	<20	NP
	9-17	Very stony sandy clay loam, very stony loam, very stony fine sandy loam, very stony sandy loam.	GM, GC, GM-GC	A-1, A-2	15-65	40-60	30-55	20-50	10-30	<30	NP-10
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Enders:											
9:											
Enders part	0-13	Stony fine sandy loam, stony loam.	SM, ML,	A-4,	20-40	80-90	70-80	65-75	40-60	20-35	4-10
	13-58	Silty clay, clay	CH, MH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Mountainburg part	0-9	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-80	30-80	20-40	15-25	<20	NP
	9-17	Very stony sandy clay loam, very stony loam, very stony fine sandy loam, very stony sandy loam.	GM, GC, GM-GC	A-1, A-2	15-65	40-60	30-55	20-50	10-30	<30	NP-10
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Gallion:											
10, 11	0-10	Silt loam	ML, CL-ML, CL	A-4, A-6	0	100	100	100	90-100	<28	NP-11
	10-42	Silt loam, silty clay loam, clay loam.	CL	A-6	0	100	100	100	90-100	28-40	11-17
	42-72	Stratified silty clay loam to very fine sandy loam.	CL, CL-ML	A-6, A-4	0	100	100	100	90-100	23-34	4-19
Leadvale:											
12, 13	0-6	Silt loam	ML, CL-ML, CL	A-4	0	100	95-100	85-95	65-85	18-32	2-10
	6-28	Silt loam, silty clay loam.	CL-ML, CL, ML	A-4, A-6	0	100	95-100	90-98	75-90	24-36	5-14
	28-56	Silt loam, silty clay loam.	CL-ML, CL	A-4, A-6, A-7	0	100	95-100	80-98	70-90	24-42	5-18
	56-77	Silty clay loam, silty clay, clay.	CL, MH, ML	A-6, A-7	0-5	90-100	90-100	85-95	70-90	32-58	12-26
Linker:											
14	0-11	Fine sandy loam	SM, ML,	A-2, A-4	0-5	65-100	60-100	55-100	25-70	<30	NP-7
	11-37	Fine sandy loam, sandy clay loam, loam.	CL, SC, SM, ML	A-4, A-6	0-10	90-100	80-100	70-100	40-80	<40	NP-18
	37-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
15:											
Linker part	0-11	Fine sandy loam	SM, ML,	A-2, A-4	0-5	65-100	60-100	55-100	25-70	<30	NP-7
	11-37	Fine sandy loam, sandy clay loam, loam.	CL, SC, SM, ML	A-4, A-6	0-10	90-100	80-100	70-100	40-80	<40	NP-18
	37-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieves number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Linker:											
15:											
Mountainburg part	0-9	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	<20	NP
	9-17	Very stony sandy clay loam, very stony loam, very stony fine sandy loam, very stony sandy loam.	GM, GC, GM-GC	A-1, A-2	15-65	40-60	30-55	20-50	10-30	<30	NP-10
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Mountainburg:											
16, 17	0-9	Gravelly fine sandy loam.	GM	A-1, A-2	5-15	30-50	25-50	20-40	15-30	---	NP
	9-17	Very stony sandy clay loam, very stony loam, very stony fine sandy loam, very stony sandy loam.	GM, GC, GM-GC	A-1, A-2	15-65	40-60	30-55	20-50	10-30	<30	NP-10
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
18	0-9	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	<20	NP
	9-17	Very stony sandy clay loam, very stony loam, very stony fine sandy loam, very stony sandy loam.	GM, GC, GM-GC	A-1, A-2	15-65	40-60	30-55	20-50	10-30	<30	NP-10
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Muskogee:											
19	0-10	Silt loam	ML, CL, CL-ML	A-4	0	100	100	95-100	85-100	18-30	1-10
	10-29	Silty clay loam, silt loam.	CL, CH	A-6, A-7	0	100	100	95-100	90-100	35-55	15-30
	29-72	Silty clay, clay	CH	A-7	0	100	100	95-100	90-100	55-70	30-40
Nella:											
20	0-5	Gravelly fine sandy loam.	ML, CL, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	5-72	Cobbly clay 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
	72-75	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
21:											
Nella part	0-5	Gravelly fine sandy loam.	ML, CL, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	5-72	Cobbly clay 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
	72-75	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Nella:											
121:											
Enders part-----	0-5	Gravelly fine sandy loam.	ML-SM, CL-ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	25-35	4-10
	5-13	Clay loam, silty clay loam, loam.	CL, ML	A-6	0	80-100	80-100	80-100	75-95	30-40	11-15
	13-58	Silty clay, clay	MH, CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
122:											
Nella part------	0-5	Gravelly fine sandy loam.	ML, CL, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	5-72	Cobbly clay 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
	72-75	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Enders part-----	0-5	Gravelly fine sandy loam.	ML, SM, CL-ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	25-35	4-10
	5-13	Clay loam, silty clay loam, loam.	CL, ML	A-6	0	80-100	80-100	80-100	75-95	30-40	11-15
	13-58	Silty clay, clay	MH, CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
123:											
Nella part------	0-5	Gravelly fine sandy loam.	ML, CL, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	5-72	Cobbly clay 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
	72-75	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Enders part-----	0-5	Gravelly fine sandy loam.	ML, SM, CL, ML	A-2, A-4	0-15	50-95	35-75	30-70	30-60	25-35	4-10
	5-13	Clay loam, silty clay loam, loam.	CL, ML	A-6	0	80-100	80-100	80-100	75-95	30-40	11-15
	13-58	Silty clay, clay	MH, CH	A-7	0	95-100	85-100	85-100	70-95	65-80	35-45
	58-60	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
124:											
Nella part------	0-5	Gravelly fine sandy loam.	ML, CL, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	5-72	Cobbly clay 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
	72-75	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Nella:											
124:											
Mountainburg part	0-9	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	<20	NP
	9-17	Very stony sandy clay loam, very stony loam, very stony fine sandy loam, very stony sandy loam.	GM, GC, GM-GC	A-1, A-2	15-65	40-60	30-55	20-50	10-30	<30	NP-10
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
125:											
Nella part	0-5	Gravelly fine sandy loam.	ML, CL, SM	A-4, A-2	0-10	65-90	60-80	55-65	30-55	<30	NP-8
	5-72	Cobbly clay 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
	72-75	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Mountainburg part	0-9	Stony fine sandy loam.	GM	A-1, A-2	30-60	40-50	30-50	20-40	15-25	<20	NP
	9-17	Very stony sandy clay loam, very stony loam, very stony fine sandy loam, very stony sandy loam.	GM, GC, GM-GC	A-1, A-2	15-65	40-60	30-55	20-50	10-30	<30	NP-10
	17-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Roellen:											
26	0-9	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	90-100	45-65	20-40
	9-72	Clay, silty clay	CH	A-7	0	100	100	95-100	90-100	55-80	30-50
Roxana:											
27, 28	0-9	Silt loam	ML, CL-ML	A-4	0	100	100	100	90-100	<27	NP-11
	9-72	Silt loam, very fine sandy loam, loamy very fine sand, loamy fine sand.	ML, CL-ML	A-4	0	100	100	85-100	50-85	<27	NP-11
Spadra:											
29	0-8	Fine sandy loam	ML, SM	A-2, A-4	0	85-100	80-100	65-80	30-75	<20	NP-3
	8-54	Loam, sandy clay loam.	CL, ML	A-4, A-6	0	90-100	90-100	80-95	55-75	25-40	8-15
	54-72	Fine sandy loam, sandy loam, gravelly fine sandy loam.	ML, CL, SM, SC	A-4, A-2	0	70-100	70-100	40-85	20-65	<30	NP-10

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	> 3 inches	4	10	40	200		
	In				Pct					Pct	
Wrightsville:											
30----------	0-18	Silt loam-------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	75-100	<31	NP-10
	18-53	Silty clay, clay, silty clay loam.	CH, CL, MH	A-7	0	100	100	95-100	90-100	41-65	22-40
	53-70	Silty clay loam, silty clay, clay.	CL, CH, MH	A-7, A-6	0	100	95-100	95-100	90-100	35-65	16-40

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Crevasse:											
1, [1]2	0-9	6.0-20	0.08-0.08	5.6-8.4	<2	Low	Low	Moderate	0.15	5	---
	9-72	6.0-20	0.02-0.06	5.6-8.4	<2	Low	Low	Moderate	0.15		
Dardanelle:											
3, 4	0-30	0.6-2.0	0.13-0.24	5.6-7.3	<2	Low	Low	Low	0.37	5	---
	30-55	0.6-2.0	0.15-0.24	5.1-7.3	<2	Moderate	Moderate	Moderate	0.32		
	55-72	0.6-2.0	0.13-0.24	5.6-8.4	<2	Low	Low	Low	0.32		
Enders:											
5	0-5	0.6-2.0	0.10-0.20	3.6-5.5	<2	Low	Low	Moderate-	0.37	3	---
	5-13	0.2-0.6	0.15-0.22	3.6-5.5	<2	Low	Moderate	High	0.43		
	13-58	<0.06	0.12-0.18	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
6	0-5	0.6-2.0	0.07-0.15	3.6-5.0	<2	Low	Low	Moderate	0.32	3	---
	5-13	0.2-0.6	0.15-0.22	3.6-5.5	<2	Low	Moderate	High	0.43		
	13-58	<0.06	0.12-0.18	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
7	0-13	0.6-2.0	0.07-0.15	3.6-5.0	<2	Low	Low	Moderate	0.32	3	---
	13-58	<0.06	0.09-0.13	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
[1]8:											
Enders part	0-5	0.6-2.0	0.07-0.15	3.6-5.0	<2	Low	Low	Moderate	0.32	3	---
	5-13	0.2-0.6	0.15-0.22	3.6-5.5	<2	Low	Moderate	High	0.43		
	13-58	<0.06	0.12-0.18	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
Mountainburg part	0-9	2.0-6.0	0.05-0.10	5.1-6.0	<2	Low	Low	Moderate	0.17	1	---
	9-17	2.0-6.0	0.05-0.10	4.5-5.5	<2	Low	Low	High	0.24		
	17-20	---	---	---	---	---	---	---	---		
[1]9:											
Enders part	0-13	0.6-2.0	0.07-0.15	3.6-5.0	<2	Low	Low	Moderate	0.32	3	---
	13-58	<0.06	0.09-0.13	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
Mountainburg part	0-9	2.0-6.0	0.05-0.10	5.1-6.0	<2	Low	Low	Moderate	0.17	1	---
	9-17	2.0-6.0	0.05-0.10	4.5-5.5	<2	Low	Low	High	0.24		
	17-20	---	---	---	---	---	---	---	---		
Gallion:											
10, 11	0-10	0.6-2.0	0.21-0.23	5.6-7.3	<2	Low	Low	Low	0.37	5	---
	10-42	0.6-2.0	0.20-0.22	5.6-8.4	<2	Moderate	Moderate	Low	0.32		
	42-72	0.6-2.0	0.20-0.23	6.1-8.4	<2	Low	Low	Low	0.37		
Leadvale:											
12, 13	0-6	0.6-2.0	0.17-0.22	4.5-5.5	<2	Low	Moderate	Moderate	0.43	3	---
	6-28	0.6-2.0	0.17-0.20	4.5-5.5	<2	Low	Moderate	Moderate	0.43		
	28-56	0.06-0.6	0.06-0.11	4.5-5.5	<2	Low	Moderate	Moderate	0.24		
	56-77	0.06-0.6	0.06-0.11	4.5-5.5	<2	Low	Moderate	Moderate	0.24		
Linker:											
14	0-11	0.6-2.0	0.11-0.17	3.6-5.5	<2	Low	Low	High	0.28	3	---
	11-37	0.6-2.0	0.11-0.20	3.6-5.5	<2	Low	Low	High	0.32		
	37-40	---	---	---	---	---	---	---	---		

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Linker:											
15:											
Linker part	0-11	0.6-2.0	0.11-0.17	3.6-5.5	<2	Low	Low	High	0.28	3	---
	11-37	0.6-2.0	0.11-0.20	3.6-5.5	<2	Low	Low	High	0.32		
	37-40	---	---	---	---	---	---	---	---		
Mountainburg part	0-9	2.0-6.0	0.05-0.10	5.1-6.0	<2	Low	Low	Moderate	0.17	1	---
	9-17	2.0-6.0	0.05-0.10	4.5-5.5	<2	Low	Low	High	0.24		
	17-20	---	---	---	---	---	---	---	---		
Mountainburg:											
16, 17	0-9	2.0-6.0	0.05-0.10	5.1-6.0	<2	Low	Low	Moderate	0.20	1	---
	9-17	2.0-6.0	0.05-0.10	4.5-5.5	<2	Low	Low	Moderate	0.24		
	17-20	---	---	---	---	---	---	---	---		
18	0-9	2.0-6.0	0.05-0.10	5.1-6.0	<2	Low	Low	Moderate	0.17	1	---
	9-17	2.0-6.0	0.05-0.10	4.5-5.5	<2	Low	Low	High	0.24		
	17-20	---	---	---	---	---	---	---	---		
Muskogee:											
19	0-10	0.6-2.0	0.16-0.24	4.5-6.0	<2	Low	Moderate	Moderate	0.43	5	---
	10-29	0.2-0.6	0.16-0.24	4.5-6.0	<2	Moderate	High	Moderate	0.37		
	29-72	0.06-0.2	0.14-0.18	5.1-7.8	<2	High	High	Moderate	0.32		
Nella:											
20	0-5	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	Low	Moderate	0.20	5	---
	5-72	0.6-2.0	0.07-0.14	4.5-5.5	<2	Low	Moderate	Moderate	0.17		
	72-75	---	---	---	---	---	---	---	---		
21:											
Nella part	0-5	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	Low	Moderate	0.20	5	---
	5-72	0.6-2.0	0.07-0.14	4.5-5.5	<2	Low	Moderate	Moderate	0.17		
	72-75	---	---	---	---	---	---	---	---		
Enders part	0-5	0.6-2.0	0.07-0.15	3.6-5.0	<2	Low	Low	Moderate	0.32	3	---
	5-13	0.2-0.6	0.15-0.22	3.6-5.5	<2	Low	Moderate	High	0.43		
	13-58	<0.06	0.12-0.18	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
22:											
Nella part	0-5	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	Low	Moderate	0.20	5	---
	5-72	0.6-2.0	0.07-0.14	4.5-5.5	<2	Low	Moderate	Moderate	0.17		
	72-75	---	---	---	---	---	---	---	---		
Enders part	0-5	0.6-2.0	0.07-0.15	3.6-5.0	<2	Low	Low	Moderate	0.32	3	---
	5-13	0.2-0.6	0.15-0.22	3.6-5.5	<2	Low	Moderate	High	0.43		
	13-58	<0.06	0.12-0.18	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
23:											
Nella part	0-5	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	Low	Moderate	0.20	5	---
	5-72	0.6-2.0	0.07-0.14	4.5-5.5	<2	Low	Moderate	Moderate	0.17		
	72-75	---	---	---	---	---	---	---	---		
Enders part	0-5	0.6-2.0	0.07-0.15	3.6-5.0	<2	Low	Low	Moderate	0.32	3	---
	5-13	0.2-0.6	0.15-0.22	3.6-5.5	<2	Low	Moderate	High	0.43		
	13-58	<0.06	0.12-0.18	3.6-5.5	<2	High	High	High	0.37		
	58-60	---	---	---	---	---	---	---	---		
24:											
Nella part	0-5	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	Low	Moderate	0.20	5	---
	5-72	0.6-2.0	0.07-0.14	4.5-5.5	<2	Low	Moderate	Moderate	0.17		
	72-75	---	---	---	---	---	---	---	---		
Mountainburg part	0-9	2.0-6.0	0.05-0.10	5.1-6.0	<2	Low	Low	Moderate	0.17	1	---
	9-17	2.0-6.0	0.05-0.10	4.5-5.5	<2	Low	Low	High	0.24		
	17-20	---	---	---	---	---	---	---	---		

See footnote at end of table.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	Mmhos/cm						
Nella:											
[1]25:											
Nella part	0-5	0.6-2.0	0.08-0.15	4.5-5.5	<2	Low	Low	Moderate	0.20	5	---
	5-72	0.6-2.0	0.07-0.14	4.5-5.5	<2	Low	Moderate	Moderate	0.17		
	72-75	---	---	---	---	---	---	---	---		
Mountainburg part	0-9	2.0-6.0	0.05-0.10	5.1-6.0	<2	Low	Low	Moderate	0.17	1	---
	9-17	2.0-6.0	0.05-0.10	4.5-5.5	<2	Low	Low	High	0.24		
	17-20	---	---	---	---	---	---	---	---		
Roellen:											
26	0-9	0.06-0.2	0.15-0.19	5.6-7.8	<2	High	High	Low	0.32	5	---
	9-72	0.06-0.2	0.14-0.17	5.6-7.8	<2	High	High	Low	0.28		
Roxana:											
27, 28	0-9	0.6-2.0	0.10-0.21	6.1-8.4	<2	Low	Low	Low	0.37	5	---
	9-72	0.6-2.0	0.10-0.19	6.6-8.4	<2	Low	Low	Low	0.37		
Spadra:											
29	0-8	0.6-2.0	0.11-0.24	4.5-6.5	<2	Low	Low	High	0.37	5	---
	8-54	0.6-2.0	0.12-0.20	4.5-5.5	<2	Low	Low	High	0.37		
	54-72	0.6-2.0	0.10-0.15	4.5-5.5	<2	Low	Low	High	0.24		
Wrightsville:											
30	0-18	0.2-0.6	0.16-0.24	4.5-5.5	<2	Low	High	High	0.49	5	---
	18-53	<0.06	0.14-0.22	4.5-5.5	<2	High	High	High	0.37		
	53-70	<0.06	0.14-0.22	4.5-5.5	<2	High	High	High	0.43		

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 18.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft.			In		In	
Crevasse:											
1, [1]2	A	None to frequent.	Brief	Dec-Apr	3.5-6.0	---	---	>60	---	---	---
Dardanelle:											
3, 4	B	None to occasional.	Brief	Dec-Apr	>6.0	---	---	>60	---	---	---
Enders:											
5, 6, 7	C	None	---	---	>6.0	---	---	40-60	Ripable	---	---
[1]8:											
Enders part	C	None	---	---	>6.0	---	---	40-60	Ripable	---	---
Mountainburg part	D	None	---	---	>6.0	---	---	12-20	Hard	---	---
[1]9:											
Enders part	C	None	---	---	>6.0	---	---	40-60	Ripable	---	---
Mountainburg part	D	None	---	---	>6.0	---	---	12-20	Hard	---	---
Gallion:											
10, 11	B	None to occasional.	Brief to long.	Dec-Apr	4.0-6.0	Apparent	Dec-Apr	>60	---	---	---
Leadvale:											
12, 13	C	None	---	---	2.0-3.0	Perched	Dec-Apr	>48	Ripable	---	---
Linker:											
[1]14	B	None	---	---	>6.0	---	---	20-40	Hard	---	---
[1]15:											
Linker part	B	None	---	---	>6.0	---	---	20-40	Hard	---	---
Mountainburg part	D	None	---	---	>6.0	---	---	12-20	Hard	---	---
Mountainburg:											
16, 17, 18	D	None	---	---	>6.0	---	---	12-20	Hard	---	---
Muskogee:											
19	C	None	---	---	>6.0	---	---	>60	---	---	---
Nella:											
20	B	None	---	---	>6.0	---	---	>60	---	---	---
[1]21:											
Nella part	B	None	---	---	>6.0	---	---	>60	---	---	---
Enders part	C	None	---	---	>6.0	---	---	40-60	Ripable	---	---
[1]22:											
Nella part	B	None	---	---	>6.0	---	---	>60	---	---	---
Enders part	C	None	---	---	>6.0	---	---	40-60	Ripable	---	---
[1]23:											
Nella part	B	None	---	---	>6.0	---	---	>60	---	---	---

See footnote at end of table.

TABLE 18.—SOIL AND WATER FEATURES—Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Cemented pan	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Depth	Hardness
					Ft			In		In	
Nella:											
Enders part	C	None	---	---	>6.0	---	---	40-60	Ripable	---	---
†24:											
Nella part	B	None	---	---	>6.0	---	---	>60	---	---	---
Mountainburg part	D	None	---	---	>6.0	---	---	12-20	Hard	---	---
†25:											
Nella part	B	None	---	---	>6.0	---	---	>60	---	---	---
Mountainburg part	D	None	---	---	>6.0	---	---	12-20	Hard	---	---
Roellen: 26	D	None to occasional.	Brief	Dec-Apr	0-1.0	Apparent	Dec-Apr	>60	---	---	---
Roxana: 27, 28	B	None to occasional.	Brief to long.	Dec-Apr	4.0-6.0	Apparent	Dec-Apr	>60	---	---	---
Spadra: 29	B	None to occasional.	Brief	Dec-Apr	>6.0	---	---	>60	---	---	---
Wrighteville: 30	D	None	---	---	0.6-1.5	Perched	Dec-Apr	>60	---	---	---

†This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Crevasse	Mixed, thermic Typic Udipsamments
Dardanelle	Fine-silty, mixed, thermic Typic Argiudolls
Enders	Clayey, mixed, thermic Typic Hapludults
Gallion	Fine-silty, mixed, thermic Typic Hapludalfs
Leadvale	Fine-silty, siliceous, thermic Typic Fragiudults
Linker	Fine-loamy, siliceous, thermic Typic Hapludults
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
Wrightsville	Fine, mixed, thermic Typic Glossaqualfs

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