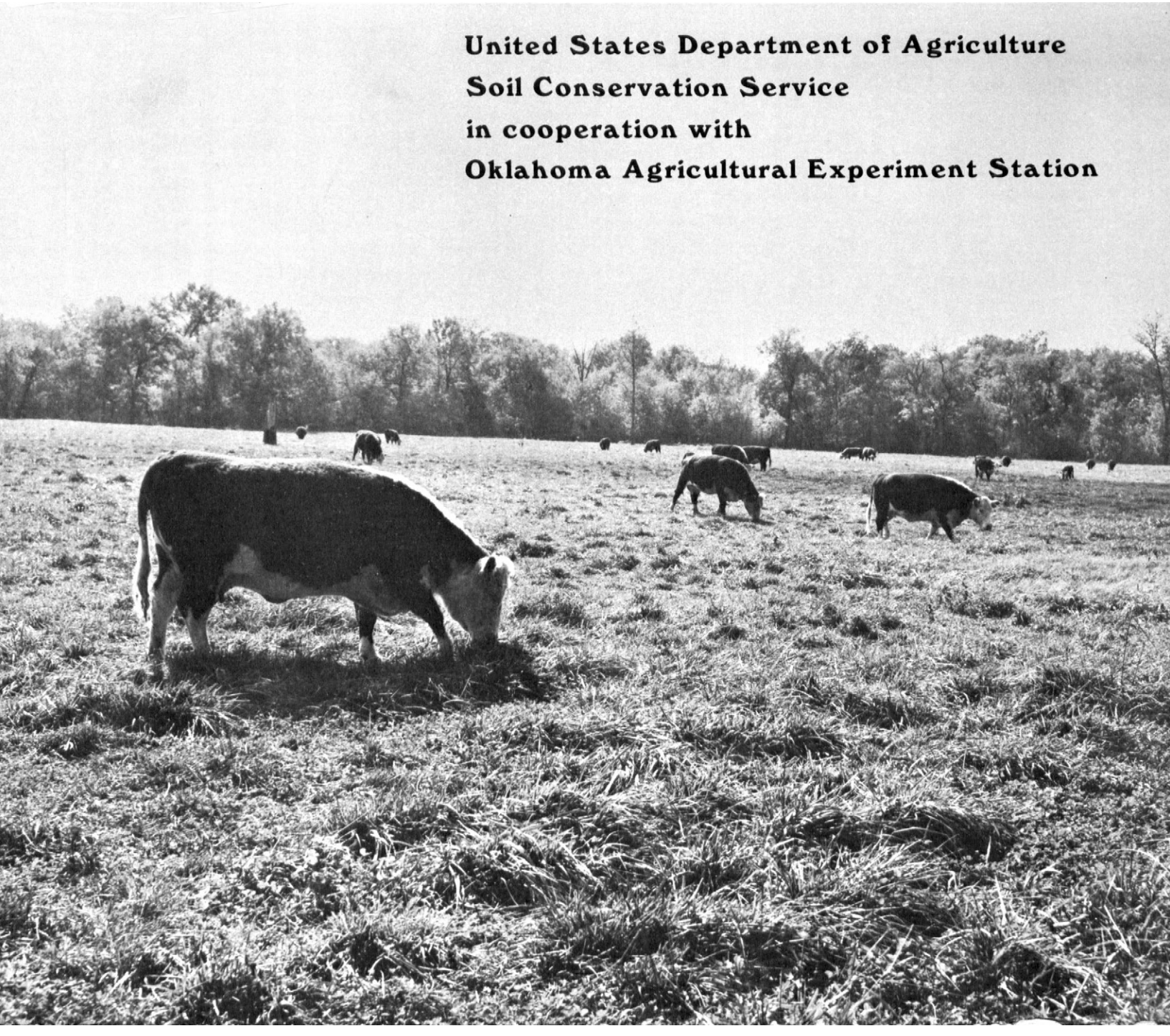
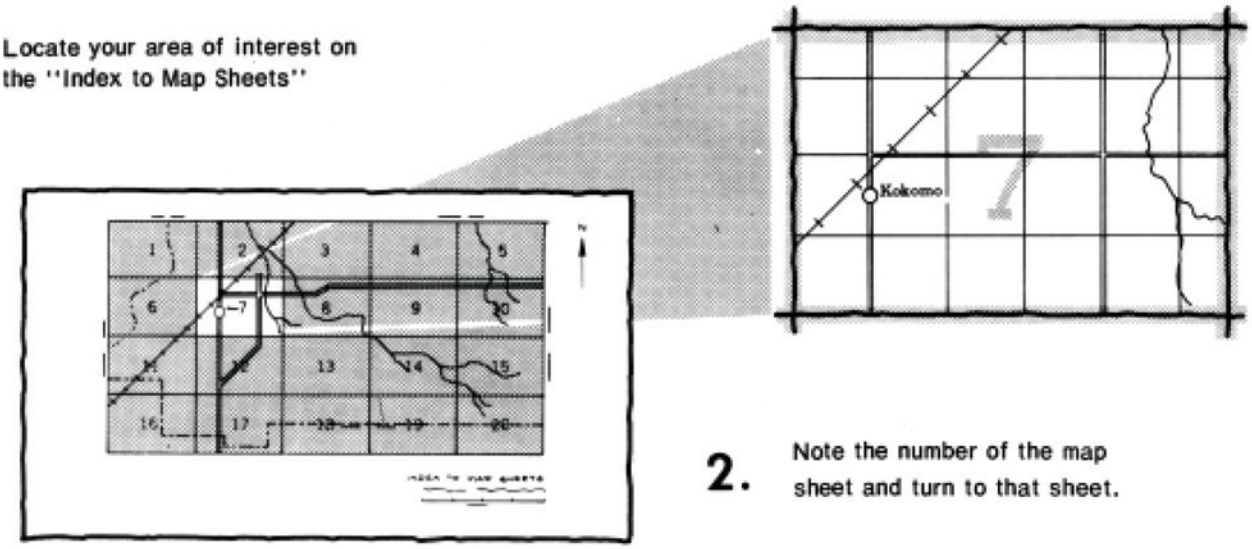
SOIL SURVEY OF
ATOKA COUNTY
OKLAHOMA

United States Department of Agriculture
Soil Conservation Service
in cooperation with
Oklahoma Agricultural Experiment Station



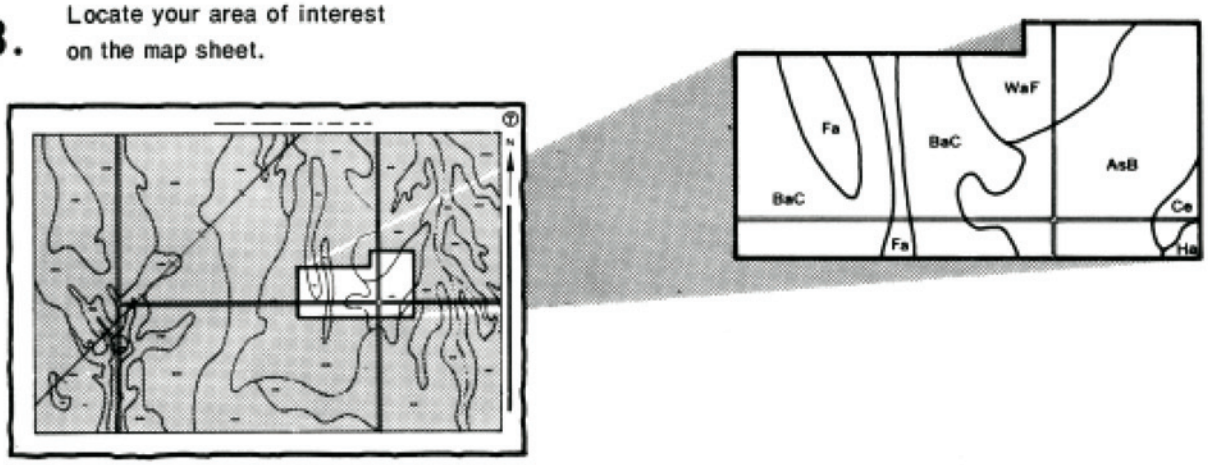
HOW TO USE

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

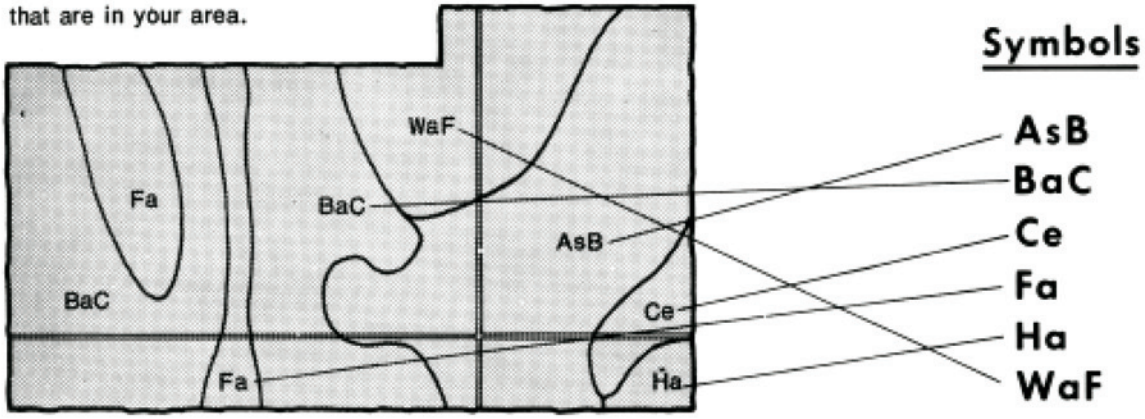


2. Note the number of the map sheet and turn to that sheet.

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

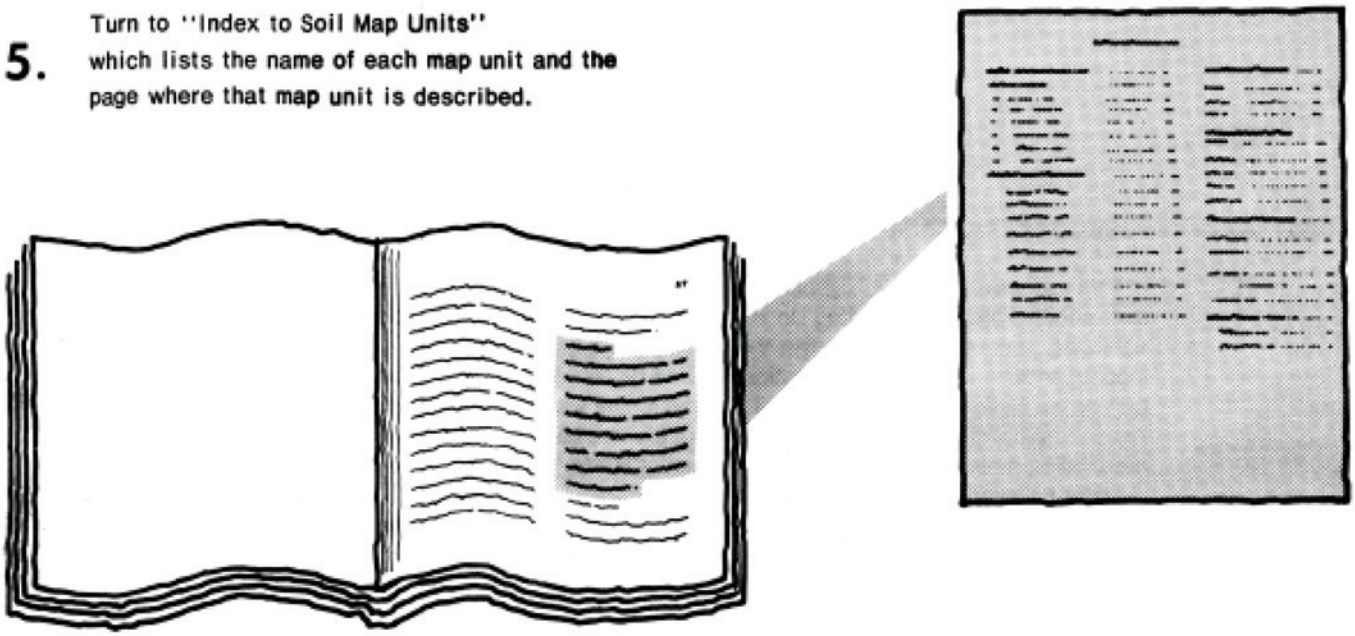


4. List the map unit symbols that are in your area.

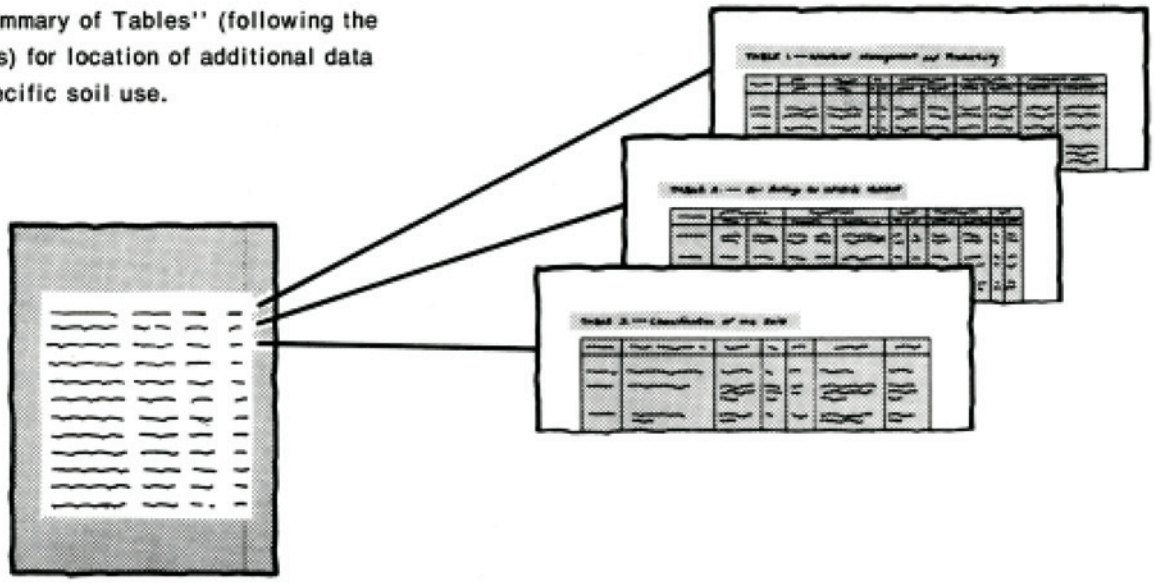


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1966 to 1975. Soil names and descriptions were approved in 1977. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1977. This survey was made cooperatively by the Soil Conservation Service and the Oklahoma Agricultural Experiment Station. It is part of the technical assistance furnished to the Atoka County Conservation District.

Soil maps in this survey may be copied without permission, but any enlargement of these maps can cause misunderstanding of the detail of mapping and result in erroneous interpretations. Enlarged maps do not show small areas of contrasting soils that could have been shown at a larger mapping scale.

Cover: Fescue grass and ladino clover furnish a large amount of forage on Kaufman clay.

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Issued August 1979

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Foreword

The Soil Survey of Atoka County 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.

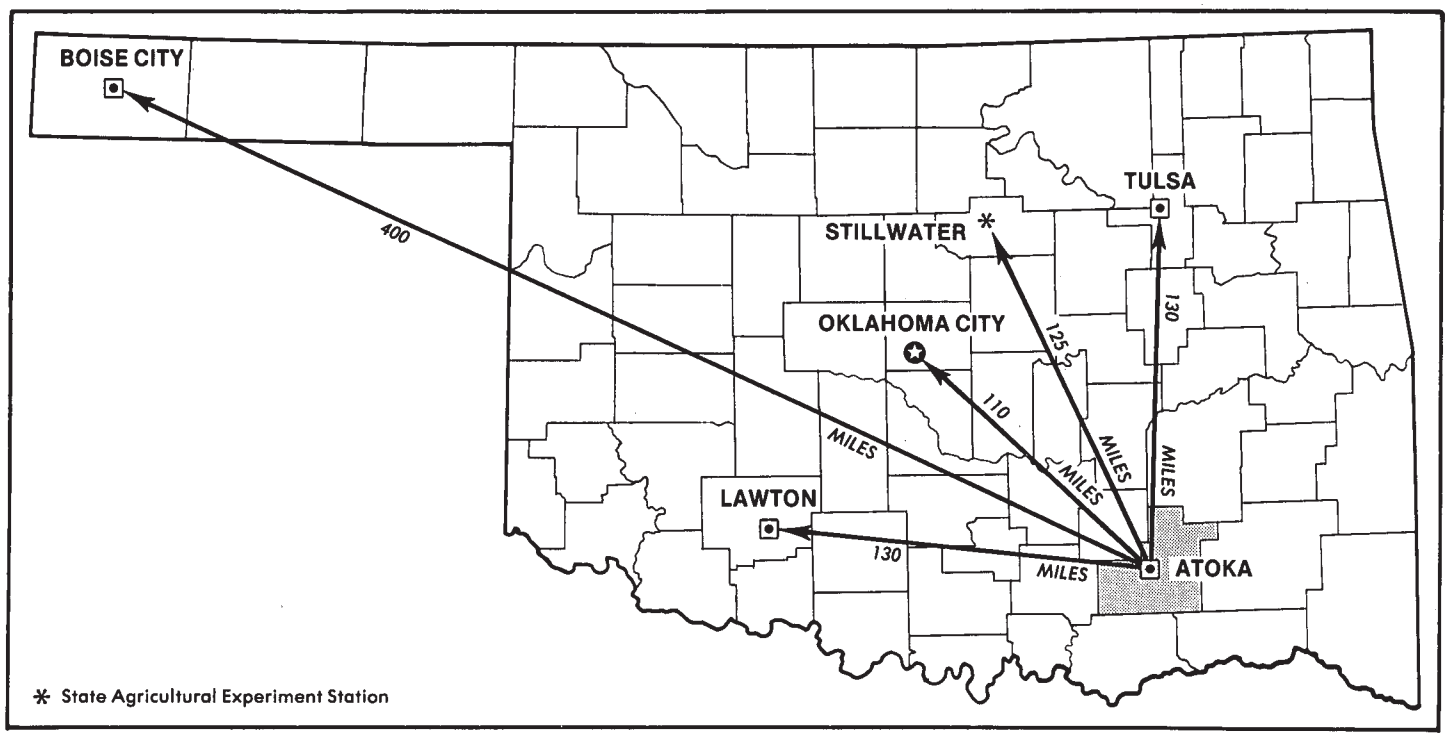
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers 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.

Roland R. Willis
State Conservationist
Soil Conservation Service



Location of Atoka County in Oklahoma.

SOIL SURVEY OF ATOKA COUNTY, OKLAHOMA

Soils surveyed by Lyle C. Shingleton and Anderson Watterson, Jr.
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service, in cooperation with
Oklahoma Agricultural Experiment Station

ATOKA COUNTY is in the southeastern part of Oklahoma (see map on facing page). It is bounded on the north by Pittsburg County, on the east by Pushmataha County, on the south by Choctaw and Bryan Counties, and on the west by Johnston and Coal Counties. It has an area of about 992 square miles or about 634,880 acres. Atoka is the county seat.

General nature of the county

This section gives general information concerning the county. It discusses physiography, drainage and relief, settlement and development, natural resources, transportation and industry, and climate.

Physiography, drainage, and relief

Atoka County is mainly in the Ouachita Mountains and Southern Coastal Plains physiography regions. Topographic differences range from the level flood plains of Muddy and Clear Boggy Creeks to the steep mountainous area of the Pine and Jackfork Mountains in the northern part of the county. The general slope is toward the south and east. Most of the drainage flows into the Muddy Boggy and Clear Boggy Creeks. Blue River drains a small area of the southwestern part of the county, and Buck Creek drains a small area in the northeastern part of the county. The major creeks draining into Muddy Boggy Creek are North Boggy, Chickasaw, Potato, and McGee Creeks. The major creeks draining into Clear Boggy Creek are Sandy, Rock, Caney, Cowpen, and Frontierhouse Creeks. All drainage from the county flows into the Red River.

The average elevation is approximately 870 feet above sea level. Pine Mountain in the northern part of the county reaches a height of 1,280 feet. The lowest point in the county is about 460 feet above sea level, which is along Muddy Boggy Creek at the southern boundary.

Settlement and development

The area originally called Champamay was settled in the late 1830's by the Choctaw Indians as a part of Indian Territory. Later the name of the area was changed in honor of the Choctaw Indian Chief Atoka Ashlatubee, who moved to the present townsite of Atoka in 1850. The work of surveying and planning the town was begun by the Choctaw Townsite Commission in September, 1880. On April 23, 1897, the Atoka Agreement was signed in Atoka, which allotted land to the Choctaw and Chickasaw Indians.

Another point of historical significance is the Boggy Depot Recreational Area located about 14 miles southwest of the city of Atoka. The site was one of the earliest settlements in the county, known to be in existence in 1837. Later, the Butterfield Overland Stage operated a stand at this location. Boggy Depot was also the home of Allen Wright, Chief of the Choctaw Indian Nation from 1866 to 1870, who suggested the name of the State of Oklahoma. His grave can be seen at the old Boggy Depot Cemetery.

Most of the early settlers were subsistence farmers. Timber, cotton, grain sorghum, peanuts, and small grains were the major cash crops. Sufficient amounts of other crops were grown to feed horses, mules, hogs, chickens, and beef and milk cattle.

Some earlier settlers left their farms, and others acquired these lands. These farms increased in size. Farmers specialized in timber, crops, and livestock enterprises in order to increase efficiency in managing larger farm units.

Natural resources

Soil is the most basic natural resource in the county. Livestock that graze the timberland and grassland and crops produced on farms are the main marketable products that are derived from the soil.

Rock, sand, and gravel are available in commercial quantities. There are clay and shale deposits that can be used for the manufacture of brick. Limestone and gravel are being used for road material. Sandstone exists in sufficient quantity for construction and can be used as abrasives. Limited amounts of coal are available as well as a few low-producing oil wells.

In most of the county, water is adequate for domestic use and for watering livestock. The mountains are an important area for recreation.

Transportation and Industry

Atoka County is served by a network of state and federal highways. Federal Highways 69 and 75 cross the county in a north-south direction through the towns of Caney, Tuskha, Atoka, and Stringtown. State Highways 3 and 7 cross the county in an east-west direction through the towns of Farris, Lane, and Atoka. State Highway 31 crosses through the northwest part of the county and serves the town of Wardville.

The Katy Railroad crosses the county in a north-south direction; and the Kansas, Oklahoma, and Gulf Railroad crosses the southwestern part. These railroads provide freight service but no passenger service. Several truck lines serve the county. Bus service is available along all highways.

The main industries in Atoka County are furniture manufacturing, dress manufacturing, and commercial dairy farms.

Climate

Atoka County is hot in summer but cool in winter, when an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfalls are infrequent. Annual total precipitation is normally adequate for cotton, feed grains, and small grains.

Table 1 gives data on temperatures and precipitation for the survey area, as recorded at Atoka, Oklahoma, for the period 1956 to 1974. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 43 degrees F, and the average daily minimum is 31 degrees. The lowest temperature on record, -2 degrees, occurred at Atoka on January 11, 1962. In summer the average temperature is 80 degrees, and the average daily maximum is 92 degrees. The highest temperature, 110 degrees, was recorded on July 15, 1956.

Growing degree days, shown in table 1 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, 25 inches, or 61 percent, usually falls during the period April through September, which includes the growing season for most crops. Two years in ten, the April-September rainfall is less than 19 inches. The heaviest 1-day rainfall during the period of record was 6.76 inches at Atoka on September 22, 1956. Thunderstorms number about 50 each year, 18 of which occur in summer.

Average seasonal snowfall is 3 inches. The greatest snow depth at any one time during the period of record was 5 inches.

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 80 percent. The percentage of possible sunshine is 75 percent in summer and 55 percent in winter. The prevailing direction of the wind is from the south. Average windspeed is highest, 13 miles per hour, in March.

Tornadoes and severe thunderstorms occur occasionally. These storms are local and of short duration, and the pattern of damage is variable and spotty.

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.

1. Eram-Dennis

Deep and moderately deep, very gently sloping to moderately steep, moderately well drained, loamy soils; on uplands

This map unit makes up about 15 percent of the county. It consists of soils that formed under tall native grasses in material weathered mostly from shale. About 36 percent of this map unit is Eram soils, 25 percent is Dennis soils, and 39 percent is minor extents of Bates, Coweta, Parsons, and Talihina soils.

Eram soils are moderately deep, gently sloping to moderately steep, moderately well drained, loamy soils that have a clayey subsoil. They are mainly on side slopes.

Dennis soils are deep, very gently sloping to sloping, moderately well drained, loamy soils that have a loamy and clayey subsoil. They are on broad, smooth areas of the uplands.

Most of the soils in this map unit are used for range, hay, or tame pasture. Many native grass meadows are in this map unit. A small acreage is used for cultivated crops. Small grains, soybeans, and grain sorghums are the main crops grown.

These soils have high potential for growing native grass and tame pasture. They have medium potential for cultivated crops. Slope and the erosion hazard are major limitations in areas of these soils. These soils have low potential for most urban uses because of high shrink-swell potential, low strength, and wetness. The potential for openland wildlife habitat is medium.

2. Endsaw-Hector

Deep and shallow, very gently sloping to very steep, well drained, loamy soils on uplands

This map unit makes up about 6 percent of the county. It consists of soils that formed under a cover of trees in colluvium and in material weathered from shale or sandstone. About 64 percent of this map unit is Endsaw soils, 17 percent is Hector soils, and 19 percent is minor extents of Bigfork, Counts, Dela, Hartsells, and Yanush soils and rock outcrops.

Endsaw soils are deep, very gently sloping to very steep, well drained, loamy soils that have a clayey subsoil. They formed in colluvium and in material weathered from shale and are mainly on side slopes.

Hector soils are shallow, very gently sloping to very steep, well drained soils that are loamy throughout the profile. They formed in material weathered from sandstone and are mainly on the ridgetops or just above the sandstone outcrops.

These soils are used mainly for woodland and range. Some areas produce hardwood trees. Most of these soils are not suited to cultivated crops or tame pasture because they are too steep or contain stones.

These soils have low potential for cultivated crops, pasture, or native grass. The erosion hazard, slope, stones, and shallow depth to rock are the major limitations. These soils also have low potential for most urban uses. Slope, shallow depth to rock, and stones are the major limitations for these uses. The potential for woodland wildlife habitat is medium.

3. Kaufman-Gowton

Deep, nearly level, somewhat poorly drained and well drained, clayey and loamy soils; on flood plains

This map unit makes up about 4 percent of the county. It consists of soils that formed under a cover of trees in loamy and clayey sediments. About 56 percent of this map unit is Kaufman soils, 32 percent is Gowton soils, and 12 percent is minor extents of Boggy, Dela, Lightning, and Trinity soils.

Kaufman soils are deep, nearly level, somewhat poorly drained soils that are mainly clayey throughout the profile. They formed mainly in clayey sediment. Gowton soils are deep, nearly level, well drained soils that are loamy throughout the profile. They formed in loamy sediment.

The soils in this map unit are used mainly for tame pasture. A small acreage is used for small grains and row crops. These soils have high potential for native grass and tame pasture. They have high potential for cropland except in the lowest parts of the flood plain where frequent flooding occurs. The potential for most urban uses is low because of flooding, very high shrink-swell potential, and wetness. The potential for woodland wildlife habitat is high.

4. Bernow-Bosville

Deep, nearly level to strongly sloping, well drained and moderately well drained, loamy soils on uplands

This map unit makes up about 29 percent of the county. It consists of soils that formed under a cover of trees in loamy and clayey sediments. About 63 percent of this map unit is Bernow soils, 13 percent is Bosville soils, and 24 percent is minor extents of Hamden, Larue, Pickton, Romia, and Stigler soils.

Bernow soils are deep, nearly level to strongly sloping, well drained soils that are loamy throughout the profile. They formed in loamy sediment on broad ridges and smooth side slopes. Bosville soils are deep, very gently sloping to strongly sloping, moderately well drained, loamy soils that have a clayey subsoil. They formed in clayey and loamy sediments on broad, smooth ridges and side slopes.

The soils in this map unit are used for tame pasture, range, row crops, and small grain. A large acreage is in woodland.

These soils have high potential for tame pasture and medium potential for native grass. They have medium potential for cultivated crops. The erosion hazard is a major limitation. The potential for most urban uses is high. High shrink-swell potential and low strength are limitations in some areas. The potential for openland and woodland wildlife habitat is high.

5. Rexor-Boggy-Guyton

Deep, nearly level, well drained, somewhat poorly drained, and poorly drained, loamy soils; on flood plains

This map unit makes up about 13 percent of the county. It consists of soils that formed mainly under a cover of trees in loamy sediments. About 21 percent of this map unit is Rexor soils, 21 percent is Boggy soils, 21 percent is Guyton soils, and 37 percent is minor extents of Counts, Dela, Gowton, Lightning, and Wrightsville soils.

Rexor soils are deep, nearly level, well drained, and loamy throughout the profile. Boggy soils are deep, nearly level, somewhat poorly drained, and loamy throughout the profile. Guyton soils are deep, nearly level, poorly drained, and loamy throughout the profile.

The soils in this map unit are used mainly for range and tame pasture. A small acreage is used for row crops and small grain. These soils have medium potential for tame pasture and native grass. They have medium potential for cultivated crops, except in the lowest parts of the flood plain where frequent flooding is a limitation. The potential for most urban uses is low because of flooding and wetness. The potential for woodland wildlife habitat is high.

6. Chigley-Agan

Deep, nearly level to strongly sloping, moderately well drained, loamy soils; on uplands

This map unit makes up less than 1 percent of the county. It consists of soils that formed under a cover of trees and grasses in material weathered from granite. About 50 percent of this map unit is Chigley soils, 17 percent is Agan soils, and 33 percent is minor extents of Dennis, Durant, and Kiti soils and outcrops of granite.

Chigley soils are deep, very gently sloping to strongly sloping, loamy soils that have a clayey subsoil. They formed in material weathered from granite and are on smooth side slopes. Agan soils are deep, nearly level to very gently sloping, loamy soils that have a clayey subsoil. They formed in material weathered from granite and are on broad, smooth ridges.

The soils in this map unit are used mainly for range and tame pasture. A small acreage is used for small grain and row crops.

These soils have high potential for native grass and tame pasture. They have medium potential for cultivated

crops. The soils are too droughty for summer-growing crops. The potential for most urban uses is low. Low strength, high shrink-swell potential, and wetness are the main limitations. The potential for openland wildlife habitat is medium.

7. Burleson-Tarrant

Deep and shallow, nearly level to sloping, moderately well drained and well drained, clayey and cobbly clayey soils; on uplands

This map unit makes up about 3 percent of the county. It consists of soils that formed under a cover of tall grass in material weathered from limestone. About 35 percent of this map unit is Burleson soils, 32 percent is Tarrant soils, and 33 percent is minor extents of Catoosa, Claremore, Durant, Heiden, and Kiti soils.

Burleson soils are deep, nearly level to very gently sloping, moderately well drained soils that are clayey throughout the profile. They formed in clayey sediment on broad, smooth areas of the uplands. Tarrant soils are shallow, nearly level to sloping, well drained soils that are cobbly and clayey throughout the profile. They formed in material weathered from limestone and are mainly on crests of ridges.

The shallow soils of this map unit are used for range. The deep soils are used mainly for small grain, row crops, or tame pasture.

These soils have medium potential for native grass and tame pasture. They have medium potential for cultivated crops. Shallow depth to rock and stones on the surface are limitations in areas of this map unit. The potential for most urban uses is low because of high shrink-swell potential and shallow depth to rock. The potential for openland wildlife habitat is medium.

8. Carnasaw-Clebit

Shallow and deep, gently sloping to steep, well drained, gravelly loamy and stony loamy soils; on uplands

This map unit makes up about 29 percent of the county. It consists of soils that formed under a cover of trees in colluvium and in material weathered from shale or sandstone. About 52 percent of this map unit is Carnasaw soils, 18 percent is Clebit soils, and 30 percent is minor extents of Bigfork, Counts, Dela, Hartsells, and Yanush soils.

Carnasaw soils are deep, gently sloping to steep, well drained, gravelly loamy soils that have a loamy and clayey subsoil. They formed in colluvium and in material weathered from shale and they are mainly on side slopes. Clebit soils are shallow, gently sloping to steep, well drained, stony loamy soils that have a very gravelly and stony loamy subsoil. They formed in material weathered from sandstone and are on ridges.

The soils in this map unit are used mainly for woodland or range. Many areas produce hardwood and pine. Most of the soils in this unit are not suited for cultivated crops or tame pasture because the soils are too stony or steep.

These soils have low potential for cultivated crops, tame pasture, or native grass. Slope, erosion hazard, stones, and shallow depth are limitations. The potential for most urban uses is low. Shallow depth to rock, slope, and stones are limitations. The potential for woodland wildlife habitat is medium.

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 in the 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 a profile that is almost alike 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 Boggy series, for example, was named for the town of Boggy in Atoka 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, Bernow fine sandy loam, 1 to 3 percent slopes, is one of several phases within the Bernow series.

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

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Bernow-Romia complex, 8 to 12 percent slopes is an example.

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. Carnasaw-Clebit 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. Hartsells and Hector soils, gullied, 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.

Most mapped areas include places that have little or no soil material and support little or no vegetation. Such places are called *miscellaneous areas*; they are delineated on the soil map and given descriptive names. Rock outcrop is an example. Some of these areas are too small to be delineated and are identified by a special symbol on the soil map.

The map units in this survey area have not all been mapped with the same degree of detail. Delineations of broadly defined units, indicated by a footnote on the soil legend at the back of this publication, are apt to be larger and vary more in composition than units that are mapped in greater detail. Composition has been controlled well enough, however, to be interpreted for the expected use of the soils.

The acreage and proportionate extent of each map unit are given in table 4 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—Agan loam, 0 to 2 percent slopes. This deep, moderately well drained, nearly level to very gently sloping soil is on broad, smooth areas of uplands in prairie areas. Most areas are more than 100 acres, but some are about 15 acres.

Typically, the surface layer is very dark grayish brown loam about 7 inches thick. The upper part of the subsoil, to a depth of about 40 inches, is very dark grayish brown clay and gravelly clay. The middle part of the subsoil is dark grayish brown gravelly clay to a depth of about 50 inches. The lower part of the subsoil is gray very gravelly clay that extends to a depth of about 65 inches.

This soil is low in natural fertility and organic matter content. It is medium acid to neutral in the surface layer. Permeability is very slow, and available water capacity is medium. It is difficult to prepare an adequate seedbed on this soil because of surface crusting and very slow water intake. This soil is droughty. The root zone is deep. A water table is at a depth of less than 2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Chigley soils. The included soils make up about 15 percent of the map unit, but separate areas are generally less than 5 acres.

This soil has low potential for small grain and row crops. When the soil is used for cropland, drought-resistant or cool-season crops are best suited. The erosion hazard is moderate where cultivated crops are grown. Returning large amounts of crop residue to the soil improves tilth, increases water intake, prevents surface crusting, and reduces the erosion hazard. Terracing and contour farming are not needed for sown crops when large amounts of crop residue are returned to the soil.

This soil has medium potential for native grass and tame pasture. The quality of grass can be maintained or improved by controlling brush, using suitable grazing practices, and protecting the grass from fire. Fertilizing tame pasture plants increases productivity and improves the quality of grass, thereby protecting the soil from erosion. This soil has low potential for woodland.

This soil has low potential for most urban uses. High to moderate shrink-swell potential and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability and wetness are the main limitations for septic tank absorption fields. To overcome these limitations, special design is needed. Sewage lagoons can be used satisfactorily on this soil.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Claypan Prairie range site.

2—Bates fine sandy loam, 1 to 3 percent slopes. This moderately deep, well drained, very gently sloping,

upland soil is on ridgetops of the prairie areas. Slopes are smooth and convex. Most areas are 15 to 30 acres, but some are smaller.

Typically, the surface layer is very dark grayish brown fine sandy loam about 12 inches thick. The subsoil is yellowish brown loam to a depth of about 20 inches and yellowish brown sandy clay loam that extends to a depth of about 35 inches. Below this is soft sandstone with thin layers of shale.

This soil is high in natural fertility and organic matter content. It is strongly acid to slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep.

Included with this soil in mapping are soils that have sandstone at a depth of 40 to 60 inches. Also included are a few intermingled areas of Coweta soils on the crest of ridges and Dennis soils on the lower parts of slopes. The included soils make up about 10 percent of this map unit, but separate areas are generally less than 3 acres.

This soil has high potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing tame pasture grasses improves the quality of grass and increases forage production, thereby protecting the soil from erosion. The quality of all grasses can be maintained or improved by controlling damage by fire and by using suitable grazing practices. This soil has low potential for commercial woodland production.

This soil has medium potential for most urban uses. The moderate depth to rock is a limitation for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area. Depth to rock is the main limitation for sewage lagoons and sanitary landfills.

This soil is in capability subclass IIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

3—Bates fine sandy loam, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping, upland soil is on ridgetops of the prairie areas in the northern part of the county. Slopes are smooth and convex. Most areas are 10 to 20 acres, but some are smaller.

Typically, the surface layer is dark brown fine sandy loam about 11 inches thick. The upper part of the subsoil, to a depth of about 15 inches, is yellowish brown loam. The lower part of the subsoil is strong brown sandy clay loam that extends to a depth of about 39 inches. Below this is soft sandstone with thin layers of shale.

This soil is high in natural fertility and organic matter content. It is strongly acid to slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep.

Included with this soil in mapping are soils that have sandstone at a depth of 40 to 60 inches. Also included are a few intermingled areas of Coweta soils on the crest of ridges and Dennis soils on the lower parts of slopes. The included soils make up about 15 percent of this map unit, but separate areas are generally less than 3 acres.

This soil has medium potential for growing row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe if cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing tame pasture grasses improves the quality of grass and increases forage production, thereby protecting the soil from erosion. The quality of all grasses can be maintained or improved by using suitable grazing practices and by protecting against damage by fire. This soil has low potential for commercial woodland production.

This soil has medium potential for most urban uses. The moderate depth to sandstone is a limitation for septic tank absorption fields, but this can be overcome by increasing the size of the absorption area. Depth to rock is the main limitation for sewage lagoons and sanitary landfills.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

4—Bates fine sandy loam, 2 to 5 percent slopes, eroded. This eroded, moderately deep, well drained, very gently sloping and gently sloping soil is on uplands of prairie grasses. In about 40 percent of the area, the surface layer and material from the upper part of the subsoil are mixed by plowing. A few crossable gullies are about 300 feet apart. Rills are common between the gullies. Slopes are smooth and convex. Most areas are 10 to 20 acres, but some are smaller.

Typically, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The subsoil is yellowish brown sandy clay loam and clay loam that

extends to a depth of about 38 inches. Below this is soft sandstone with thin layers of shale.

This soil is medium in natural fertility and organic matter content. It is strongly acid to slightly acid throughout. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep.

Included with this soil in mapping are areas of soils that are similar to Bates soils but have a grayish brown or brown surface layer that is 5 to 9 inches thick. These areas make up about 35 percent of this map unit. Also included are a few intermingled areas of Coweta soils on the crest of ridges and Dennis soils on the lower parts of slopes. These soils make up about 10 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. The main concerns of management are controlling grazing, proper stocking, and controlling weeds and brush. Fertilizing tame pasture grasses improves the quality of the grasses and increases forage production, thereby protecting the soil from erosion. This soil has low potential for commerical woodland production.

This soil has medium potential for most urban uses because of the moderate depth to sandstone. Depth to rock is a limitation for septic tank absorption fields. This limitation can be overcome by increasing the size of the absorption area. Depth to rock is the main limitation for sewage lagoons and sanitary landfills.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

5—Bates-Coweta complex, 2 to 5 percent slopes. The soils in this complex are so intermingled that it is impractical to separate them at the scale selected for mapping. These very gently sloping or gently sloping soils are on smooth hillcrests. Areas of each soil range from 3 to 5 acres.

Bates fine sandy loam makes up about 50 to 60 percent of each mapped area. Typically, the surface layer is very dark grayish brown fine sandy loam about 10 inches thick. The upper part of the subsoil is dark brown loam to a depth of about 24 inches. The lower part of the subsoil is yellowish brown sandy clay loam that extends to a depth of about 31 inches. Below this is sandstone and thin layers of shale.

This soil is high in natural fertility and organic matter content. It is strongly acid to slightly acid. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep.

Coweta fine sandy loam makes up about 30 to 40 percent of each mapped area. Typically, the surface layer is very dark grayish brown fine sandy loam about 11 inches thick. The subsoil is yellowish brown gravelly clay loam to a depth of about 16 inches. The underlying material is light brownish yellow loam that is 50 to 60 percent interbedded sandstone and shale fragments, grading to sandstone interbedded with shale at a depth of about 20 inches.

This soil is high in natural fertility and organic matter content. It is strongly acid to slightly acid throughout the profile. Permeability is moderate and available water capacity is low. The root zone is shallow.

Included with this complex in mapping are a few small areas of soils that are similar to the Coweta soil except the surface layer is underlain by hard sandstone at a depth of 4 to 20 inches.

The soils in this complex have medium potential for crops. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming are practices that help to reduce runoff and to control erosion.

The soils in this complex have medium potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases forage production, thereby protecting the soil from erosion. The quality of all grasses can be maintained or improved by controlling grazing and by protecting against damage by fire.

The soils in this complex have low potential for woodland production because of the moderate to shallow depth to sandstone. They have medium potential for most urban uses because of the moderate to shallow depth to sandstone. Depth to rock is the main limitation for septic tank absorption fields, sewage lagoons, and trench sanitary landfills.

This complex is in capability subclass IVe. It is not assigned to a woodland group. The Bates part is in the Loamy Prairie range site, and the Coweta part is in the Shallow Prairie range site.

6—Bernow fine sandy loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on smooth hilltops. Slopes are smooth and slightly convex. Most areas are about 150 acres, but some are about 15 acres.

Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsurface layer is pale brown fine sandy loam about 6 inches thick. The upper part of the subsoil to a depth of about 33 inches is brownish yellow sandy clay loam. The lower part of the subsoil, to

a depth of 62 inches, is yellowish brown sandy clay loam with vertical streaks of light gray clean sand grains.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are a few intermingled areas of Hamden and Larue soils. The included soils make up about 15 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has high potential for crops, and all crops grown in the county are well adapted to this soil. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is slight where cultivated crops are grown. Minimum tillage and the use of cover crops help to reduce runoff and to control erosion.

This soil has medium potential for native grass and high potential for tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing tame pasture plants increases production and improves the quality of grass, thereby protecting the soil from erosion. The quality of all grasses can be maintained or improved by controlling grazing, proper stocking, and preventing fires.

This soil has medium potential for woodland production. It has no significant limitations for woodland use or management.

This soil has high potential for most urban uses and no significant limitations for septic tank absorption fields and sanitary landfills. The main limitation for dwellings, small commercial buildings, and roads and streets is moderate shrink-swell potential in the upper part of the subsoil, but this limitation can be easily overcome.

This soil is in capability class I, woodland group 4o, and the Sandy Savannah range site.

7—Bernow fine sandy loam, 1 to 3 percent slopes. This deep, well drained, very gently sloping soil is on wooded uplands. Slopes are smooth and convex. Most areas are 40 to 80 acres, but some are about 15 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 6 inches thick. The subsurface layer is pale brown fine sandy loam about 9 inches thick. The upper part of the subsoil, to a depth of about 36 inches, is brownish yellow sandy clay loam. The lower part of the subsoil, to a depth of 65 inches, is yellowish brown sandy clay loam with vertical streaks of light gray, clean sand grains.

This soil is low in natural fertility and organic matter content. It is medium acid to neutral in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are soils that have soft sandstone at a depth of 40 to 60 inches. Also included are a few intermingled areas of Hamden and Larue soils. The included soils make up about 10 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has high potential for crops. All crops grown in the county can be grown on this soil. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has medium potential for native grass and high potential for tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases the production of grass and improves the quality of grass, thereby protecting the soil from erosion. The main concerns of management are controlling grazing, preventing fire, and controlling erosion.

This soil has medium potential for woodland production. It has no significant limitations for woodland use or management.

This soil has high potential for most urban uses and no significant limitations for septic tank absorption fields and sanitary landfills. The main limitation for dwellings, small commercial buildings, and roads and streets is moderate shrink-swell potential in the upper part of the subsoil, but this limitation can be easily overcome.

This soil is in capability subclass IIe, woodland group 4o, and the Sandy Savannah range site.

8—Bernow fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on wooded uplands. Slopes are smooth and convex. Most areas are 40 to 60 acres, but some are about 15 acres.

Typically, the surface layer is brown fine sandy loam about 5 inches thick. The subsurface layer is yellowish brown fine sandy loam about 7 inches thick. The upper part of the subsoil, to a depth of about 36 inches, is brownish yellow sandy clay loam. The lower part of the subsoil, to a depth of about 65 inches, is yellowish brown sandy clay loam with vertical streaks of light gray, clean sand grains.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are a few areas of soils that have soft sandstone at a depth of 40 to 60 inches. Also included are a few intermingled areas of Bosville and Larue soils. The included soils make up about 15 to 20 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has medium potential for native grass and high potential for tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing improves the quality of grass and increases production, thereby protecting the soil from erosion. The quality of all grasses can be maintained or improved by controlled grazing, proper stocking, and controlling weeds and brush.

This soil has medium potential for woodland production. It has no significant limitations for woodland use or management.

This soil has high potential for most urban uses and no significant limitations for septic tank absorption fields and sanitary landfills. Moderate shrink-swell potential in the upper part of the subsoil is the main limitation for dwellings, small commercial buildings, and roads and streets, but this limitation can be easily overcome.

This soil is in capability subclass IIIe, woodland group 4o, and the Sandy Savannah range site.

9—Bernow fine sandy loam, 1 to 5 percent slopes, eroded. This deep, well drained, very gently sloping to gently sloping eroded soil is on uplands. Slopes are smooth and convex. Most areas are 10 to 20 acres, but some are smaller.

Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsurface layer is yellowish brown fine sandy loam about 3 inches thick. The upper part of the subsoil, to a depth of about 40 inches, is yellowish brown sandy clay loam. The lower part of the subsoil, to a depth of about 65 inches, is strong brown sandy clay loam with gray mottles and vertical streaks of light gray, clean sand grains. Rills are common between small crossable gullies that are about 300 feet apart. In about 40 percent of the area, the surface layer and material from the upper part of the subsoil are mixed by plowing.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are areas of Romia and Bosville soils. These included soils make up about 15 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has medium potential for native grass and high potential for tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. The quality and quantity of tame pasture grasses can be improved by adding fertilizer. The quality of all grasses can be maintained or improved by proper stocking, controlling weeds and brush, preventing fires, and controlling grazing.

This soil has medium potential for woodland production. Plant competition is the main limitation. The quality of trees can be maintained by protecting against damage by fire, thinning, and selectively harvesting on a planned schedule.

This soil has high potential for most urban uses and no significant limitations for septic tank absorption fields and sanitary landfills. Moderate shrink-swell potential in the upper part of the subsoil is the main limitation for dwellings, small commercial buildings, and roads and streets; but this limitation can be easily overcome.

This soil is in capability subclass IIIe, woodland group 4o, and the Sandy Savannah range site.

10—Bernow fine sandy loam, 5 to 8 percent slopes. This deep, well drained, sloping soil is on wooded uplands. Slopes are smooth and convex. Most areas are 40 to 80 acres, but some are about 15 acres.

Typically, the surface layer is dark brown fine sandy loam about 4 inches thick. The subsurface layer is brown fine sandy loam about 4 inches thick. The upper part of the subsoil, to a depth of about 20 inches, is yellowish red sandy clay loam. The lower part of the subsoil, to a depth of about 80 inches, is brownish yellow sandy clay loam with mottles in shades of red, yellow, brown, or gray and with pockets and vertical streaks of light gray, clean sand grains.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are a few areas of soils that have soft sandstone at a depth of 40 to 60 inches. Also included are a few intermingled areas of Bosville and Larue soils. The included soils make up about 15 to 25 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has low potential for crops. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is very severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help reduce runoff and control erosion.

This soil has medium potential for native grass and high potential for tame pasture. It is used mostly for

tame pasture. Bermudagrass or bahiagrass combined with clovers is the most common mixture used for tame pasture. Fertilizing increases production, and increases the quality of grass, thereby protecting the soil from erosion. The quality of all grasses can be improved by controlling weeds and brush, proper stocking, and controlling grazing.

This soil has medium potential for woodland production. The limitation is plant competition.

This soil has high potential for most urban uses and no significant limitations for septic tank absorption fields and sanitary landfills. Slope is the main limitation for small commercial buildings and sewage lagoons. Moderate shrink-swell potential in the upper part of the subsoil is the main limitation for dwellings, buildings, and roads and streets; but this limitation can be easily overcome.

This soil is in capability subclass IVe, woodland group 4o, and the Sandy Savannah range site.

11—Bernow-Romia complex, 8 to 12 percent slopes. This complex consists of areas of the well drained Bernow and Romia soils that are so intermingled that they could not be separated at the scale selected for mapping. They occur in narrow areas along the side slopes above drainageways. Areas of each soil range from 2 to 10 acres.

Bernow fine sandy loam makes up about 60 percent of each mapped area. Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsurface layer is pale brown fine sandy loam about 8 inches thick. The upper part of the subsoil, to a depth of about 50 inches, is yellowish red sandy clay loam. The lower part of the subsoil, to a depth of about 72 inches, is yellowish red sandy clay loam with vertical streaks of light gray, clean sand grains.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is high. The root zone is deep.

Romia fine sandy loam makes up about 25 percent of each mapped area. Typically, the surface layer is dark brown fine sandy loam about 6 inches thick. The subsurface layer is brown fine sandy loam about 8 inches thick. The upper part of the subsoil, to a depth of 32 inches, is yellowish red clay loam. The lower part of the subsoil is yellowish red sandy clay loam that extends to a depth of about 44 inches. Below this is soft, red sandstone.

This soil is low in natural fertility and organic matter content. It has moderate permeability, and available water capacity is medium. The root zone is deep.

Included with the soils in this complex, and making up about 15 percent of the map unit, are small areas of Bosville and Larue soils.

The soils in this complex have low potential for crops. Slope and the severe erosion hazard are the main limitations. These soils are best suited to permanent vegetation.

These soils have medium potential for native grass and tame pasture. Bermudagrass or bahiagrass is the most common mixture used for tame pasture. The quality of grasses can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by fire. Fertilizing increases plant growth and the quality of grass, thereby protecting the soil from erosion.

These soils have medium potential for woodland production. They have no significant limitation for woodland use and management. Trees can be maintained or improved by protecting against damage by fire, planting suitable species, removing or controlling inferior species, and selectively harvesting them on a planned schedule.

These soils have medium potential for most urban uses. Slope is the main limitation for sewage lagoons, septic tank absorption fields, area sanitary landfills, dwellings, small commercial buildings, and roads and streets.

This complex is in capability subclass VIe. The Bernow part is in woodland group 4o and Romia part in woodland group 4o. This complex is in the Sandy Savannah range site.

12—Bernow soils, gullied. This map unit consists of deep, well drained, very gently sloping to sloping soils. Slopes are mostly 2 to 8 percent. These soils are on narrow ridges, crests, and side slopes. Most areas are 10 to 100 acres.

Gullies caused by water erosion range from 200 to 400 feet apart, 1 foot to 5 feet deep, and 10 to 20 feet across. Between gullies, the surface layer has been removed by erosion in about 50 percent of the area. In about 20 percent of the area, the original surface layer and material from the upper part of the subsoil have been mixed by past cultivation. In these areas, the present surface layer is fine sandy loam, loamy fine sand, and sandy clay loam.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown fine sandy loam about 8 inches thick. The upper part of the subsoil, to a depth of about 34 inches, is yellowish brown sandy clay loam. The lower part of the subsoil, to a depth of about 65 inches, is yellowish brown sandy clay loam with gray mottles and vertical streaks of light gray, clean fine sand grains.

Included with these soils in mapping are areas of Romia and Bosville soils. These included soils make up about 15 percent of this map unit, but separate areas are generally less than 5 acres.

Bernow soils are low in natural fertility and organic matter content. They are medium acid or slightly acid in the surface layer, except where limed. Permeability is moderate, and available water capacity is high. The root zone is deep.

These soils have low potential for cultivated crops. The main limitation is a very severe erosion hazard. They have medium potential for native grass and tame pasture plants. The main concerns of management are the severe erosion hazard and the maintenance of tilth and fertility. Cultivated areas need to be returned to such permanent vegetation as tame pasture plants, native grasses, or trees in order to reduce soil erosion. Fertilizing, diverting overhead water, and shaping gully banks are needed for the successful establishment of tame pasture plants. The quality and quantity of all grasses can be maintained or improved by proper grazing, controlling weeds or brush, and protecting against damage by fire.

These soils have low potential for trees. Areas suitable for trees can be planted to shortleaf pine or loblolly pine. The quality of trees can be maintained by protecting against damage by fire, by thinning, and by selectively harvesting on a planned schedule.

These soils have medium potential for most urban uses. The gullies need to be shaped and filled in some areas. Moderate shrink-swell potential in the upper part of the subsoil is the main limitation for dwellings, small commercial buildings, and roads and streets; but this limitation can be easily overcome.

These soils are in capability subclass VIe, woodland group 4c, and the Eroded Sandy Savannah range site.

13—Bigfork-Yanush association, steep. This association consists of moderately deep and deep soils that are in a regular and repeating pattern. The landscape is mainly a series of rounded knobs or low ridges that are in a northeast to southwest direction, which is the direction of outcrops of chert and novaculite bedrock. Most areas have narrow, sharp, rounded ridges; steep, V-shaped side slopes; and narrow flood plains. Slope gradients range from about 15 to 45 percent. Bigfork soils are on the ridges, and Yanush soils are on the side slopes. Bigfork soils formed in material weathered from chert and novaculite. Yanush soils formed in colluvial outwash material. The areas are mostly parallel to the ridges in long delineations that range from 200 to 3,000 acres. Areas of each soil range from 2 to 20 acres.

The moderately deep Bigfork soils make up 60 percent of the association. Typically, the surface layer is grayish brown cherty silt loam about 5 inches thick. The subsoil is brown cherty silty clay loam to a depth of about 35 inches. Below this is tilted, hard chert.

Bigfork soils are low in natural fertility and organic matter content. They are slightly acid to strongly acid in the surface layer. Permeability is moderate, and available water capacity is low. The root zone is moderately deep.

Yanush soils make up 30 percent of the association. Typically, the surface layer is dark brown, coarse cherty silt loam about 7 inches thick. The subsurface layer is pale brown, coarse cherty silt loam to a depth of about 13 inches. The upper part of the subsoil is dark reddish brown very cherty silty clay loam to a depth of about 34 inches. The lower part of the subsoil is yellowish red very cherty silty clay loam to a depth of 66 inches.

Yanush soils are low in natural fertility and organic matter content. They are medium acid or slightly acid in the surface layer. Permeability is moderate and available water capacity is medium. The root zone is deep.

Included with this complex in mapping are areas of exposed bedrock and soils that are similar to Bigfork soils except depth to bedrock is less than 20 inches. Also included are narrow areas of Rexor and Dela soils. The included areas make up about 10 percent of the map unit.

The soils in this association have low potential for crops because of steep slopes and rock fragments. They have a very severe erosion hazard. Most areas of these soils are used for woodland or grazing by cattle. The potential for tame pasture is low because of steep slopes, low available water capacity, and the high content of rock fragments. These soils are better suited to native vegetation. Management concerns include proper stocking, controlled grazing, and weed and brush control.

The soils in this association have low potential for woodland. Shortleaf pine and southern red oak are important trees. The soils have steep slopes, stones, and coarse chert fragments that restrict equipment use.

The soils in this association have low potential for urban use. Slope is a limitation for all urban uses. Moderate depth to rock is also a limitation in areas of Bigfork soils.

This association is in capability subclass VIIs, woodland group 5f, and the Steep Chert Savannah range site.

14—Boggy fine sandy loam. This deep, somewhat poorly drained, nearly level soil is on narrow flood plains in wooded areas. Slopes are smooth and slightly concave. Most areas are 25 to 130 acres, but some are 15 acres.

Typically, the surface layer is dark grayish brown, light brownish gray, and gray fine sandy loam about 16 inches thick. Below this, to a depth of about 72 inches, are stratified layers of dark brownish gray or gray loam with mottles in shades of brown.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer. Permeability is moderate, and available water capacity is high. This soil is subject to frequent flooding and has a water table within a depth of 2 feet of the surface during spring and winter. The root zone is deep.

Included with this soil in mapping are a few intermingled areas of Dela and Rexor soils. The included soils make up about 10 percent of this map unit, but separate areas are generally less than 3 acres.

This soil has low potential for crops because of frequent flooding and a high water table. It has medium potential for tame pasture. Bermudagrass, fescue, or ba-

hiagrass combined with clover is the most common mixture used for tame pasture. This soil has high potential for woodland production. The main limitation in using equipment is frequent flooding. This soil has low potential for urban use. Flooding and wetness are the main limitations.

This soil is in capability subclass Vw and woodland group 2w; it was not assigned to a range site.

15—Bosville fine sandy loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on broad areas of the uplands. Slopes are smooth and slightly convex. Most areas are 10 to 20 acres, but some are about 15 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The subsurface layer is pale brown fine sandy loam about 3 inches thick. The subsoil, to a depth of 72 inches, is yellowish red and red clay with mottles in shades of yellow, brown, or gray.

This soil is low in natural fertility and organic matter content. It is strongly acid or medium acid in the surface layer, except where it has been limed. Permeability is very slow, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep. A water table is at a depth of 1 foot to 2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Bernow, Hamden, and Romia soils. The included soils make up about 10 to 20 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has medium potential for row crops and small grain. Good tilth can be obtained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases production and improves the quality of grass, thereby protecting the soil from erosion. The quality of all grasses can be maintained or improved by controlling weeds and brush, proper stocking, and preventing fires.

This soil has medium potential for woodland production. The main management concerns are seedling mortality and equipment limitations.

This soil has low potential for urban uses because of high shrink-swell potential, low strength, high clay content, very slow permeability, and wetness. Special design is needed to overcome these limitations.

This soil is in capability subclass IIIe, woodland group 4c, and the Sandy Savannah range site.

16—Bosville fine sandy loam, 3 to 5 percent slopes. This deep, moderately well drained, gently sloping soil is on broad areas of the uplands. Slopes are smooth and slightly convex. Most areas are 20 to 50 acres, but some are about 15 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. The subsoil, to a depth of 72 inches, is yellowish red and red clay with mottles in shades of brown or gray.

This soil is low in natural fertility and organic matter content. It is strongly acid or medium acid in the surface layer, except where it has been limed. Permeability is very slow, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep. A water table is at a depth of 1 foot to 2 feet during winter and spring.

Included with this soil in mapping are areas of Bernow and Romia soils. The included soils make up about 15 to 20 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has medium potential for row crops and small grain. Good tilth can be obtained by returning crop residue to the soil. The erosion hazard is severe, and intensive management is needed to prevent it where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. The quality of grass can be maintained or improved by controlling brush, applying fertilizer, and using suitable grazing practices.

This soil has medium potential for woodland production. The main management concerns are seedling mortality and equipment limitations.

This soil has low potential for urban use because of high shrink-swell potential, low strength, high clay content, wetness, and very slow permeability. Special design is needed to overcome these limitations.

This soil is in capability subclass IVe, woodland group 4c, and the Sandy Savannah range site.

17—Bosville fine sandy loam, 5 to 12 percent slopes. This deep, moderately well drained, sloping to strongly sloping soil is on broad areas of the uplands. Slopes are smooth and slightly convex. Most areas are 100 to 200 acres, but some are 5 to 10 acres.

Typically, the surface layer is dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. The subsoil, to a depth of 72 inches, is yellowish red and red clay with mottles in shades of brown or gray.

This soil is low in natural fertility and organic matter content. It is strongly acid or medium acid in the surface

layer, except where it has been limed. Permeability is very slow, and available water capacity is high. The root zone is deep. A water table is at a depth of 1 foot to 2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Bernow and Romia soils. The included soils make up about 30 to 40 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has low potential for crops. The erosion hazard is very severe where cultivated crops are grown. This soil is best suited to native or tame grass pasture.

This soil has medium potential for hay, pasture, and native grass. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Native and tame pasture grasses can be maintained or improved by controlling brush and by using suitable grazing practices.

This soil has medium potential for woodland production. The main management concerns are seedling mortality and equipment limitations. Woodland can be maintained or improved by protecting against damage by fire, controlling inferior species of trees by planting suitable trees, and selectively harvesting on a planned schedule.

This soil has low potential for urban use because of high shrink-swell potential, low strength, high clay content, wetness, slope, and very slow permeability. Special design is needed to overcome these limitations.

This soil is in capability subclass VIe, woodland group 4c, and the Sandy Savannah range site.

18—Burleson clay, 0 to 1 percent slopes. This deep, moderately well drained, nearly level soil is on uplands. Slopes are smooth or slightly concave. Most areas are 35 to 100 acres, but some are about 15 acres.

Typically, the surface layer is black clay about 24 inches thick. The next layer, to a depth of about 40 inches, is gray clay. Below this to a depth of about 72 inches is olive yellow clay.

This soil is high in natural fertility and organic matter content. It shrinks and develops wide cracks when dry and expands greatly when wet. It is slightly acid to moderately alkaline in the surface layer. Permeability is very slow, and available water capacity is high. This soil is difficult to till because of the high clay content in the surface layer. The root zone is deep.

Included with this soil are a few intermingled areas of Heiden and Durant soils. The included soils make up about 15 percent of the map unit, but individual areas are generally less than 3 acres.

This soil has high potential for row crops and small grain (fig. 1). A management system that increases water intake, improves soil structure, prevents surface crusting, and maintains fertility promotes high yields. A simple drainage system is generally needed to improve surface drainage. In a few areas, diversion terraces on long slopes can be used to reduce soil erosion.

This soil has high potential for native grass and tame pasture. Droughtiness limits pasture production during the summer. The quality of grasses can be maintained or improved by proper grazing, controlling weeds, and protecting against damage by fire.

This soil has low potential for woodland and for most urban uses. High shrink-swell potential is the main limitation for dwellings, small commercial buildings, and roads and streets. Special design is needed for foundations and road beds to prevent cracking. The use of this soil for septic tank absorption fields is limited because of very slow permeability.

This soil is in capability subclass IIw, It was not assigned to a woodland group. It is in the Blackclay Prairie range site.

19—Burleson clay, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on uplands. The slopes are smooth and slightly convex. Most areas are more than 100 acres, but some are 15 acres.

Typically, the surface layer is black clay about 24 inches thick. The next layer, to a depth of about 48 inches, is dark gray clay. Below this is olive yellow clay that extends to a depth of about 73 inches.

This soil is high in natural fertility and organic matter content. It shrinks and develops wide cracks when dry and expands greatly when wet. It is slightly acid to moderately alkaline in the surface layer. Permeability is very slow, and available water capacity is high. This soil is difficult to till because of the high clay content in the surface layer. The root zone is deep.

Included with this soil are intermingled areas of Heiden and Durant soils. Heiden soils make up about 20 percent and Durant soils make up about 10 percent of this map unit. Separate areas of these included soils are generally less than 3 acres.

This soil has high potential for row crops and small grain. The erosion hazard is moderate on areas used for clean tilled crops. For continuously high yields, a management system is needed to provide proper fertilization and to return large amounts of plant residue to improve tilth, reduce surface crusting, increase water intake rate, and prevent erosion. Terracing, contour farming, and using cover crops help to control erosion (fig. 2).

This soil has high potential for native grass and tame pasture. Droughtiness limits pasture production during the summer. Tame pasture grasses can be improved by controlling brush, fertilizing, and using suitable grazing practices.

This soil has low potential for woodland and most urban uses. High shrink-swell potential is the main limitation for dwellings, small commercial buildings, and roads and streets. Special design is needed for foundations and road beds to prevent cracking. The use of this soil for septic tank absorption fields is limited because of very slow permeability.

This soil is in capability subclass IIe. It was not assigned to a woodland group. It is in the Blackclay Prairie range site.

20—Carnasaw-Clebit complex, 3 to 5 percent slopes. This map unit consists of small areas of the Carnasaw soil and the Clebit soil that are so intermingled that they could not be separated at the scale selected for mapping. They are well drained, deep and shallow soils on smooth side slopes and smooth ridges. The mapped areas range from 20 to 200 acres. Areas of each soil are 3 to 20 acres.

The deep Carnasaw fine sandy loam makes up about 70 percent of each mapped area. Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown fine sandy loam about 3 inches thick. The subsoil, to a depth of about 48 inches, is red clay. Below this is soft shale.

The Carnasaw soil is low in natural fertility and organic matter content. It is strongly acid or medium acid in the surface layer. Permeability is slow, and available water capacity is medium. The root zone is deep.

The shallow Clebit gravelly fine sandy loam makes up about 20 percent of each mapped area. Typically, the surface layer is brown gravelly fine sandy loam about 3 inches thick. The subsoil is pale brown gravelly fine sandy loam to a depth of about 18 inches. Below this is hard sandstone.

The Clebit soil has low natural fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Included with this complex in mapping are Hartsells soils and areas of soils that have a profile similar to the Carnasaw soil, but depth to shale is more than 60 inches. Also included are soils that have a profile similar to the Carnasaw soil and have gray mottles in the upper part of the subsoil. These soils make up about 10 percent of the mapped area.

The soils in this complex have medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe. Minimum tillage, using cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

These soils have medium potential for tame pasture and native grass. Native or tame pasture grasses can be maintained or improved by controlling brush, protecting against damage by fire, and using suitable grazing practices. Fertilizing tame pasture grasses increases production, thereby protecting the soil from erosion.

These soils have medium potential for woodland. The main management concerns are the erosion hazard, seedling mortality, and equipment limitations.

These soils have low potential for most urban uses. Slow permeability of the Carnasaw soil is a limitation for septic tank absorption fields. This can be overcome by increasing the size of the absorption area. The main limitation for most urban uses is the shallow depth to rock of the Clebit soil.

This complex is in capability subclass IVe. The Carnasaw part is in woodland group 4o, and the Sandy Savannah range site. The Clebit part is in the woodland group 5d and the Shallow Savannah range site.

21—Carnasaw-Clebit complex, 5 to 8 percent slopes. This map unit consists of small areas of the Carnasaw soil and the Clebit soil that are so intermingled that they could not be separated at the scale selected for mapping. They are well drained, deep and shallow soils on smooth side slopes and smooth ridges. The mapped areas range from 20 to 200 acres. Areas of each soil are 3 to 20 acres.

The deep Carnasaw fine sandy loam makes up about 65 percent of each mapped area. Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown fine sandy loam about 5 inches thick. The subsoil, to a depth of 46 inches, is red clay. Below this is soft shale.

The Carnasaw soil is low in natural fertility and organic matter content. It is strongly acid or medium acid in the surface layer. Permeability is slow, and available water capacity is medium. The root zone is deep.

The shallow Clebit gravelly fine sandy loam makes up about 25 percent of each mapped area. Typically, the surface layer is brown gravelly fine sandy loam about 3 inches thick. The subsoil is yellowish brown gravelly loam about 13 inches thick. Below this is tilted, hard sandstone.

The Clebit soil is low in natural fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Included with this complex in mapping are areas of soils that have a profile similar to the Carnasaw soil, but depth to shale is more than 60 inches or less than 40 inches. Also included are soils that have a profile similar to the Carnasaw soil but have gray mottles in the upper part of the subsoil. These soils make up about 10 percent of the area.

The soils in this map unit have low potential for crops because of a severe erosion hazard. They have medium potential for pasture and native grass. Native or tame pasture grasses can be maintained or improved by controlling brush, protecting against damage by fire, and using suitable grazing practices. Fertilizing tame pasture grasses increases production, thereby protecting the soil from erosion.

The soils in this map unit have medium potential for woodland. Woodland can be maintained by protecting against damage by fire, planting suitable trees, controlling inferior species of trees, and selectively harvesting on a planned schedule.

These soils have low potential for most urban uses. Slow permeability of the Carnasaw soil is a limitation for septic tank absorption fields. This can be overcome by increasing the size of the absorption area. The main limitation for most urban uses is the shallow depth to rock of the Clebit soil.

This complex is in capability subclass VIe. The Carnasaw part is in woodland group 4o and the Sandy Savannah range site. The Clebit part is in woodland group 5d and the Shallow Savannah range site.

22—Carnasaw-Clebit association, moderately steep. This association consists of deep and shallow soils that are in a regular and repeating pattern. The landscape is mainly low hills and narrow valleys. Elevation ranges from 100 to 300 feet. Slopes range from 8 to 25 percent. The Carnasaw soils are mainly on the north and west slopes, intermingled with occasional areas of the shallow Clebit soils and outcrops of rock across the side slopes. The Carnasaw soils also occupy a dominant part of the south and east slopes, but the shallow Clebit soils and outcrops of rock make up a significant part of the area. Boulders and stones are mainly on the south and east slopes. The areas are parallel to the ridges in long delineations and are 100 to several thousand acres.

The deep Carnasaw soils make up about 60 percent of this association. Typically, the surface layer is brown gravelly loam about 4 inches thick. The subsurface layer is pale brown loam about 3 inches thick. The upper part of the subsoil, to a depth of 24 inches, is red clay. The lower part of the subsoil, to a depth of 42 inches, is yellowish red clay. Below this is soft shale (fig. 3).

The Carnasaw soils have low natural fertility and organic matter content. They are strongly acid or medium acid in the surface layer. Permeability is slow, and available water capacity is medium. The root zone is deep.

The shallow Clebit soils make up about 20 percent of this association. Typically, the surface layer is brown stony fine sandy loam about 5 inches thick. The subsoil is strong brown very gravelly and stony fine sandy loam to a depth of about 16 inches. Below this is hard, tilted sandstone.

The Clebit soils have low natural fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Included with this association in mapping are soils on foot slopes that have a profile similar to Carnasaw soils, but the depth to shale is more than 60 inches. Also included are soils on ridges that have a profile similar to Carnasaw soils, but the depth to shale is slightly less than 40 inches. These soils make up about 12 percent. Also included in mapping, and making up about 8 percent of the mapped area, are outcrops of rock across the side slopes.

The soils in this association have low potential for field crops. They have a very severe erosion hazard, moderately steep slopes, and stone fragments in the soil and on the surface. These soils have low potential for native grass and tame pasture because of stoniness. Where it is practical to remove surface stones, potential can be improved. These soils have low potential for woodland. Shortleaf pine and oaks are the dominant trees. Stones and slopes are limitations to management and equipment use.

These soils have very low potential for most urban uses. Slope, the content of rocks and stones, and shallow depth to rock of Clebit soils are the main limitations for most urban uses.

This association is in capability subclass VIIs. The Carnasaw part is in woodland group 4x and the Sandy Savannah range site. The Clebit part is in the woodland group 5x and the Shallow Savannah range site.

23—Carnasaw-Clebit association, steep. This association consists of deep and shallow soils that are in a regular and repeating pattern. The landscape is mainly low hills and narrow valleys. Elevation ranges from 100 to 300 feet. Slopes range from 25 to 45 percent. The Carnasaw soils are mostly on the north and west slopes, intermingled with occasional areas of the shallow Clebit soils and outcrops of rock across the side slopes. The Carnasaw soils also occupy a dominant part of the south and east slopes, but the shallow Clebit soils and outcrops of rock make up a significant part of the area. Boulders and stones are mainly on the south and east slopes. The areas are parallel to the ridges in long delineations and are 100 to several thousand acres.

The deep Carnasaw soils make up about 50 percent of this association. Typically, the surface layer is very dark grayish brown stony fine sandy loam about 4 inches thick. The subsurface layer is pale brown stony loam about 10 inches thick. The upper part of the subsoil, to a depth of 37 inches, is yellowish red clay. The lower part of the subsoil, to a depth of about 42 inches, is reddish yellow clay. Below this is soft shale.

The Carnasaw soils have low natural fertility and organic matter content. The surface layer is strongly acid or medium acid. Permeability is slow, and available water capacity is medium. The root zone is deep.

The shallow Clebit soils make up about 20 percent of this association. Typically, the surface layer is very dark grayish brown stony fine sandy loam about 5 inches thick. The subsoil is pale brown very gravelly and stony fine sandy loam to a depth of about 16 inches. Below this is hard, tilted sandstone.

The Clebit soils have low natural fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Included with this association in mapping are footslope areas of soils that have a profile similar to Carnasaw soils, but the depth to shale is more than 60 inches. Also included are soils on ridges. They have a profile similar

to Carnasaw soils, but the depth to shale is slightly less than 40 inches. These soils make up about 10 percent of the mapped area. Also included in mapping, and making up about 10 percent of the mapped area, are outcrops of rock across the side slopes. Soils that have a profile similar to the Carnasaw soils but have gray mottles in the upper part of the subsoil make up about 10 percent of the area.

The soils in this association have low potential for field crops. They have a severe erosion hazard, steep slopes, and stones. These soils have low potential for native grass and tame pasture because of stoniness and steep slopes. Where it is practical to remove stones from the surface, potential can be improved. The soils in this association have low potential for woodland. Shortleaf pine and oaks are the dominant trees. Stones and steep slopes are limitations to management and equipment use. The soils in this association have very low potential for most urban uses. Rocks and stones, slope, and shallow depth to rock of the Clebit soils are the main limitations for most urban uses.

This association is in capability subclass VIIs, woodland group 5x, and the Savannah Breaks range site.

24—Chigley fine sandy loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on broad ridges of uplands. Slopes are smooth and slightly convex. Most areas are 20 to 40 acres, but some are smaller.

Typically, the surface layer is very dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is pale brown gravelly fine sandy loam about 4 inches thick. The upper part of the subsoil, to a depth of 34 inches, is strong brown and red clay with mottles in shades of brown and red. The lower part of the subsoil, to a depth of 50 inches, is yellowish brown gravelly clay with mottles in shades of red, yellow, brown, or gray. The underlying material to a depth of 72 inches is brownish yellow gravelly clay loam. Below 72 inches is hard granite bedrock.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderately slow, and available water capacity is high. The root zone is deep. A water table is at a depth of 3 to 4 feet during winter and spring.

Included with this soil in mapping are soils that have a fine sandy loam subsoil and are about 40 inches deep to bedrock. Also included are a few intermingled areas of Agan soils. The included soils make up about 20 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Native and tame pasture grasses can be maintained or improved by controlling brush, protecting against damage by fire, and using suitable grazing practices. Fertilizing tame pasture grasses will increase production, thereby protecting the soil from erosion. This soil has low potential for woodland.

This soil has low potential for most urban uses. Wetness and moderately slow permeability are the limitations for septic tank absorption fields. Low strength is the main limitation for dwellings, small commercial buildings, and roads and streets.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Sandy Savannah range site.

25—Chigley-Rock outcrop complex, 1 to 12 percent slopes. This complex consists of small areas of granite Rock outcrop and the very gently sloping to strongly sloping Chigley soil that are so intermingled that they could not be separated at the scale selected for mapping. This complex is on uplands. Areas of each component are 1 acre to 5 acres.

Chigley gravelly sandy loam makes up about 50 percent of each mapped area. Typically, the surface layer is very dark grayish brown gravelly sandy loam about 6 inches thick. The subsurface layer is pale brown gravelly sandy loam about 4 inches thick. The subsoil, to a depth of about 45 inches, is yellowish red clay with mottles in shades of red, yellow, brown, or gray. The underlying material, to a depth of 60 inches or more, is gravelly clay loam.

This soil is low in natural fertility and organic matter content. The surface layer is medium acid or slightly acid. Permeability is moderately slow, and available water capacity is high. The root zone is deep. A water table is at a depth of 3 to 4 feet during winter and spring.

Rock outcrops of granite make up about 30 percent of this map unit. The outcrops of rock are intermingled with areas of the Chigley soil.

Included with this soil in mapping are areas of a similar soil that makes up about 20 percent of each mapped area. This soil has a less clayey subsoil and has hard granite bedrock at a depth of less than 40 inches.

The Chigley soil has low potential for crops, native grass, and tame pasture. Outcrops of rock in an irregular pattern are a limitation that is very difficult to overcome. Native grass can be maintained or improved by controlling brush, protecting against damage by fire, and using suitable grazing practices.

The Chigley soil has low potential for woodland. Strongly sloping areas create an erosion hazard, and the

use of logging equipment is restricted because of large stones and outcrops of rock.

This soil has low potential for most urban uses. Outcrops of rock are the main feature that limits urban development. In areas of the Chigley soil, low strength and slope are the main limitations for dwellings, small commercial buildings, and roads and streets.

This complex is in capability subclass VIIe. It was not assigned to a woodland group. The Chigley part is in the Sandy Savannah range site, and the Rock outcrop part was not assigned to a range site.

26—Claremore-Catoosa complex, 1 to 3 percent slopes. This complex consists of areas of the Claremore soil and the Catoosa soil that are so intermingled that they could not be separated at the scale selected for mapping. These soils are on broad, smooth areas of the uplands. Areas of each soil are 1 to 5 acres.

Claremore loam makes up about 50 percent of each mapped area. Typically, the surface layer is dark brown loam about 8 inches thick. The subsoil is dark reddish brown clay loam that extends to a depth of about 18 inches. Below this is hard limestone.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid to neutral. Permeability is moderate, and available water capacity is low. The root zone is shallow.

Catoosa loam makes up about 40 percent of each mapped area. Typically, the surface layer is dark brown loam about 12 inches thick. The subsoil is brown clay loam that extends to a depth of about 32 inches. Below this is hard limestone.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep.

Included with this complex in mapping are a few small areas of a soil that is similar to the Catoosa soil, but it is more than 40 inches deep to hard limestone bedrock.

The soils in this complex have medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

These soils have medium potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Management concerns are controlling weeds, proper stocking, and preventing fires. Fertilizing tame pasture grasses increases forage production, thereby protecting the soil from erosion.

The soils in this complex have low potential for woodland. Depth to bedrock is a limitation.

These soils have low potential for most urban uses. The shallow depth to rock in areas of the Claremore soil is the main limitation for most urban uses.

This complex is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

27—Counts loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on uplands in wooded areas. Slopes are smooth. Most areas are 15 to 40 acres.

Typically, the surface layer is dark grayish brown loam about 8 inches thick. The subsurface layer is grayish brown loam about 7 inches thick. The upper part of the subsoil, to a depth of about 50 inches, is yellowish brown and brownish yellow clay with red and light gray mottles. The lower part of the subsoil, to a depth of 70 inches, is yellowish brown clay with gray mottles.

This soil is low in fertility and organic matter content. The surface layer is strongly acid or medium acid, except where it has been limed. Permeability is very slow, and available water capacity is high. The root zone is deep. A water table is at a depth of 1 foot to 2 feet during winter and spring.

Included with this soil in mapping and making up about 6 percent of the mapped area, are soils on mounds in which the combined thickness of the surface and subsurface layers is 16 to 30 inches. These soils have a transition layer of clay loam about 8 inches deep to the clay subsoil. Also included are a few intermingled areas of Parsons and Lightning soils. The included soils make up about 10 percent of the map unit, but separate areas are generally less than 5 acres.

This soil has medium potential for row crops and small grain. Its potential is limited because of wetness in the winter and spring and droughtiness in the summer. The erosion hazard is slight where cultivated crops are grown. Minimum tillage, cover crops, contour farming, and returning large amounts of crop residue to the soil help to reduce runoff and to control erosion.

The potential for native grass and tame pasture is high. Fertilizer helps to increase forage production and the quality of tame pasture grasses. The quality of all grasses can be maintained or improved by controlling brush, preventing fires, and proper grazing.

This soil has medium potential for woodland. Trees can be maintained by protecting against damage by fire, planting suitable species, removing or controlling inferior species, and selectively harvesting trees on a planned schedule.

This soil has low potential for most urban uses. High shrink-swell potential, wetness, and low strength are limitations for most urban uses.

This soil is in capability subclass IIw, woodland group 4o, and the Loamy Savannah range site.

28—Dela fine sandy loam. This deep, moderately well drained, nearly level soil is on flood plains. Slopes are smooth. Most areas are more than 100 acres, but

long, narrow areas of about 15 acres are along small creeks.

Typically, the surface layer is brown fine sandy loam to a depth of about 8 inches and dark grayish brown fine sandy loam to a depth of about 18 inches. The underlying material to a depth of 55 inches is brown fine sandy loam and dark grayish brown loam and to a depth of 72 inches is yellowish brown very fine sandy loam.

This soil is medium in natural fertility and organic matter content. It is strongly acid to slightly acid in the surface layer. Permeability is moderately rapid, and available water capacity is medium. This soil is occasionally flooded. It has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep. A water table is at a depth of 3 to 5 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Boggy and Rexor soils. The included soils make up about 10 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has high potential for row crops and small grain (fig. 4). Good tilth can be maintained by returning crop residue to the soil. Minimum tillage and the use of cover crops help to maintain soil structure and to prevent surface crusting.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases forage production. The quality of all grasses can be maintained or improved by controlling grazing, preventing fires, controlling brush, and proper stocking. This soil has high potential for woodland production. It has no significant limitations. This soil has low potential for urban use. Flooding is the main limitation. This limitation can be reduced only by major flood control measures.

This soil is in capability subclass IIw and woodland group 2o. It was not assigned to a range site.

29—Dennis loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on prairie uplands. Slopes are smooth and slightly convex. Most areas are 40 to 80 acres, but some are 15 acres.

Typically, the surface layer is very dark grayish brown loam to a depth of 12 inches and dark brown loam to a depth of 16 inches. The upper part of the subsoil, to a depth of about 25 inches, is dark yellowish brown clay loam. The middle part of the subsoil is brown and strong brown clay with red, strong brown, and gray mottles to a depth of about 48 inches. The lower part of the subsoil is coarsely mottled, reddish yellow and gray clay that extends to a depth of about 72 inches.

This soil is high in natural fertility and organic matter content. It is slightly acid to strongly acid in the surface layer. Permeability is slow, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep. A water table is at a depth of 2 to 3 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Bates and Eram soils. These included soils make up about 10 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has high potential for crops. Good tilth can be maintained by returning large amounts of crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage and the use of cover crops help to reduce runoff and to control erosion. Terraces are not needed if sown crops are grown and if large amounts of crop residue are returned to the soil.

This soil has high potential for native grass and tame pasture. The grass can be maintained or improved by controlling grazing, protecting against damage by fire, and controlling brush. Fertilizing tame pasture grasses increases production, thereby helping to protect the soil from erosion. This soil has low potential for woodland.

This soil has low potential for most urban uses. High shrink-swell potential and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets. Wetness and slow permeability are the main limitations for septic tank absorption fields.

This soil is in capability subclass IIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

30—Dennis loam, 2 to 5 percent slopes, eroded. This deep, moderately well drained, very gently sloping to gently sloping eroded soil is on uplands in prairie areas. It has been cultivated and eroded. In about 40 percent of the area, the original surface layer and material from the upper part of the subsoil are mixed by plowing. There are a few uncrossable gullies about 300 feet apart. Rills are common between the gullies. Slopes are smooth and convex. Most areas are 20 to 80 acres, but some are 10 acres.

Typically, the surface layer is very dark grayish brown loam about 8 inches thick. The upper part of the subsoil is dark brown clay loam to a depth of about 24 inches. The lower part of the subsoil, to a depth of about 72 inches, is yellowish brown clay with mottles in shades of gray, red, or brown.

This soil is low in natural fertility and organic matter content because much of the original surface layer has been removed by erosion. The surface layer is slightly acid to strongly acid. Permeability is slow, and available water capacity is high. Surface crusting is a problem in seedbed preparation. The root zone is deep. A water table is at a depth of 2 to 3 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Bates and Eram soils. Also included are similar soils that have a brown or pale brown loam surface layer less than 10 inches thick. These inclusions make up about 30 percent of this map unit.

This soil has medium potential for row crops and small grain. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, cover crops, terraces, and returning large amounts of crop residue to the soil help to reduce runoff, increase water intake, reduce surface crusting, and control erosion.

This soil has high potential for native grass and tame pasture. The grass can be maintained or improved by preventing fires, controlling grazing, and controlling brush. This soil has low potential for woodland.

This soil has low potential for most urban uses. High shrink-swell potential and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets. Wetness and slow permeability are the main limitations for septic tank absorption fields.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

31—Dennis and Eram soils, 2 to 8 percent slopes, severely eroded. This map unit consists of very gently sloping to sloping, severely eroded upland soils. All of this map unit has been cultivated. The original surface layer has been partially or completely removed by sheet and rill erosion on about 50 percent of the area. A few gullies are 1 foot to 6 feet deep and 10 to 20 feet wide. This map unit consists of Dennis and Eram soils, which are closely associated but in an irregular pattern. Individual areas of each of the soils are large enough to separate, but because of present and predicted use, they were not separated. Both soils are in most mapped areas, but there are a few areas in which one or the other does not occur.

A typical area of this map unit is about 55 percent Dennis soils, 30 percent Eram soils, and about 5 percent each of Bates, Coweta, and Parsons soils. The well drained Bates and Coweta soils are on or near the hill crest above Dennis and Eram soils. The somewhat poorly drained Parsons soils are on nearly level areas just below Dennis and Eram soils.

Typically, Dennis soils have a very dark grayish brown loam surface layer about 12 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is yellowish brown clay loam. The lower part of the subsoil is mottled, yellowish brown clay that extends to a depth of about 72 inches.

Dennis soils are low in natural fertility and organic matter content because of erosion. They are medium acid to very strongly acid. Permeability is slow, and available water capacity is high. These soils have poor tilth because they have been eroded. They have a deep root zone. A water table is at a depth of 2 to 3 feet during winter and spring.

Typically, Eram soils have a surface layer of very dark grayish brown clay loam about 10 inches thick. The subsoil is olive brown clay to a depth of about 32 inches. Below this is soft gray shale.

The Eram soils are low in natural fertility and organic matter because of erosion. They are medium acid or slightly acid. Permeability is slow, and available water capacity is medium. These soils have poor tilth because of erosion. They have a moderately deep root zone. A water table is at a depth of 2 to 3 feet during winter and spring.

This map unit has very low potential for farming. The soils are severely eroded and have a very severe erosion hazard if the grass cover is removed.

This map unit has low potential for tame pasture and native grasses. The soils should be returned to permanent vegetation. Tame pasture grass or native grass can be established if gullies are sloped, runoff from higher areas is diverted, critical areas are mulched, and fertilizer is applied.

This map unit has low potential for woodland and for most urban uses. Low strength and high shrink-swell potential are the main limitations for dwellings, small commercial buildings, and roads and streets. In addition, gullies need to be shaped and smoothed.

These soils are in capability subclass VIe. They are not assigned to a woodland group. They are in the Eroded Prairie range site.

32—Durant loam, 1 to 3 percent slopes. This deep, moderately well drained, very gently sloping soil is on prairie uplands. Slopes are smooth and convex. Most areas are more than 100 acres, but some are 15 acres.

Typically, the surface layer is very dark brown loam about 9 inches thick. The upper part of the subsoil is dark brown silty clay loam about 3 inches thick. The middle part of the subsoil is mottled, olive brown clay to a depth of about 24 inches. The lower part of the subsoil is mottled, light olive brown clay that extends to a depth of about 70 inches.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid. Permeability is very slow, and available water capacity is high. This soil has good tilth and a deep root zone.

Included with this soil in mapping are a few intermingled areas of Burleson and Heiden soils. These included soils make up about 10 percent of the map unit, but separate areas are generally less than 3 acres.

This soil has medium potential for row crops and small grain. The erosion hazard is moderate where cultivated crops are grown. Returning crop residue to the soil, minimum tillage, cover crops, and terraces help to reduce runoff and to control erosion.

This soil has high potential for tame pasture and native grass. The quality of grass can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by fire. Fertilizing tame pasture grasses increases the amount of forage.

This soil has low potential for woodland. It has low potential for most urban uses. High shrink-swell potential and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets.

This soil is in capability subclass IIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

33—Durant loam, 1 to 3 percent slopes, eroded. This deep, moderately well drained, very gently sloping eroded soil is on prairie uplands. Part of the original surface layer has been removed by erosion in about 60 percent of the area. In about 25 percent of the area, the original surface layer and material from the upper part of the subsoil have been mixed by tillage. Rills caused by water erosion are common throughout the area. A few gullies are present. Slopes are long and convex. Most areas are 10 to 40 acres, but some are smaller.

Typically, the surface layer is very dark grayish brown loam about 6 inches thick. The upper part of the subsoil is dark brown clay loam about 10 inches thick. The middle part of the subsoil, to a depth of about 54 inches, is mottled, olive brown clay. The lower part of the subsoil is mottled, light olive brown clay that extends to a depth of about 70 inches.

This soil is medium in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer. Permeability is very slow, and available water capacity is high. This soil has fair tilth, and the root zone is deep.

Included with this soil in mapping are soils that are similar but have a silt loam surface layer that changes abruptly to a gray clay subsoil. Also included are a few intermingled areas of Burleson and Dennis soils. These included soils make up about 15 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has low potential for crops. Its potential is limited by the loss of the surface layer and fertility because of erosion. Surface crusting and very slow water intake are also limitations. The erosion hazard is moderate where cultivated crops are grown. Cover crops, minimum tillage, terraces, farming on the contour, and returning large amounts of crop residue to the soil help to reduce surface crusting, improve water intake, and prevent erosion. Because of the erosion hazard, close sown crops that produce large amounts of residue are best suited to this soil.

This soil has high potential for native grass and tame pasture. The quality of grass can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by fire. Fertilizing tame pasture grasses increases the amount of forage. This soil has low potential for woodland.

This soil has low potential for most urban uses. High shrink-swell potential and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

34—Endsaw-Hector complex, 2 to 5 percent slopes. This complex consists of areas of the Endsaw soil and the Hector soil that are so intermingled that they could not be separated at the scale selected for mapping. These deep and shallow, well drained, gently sloping soils are on smooth hilltops and side slopes. Areas of each soil are 3 to 10 acres.

Endsaw fine sandy loam makes up about 50 to 60 percent of each mapped area. Typically, the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is pale brown fine sandy loam about 3 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is red clay. The lower part of the subsoil, to a depth of about 42 inches, is mottled, red and grayish brown clay. Below this is olive brown soft shale.

This soil is low in natural fertility and organic matter content. The surface layer is strongly acid or medium acid. Permeability is slow, and available water capacity is high. The root zone is deep.

Hector fine sandy loam makes up about 20 to 30 percent of each mapped area. Typically, the surface layer is brown fine sandy loam about 3 inches thick. The subsurface layer is pale brown fine sandy loam about 3 inches thick. The subsoil is strong brown loam that extends to a depth of about 18 inches. Below this is hard sandstone.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout the profile. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Included with this complex in mapping are intermingled areas of Hartsells soils, which make up 10 to 20 percent of the map unit. Outcrops of sandstone make up about 1 percent.

This complex has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This complex has medium potential for tame pasture and low potential for native grass. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. The quality of all grasses can be maintained or improved by proper stocking and grazing, controlling brush, and preventing fires.

This complex has low potential for woodland production. The main concern of woodland management is seedling mortality.

This complex has low potential for most urban uses. The shallow depth to rock on the Hector soil is the main limitation for dwellings, small commercial buildings, roads

and streets, septic tank absorption fields, sewage lagoons, and trench sanitary landfills.

This complex is in capability subclass IVe. The Endsaw part is in woodland group 5o and the Sandy Savannah range site. The Hector part is in the woodland group 5d and the Shallow Savannah range site.

35—Endsaw-Hector complex, 5 to 8 percent slopes. This complex consists of areas of the Endsaw soil and the Hector soil that are so intermingled that they could not be separated at the scale selected for mapping. These deep and shallow, well drained, sloping soils are on side slopes and ridgetops. Areas of each soil are 3 to 10 acres.

Endsaw fine sandy loam makes up about 65 to 75 percent of each mapped area. Typically, the surface layer is very dark grayish brown fine sandy loam about 2 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. It contains about 10 percent cobbles and stones. The upper part of the subsoil, to a depth of about 20 inches, is red clay. The lower part of the subsoil, to a depth of about 36 inches, is mottled, reddish brown clay. Below this is olive gray soft shale.

This soil is low in natural fertility and organic matter content. The surface layer is strongly acid or medium acid. Permeability is slow, and available water capacity is high. The root zone is deep.

Hector fine sandy loam makes up about 15 to 30 percent of each mapped area. Typically, the surface layer is very dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. The subsoil is strong brown loam to a depth of about 14 inches. Below this is hard sandstone.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout the profile. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Included with this complex in mapping are a few small areas of Hartsells soils. Outcrops of sandstone make up about 2 percent of this complex.

The soils in this complex have low potential for row crops and small grain. Slope, rock outcrops, and shallow depth to bedrock are limitations that are very difficult to overcome. The soils are best suited to grass or woodland.

The soils in this complex have low potential for native grass and medium potential for tame pasture. The stones on the surface are not too numerous to prevent preparation of a seedbed or the use of maintenance equipment. Bermudagrass or bahiagrass combined with clover is the most common mixture for tame pasture. Controlling brush, proper grazing, and protecting against damage by fire are practices that maintain or improve the quality and quantity of all grasses.

The soils in this complex have low potential for woodland. The main concern of management is seedling mortality.

The soils in this complex have low potential for most urban uses. The shallow depth to rock in the Hector soil is the main limitation for dwellings, small commercial buildings, roads and streets, septic tank absorption fields, sewage lagoons, and trench sanitary landfills.

This complex is in capability subclass VIe. The Endsaw part is in woodland group 5o and the Sandy Savannah range site. The Hector part is in woodland group 5d and the Shallow Savannah range site.

36—Endsaw-Hector complex, 8 to 30 percent slopes. This complex consists of areas of the Endsaw soil and the Hector soil that are so intermingled that they could not be separated at the scale selected for mapping. These deep and shallow, well drained, strongly sloping to steep soils are on large, broad, hilly areas that are generally more than 500 acres. Areas of each soil are 3 to 10 acres.

Endsaw fine sandy loam makes up about 80 percent of each mapped area. Typically, the surface layer is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam about 5 inches thick. The upper part of the subsoil, to a depth of about 28 inches, is red clay. The middle part of the subsoil, to a depth of about 40 inches, is mottled, yellowish red clay. The lower part of the subsoil is mottled yellowish red, gray, and yellowish brown clay to a depth of about 48 inches. Below this is pale yellow soft shale.

This soil is low in natural fertility and organic matter content. The surface layer is strongly acid or medium acid. Permeability is slow, and available water capacity is high. The root zone is deep.

Hector fine sandy loam makes up about 10 to 15 percent of each mapped area. Typically, the surface layer is brown fine sandy loam about 3 inches thick. The subsurface layer is brown fine sandy loam about 3 inches thick. The subsoil is strong brown loam to a depth of about 18 inches. Below this is hard, fractured sandstone.

This soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout the profile. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Sandstone outcrops make up about 5 to 10 percent of each mapped area. Included with this complex in mapping are a few small areas of Hartsells soils.

The soils in this complex have low potential for row crops and small grain. The erosion hazard is very severe where the surface cover is removed. Outcrops of sandstone, steep slopes, and shallow depth to rock are limitations that are very difficult to overcome.

These soils have low potential for native grass and tame pasture. The quality and quantity of native grass

can be maintained or improved by controlling brush, proper grazing, and preventing fires.

The soils in this complex have low potential for woodland. Slopes are steep enough to create a very severe erosion hazard, and the use of equipment is restricted because of outcrops of sandstone. Seedling mortality is also a concern in woodland management.

The soils in this complex have low potential for most urban uses. Slope and the shallow depth to rock in the Hector soil are the main limitations for dwellings, small commercial buildings, roads and streets, septic tank absorption fields, sewage lagoons, and trench sanitary landfills.

This complex is in capability subclass VIIs. The Endsaw part is in woodland group 5o and the Sandy Savannah range site. The Hector part is in woodland group 5d and the Shallow Savannah range site.

37—Endsaw-Hector complex, 30 to 50 percent slopes. This complex consists of areas of the Endsaw soil and the Hector soil that are so intermingled that they could not be separated at the scale selected for mapping. These deep and shallow, well drained, steep or very steep soils are on broad areas that are generally more than 500 acres. Areas of each soil are 3 to 10 acres.

Endsaw stony fine sandy loam makes up about 60 to 80 percent of each mapped area. Typically, the surface layer is very dark grayish brown stony fine sandy loam about 3 inches thick. The subsurface layer is pale brown stony fine sandy loam about 6 inches thick. The upper part of the subsoil to a depth of about 30 inches, is red clay. The lower part of the subsoil, to a depth of about 43 inches, is reddish brown clay with yellowish brown mottles. Below this is soft shale.

This soil is low in natural fertility and organic matter content. The surface layer is strongly acid or medium acid. Permeability is slow, and available water capacity is high. The root zone is deep.

Hector stony fine sandy loam makes up about 15 to 25 percent of each mapped area. Typically, the surface layer is dark brown stony fine sandy loam about 3 inches thick. The subsurface layer is pale brown stony fine sandy loam about 4 inches thick. The subsoil is very pale brown loam that extends to a depth of about 18 inches. Below this is hard sandstone.

The soil is low in natural fertility and organic matter content. It is strongly acid or very strongly acid throughout the profile. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Sandstone outcrops make up 5 to 10 percent of each mapped area. Included with this complex in mapping are a few small areas of Hartsells soils.

The soils in this complex have a very low potential for row crops and small grain. Large stones, rock outcrops, steep slopes, and shallow depth to rock are limitations that are very difficult to overcome.

These soils have low potential for native grass and tame pasture. The quality and quantity of native grass can be maintained or improved by controlling brush, proper grazing, and preventing fires.

The soils in this complex have low potential for woodland. Slopes are steep enough to create a very severe erosion hazard, and the use of equipment is restricted because of large stones and sandstone outcrops. Seedling mortality is also a concern in woodland management.

These soils have low potential for most urban uses. Slope, large stones, and the shallow depth to rock in the Hector soil are the main limitations for dwellings, small commercial buildings, roads and streets, septic tank absorption fields, sewage lagoons, and trench sanitary landfills.

This complex is in capability subclass VIIs. The Endsaw part is in woodland group 5r, and the Hector part is in woodland group 5d. Both soils are in the Savannah Breaks range site.

38—Eram clay loam, 3 to 5 percent slopes. This moderately deep, moderately well drained, gently sloping soil is on broad areas of the uplands. Most areas are 50 to 100 acres, but some are smaller.

Typically, the surface layer is very dark grayish brown clay loam about 11 inches thick. The upper part of the subsoil is mottled, very dark grayish brown clay to a depth of about 22 inches. The lower part of the subsoil is olive brown clay that extends to a depth of about 33 inches. Below this is gray and olive, soft clay shale.

This soil is high in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is slow, and available water capacity is medium. This soil has fair tilth, and the root zone is moderately deep. A water table is at a depth of 2 to 3 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Dennis and Talihina soils. The included soils make up about 10 percent of this map unit, but separate areas are generally less than 5 acres.

This soil is used mostly for native grass but has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Small grain and other closely-spaced sown crops are best suited to this soil. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for hay and tame pasture. Fertilizing tame pasture grass increases the quality and quantity of forage. The quality of all grasses can be maintained or improved by protecting against damage by fire, using suitable grazing practices,

and controlling weeds. This soil has low potential for woodland production.

This soil has low potential for most urban uses. High shrink-swell potential, wetness, and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets.

This soil is in capability subclass IVe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

39—Eram clay loam, 5 to 8 percent slopes. This moderately deep, moderately well drained, sloping soil is on long, narrow foot slopes that are mainly on uplands. Slopes are smooth and slightly convex. Most areas are 30 to 50 acres, but some are smaller.

Typically, the surface layer is very dark grayish brown clay loam about 10 inches thick. The upper part of the subsoil, to a depth of about 16 inches, is very dark grayish brown clay with yellowish red mottles. The lower part of the subsoil is olive clay that extends to a depth of about 28 inches. Below this is gray or olive shale.

This soil is high in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is slow, and available water capacity is medium. This soil has fair tilth, and the root zone is moderately deep. A water table is at a depth of 2 to 3 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Talihina soils. The included soils make up about 20 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has very low potential for row crops and small grain. The erosion hazard is very severe where cultivated crops are grown. This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing tame pasture grasses increases the quantity of forage. The quality of all grasses can be maintained or improved by protecting against damage by fire, using suitable grazing practices, and controlling weeds. This soil has low potential for woodland.

This soil has low potential for most urban uses. High shrink-swell potential, wetness, and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets.

This soil is in capability subclass VIe. It was not assigned to a woodland group. It is in the Loamy Prairie range site.

40—Eram-Talihina complex, 5 to 20 percent slopes. This complex consists of the Eram soil and the Talihina soil that are so intermingled that they could not be separated at the scale selected for mapping. These moderately deep and shallow, moderately well drained, sloping to moderately steep soils are on broad areas of rolling hills. They have sandstone cobbles and stones on the surface. Areas of each soil are 5 to 20 acres.

Eram clay loam makes up about 50 to 60 percent of each mapped area. Typically, the surface layer is very dark grayish brown clay loam about 9 inches thick. The upper part of the subsoil is very dark grayish brown clay. The lower part of the subsoil, to a depth of about 30 inches, is mottled, olive brown clay. Below this is soft, gray and olive shale.

The soil is high in natural fertility and organic matter content. The surface layer is medium acid or slightly acid. Permeability is slow, and available water capacity is medium. The root zone is moderately deep. A water table is at a depth of 2 to 3 feet during winter and spring.

Talihina clay loam makes up about 40 to 50 percent of each mapped area. Typically, the surface layer is very dark grayish brown clay loam about 7 inches thick. The subsoil to a depth of about 16 inches is dark grayish brown clay. Below this is soft, olive gray and olive shale.

This soil is medium in natural fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is slow, and available water capacity is low. The root zone is shallow. A water table is at a depth of 1/2 foot to 2 feet during winter and spring.

Included with this complex in mapping are a few long, narrow areas of soils that have a fine sandy loam surface layer and a yellowish brown sandy clay loam subsoil underlain by sandstone at a depth of 10 to 20 inches. These areas are adjacent to sandstone outcrops. Sandstone outcrops make up about 5 percent of the mapped area.

The soils in this complex have low potential for row crops and small grain. Large stones on the surface, the very severe erosion hazard, and shallow areas are limitations that are very difficult to overcome.

These soils have high potential for native grass and low potential for tame pasture. The quantity of tame pasture grasses can be improved by fertilizing. The quality of all grasses can be maintained or improved by proper stocking and grazing, controlling weeds, and preventing fires.

The soils in this complex have low potential for woodland. They have low potential for most urban uses. The main limitations for dwellings, small commercial buildings, and roads and streets are low strength, slope, and high shrink-swell potential. The moderate and shallow depth to shale is a limitation for septic tank absorption fields and sewage lagoons.

This complex is in capability subclass VIs. It was not assigned to a woodland group. The Eram part is in the Loamy Prairie range site, and the Talihina part is in the Shallow Prairie range site.

41—Gowton clay loam. This deep, well drained, nearly level soil is mostly on the flood plain of Clear Boggy Creek or its tributaries. Slopes are smooth. Most

areas along major creeks are 40 to 80 acres. On smaller tributaries, however, there are long, narrow areas of 5 to 10 acres.

Typically, the surface layer is very dark brown clay loam to a depth of 31 inches and very dark grayish brown clay loam to a depth of 38 inches. The underlying material to a depth of 68 inches is grayish brown clay loam.

This soil is high in natural fertility and organic matter content. The surface layer is medium acid to neutral. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep. This soil is subject to occasional flooding.

Included with this soil in mapping are some areas that have deposits of brown or pale brown fine sandy loam that are up to 10 inches thick. Also included are a few intermingled areas of Kaufman and Dela soils. The included soils make up about 20 to 30 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has high potential for row crops and small grain. Proper fertilization and returning plant residue to the soil help to maintain fertility and good tilth.

This soil has high potential for tame pasture and native grass. Fescue or bermudagrass combined with clover is generally used for tame pasture. Proper pasture management which includes fertilization is needed to maintain production.

This soil has high potential for woodland. It has no significant limitations for woodland management. It has low potential for most urban uses. Flooding is the main limitation for dwellings, small commercial buildings, roads and streets, septic tank absorption fields, and sanitary landfills.

This soil is in capability subclass IIw and woodland group 2o. It was not assigned to a range site.

42—Guyton silt loam. This deep, poorly drained, nearly level soil is generally on the flood plain of Muddy Boggy Creek or its tributaries. Areas are broad and smooth. Most of them are more than 100 acres on the main flood plain. On the smaller tributaries, however, there are long, narrow areas of 5 to 10 acres.

Typically, the surface layer is grayish brown silt loam about 8 inches thick. The subsurface layer is gray silt loam about 9 inches thick. The upper part of the subsoil, to a depth of 22 inches, is gray silty clay loam with vertical streaks and tongues of light brownish gray silt loam. The middle part of the subsoil is mottled, light gray silt loam to a depth of about 32 inches. The lower part of the subsoil is mottled, light gray silty clay loam that extends to a depth of about 80 inches.

This soil is low in natural fertility and organic matter. The surface layer is medium acid to very strongly acid. Permeability is slow, and available water capacity is high. Surface crusting and wetness are conditions that damage soil tilth. This soil is subject to occasional flooding. The root zone is deep. A water table is at a depth of less than 1 1/2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Lightning and Rexor soils. The included soils make up about 10 percent of the map unit, but separate areas are generally less than 3 acres.

This soil has medium potential for row crops and small grain. Its potential is limited because of wetness and surface crusting. A drainage system, large amounts of crop residue, and proper amounts of fertilizer are usually needed to obtain high yields.

This soil has medium potential for tame pasture and low potential for native grass. Cool season grasses and legumes are best adapted to this soil. The quality of grass can be maintained or improved by fertilizing, controlling brush, preventing fires, and controlling grazing.

This soil has medium potential for woodland. The main concerns of management are equipment limitations and seedling mortality. This soil has low potential for most urban uses. Flooding and wetness are the main limitations for most urban uses.

This soil is in capability subclass IVw and woodland group 2w. It was not assigned to a range site.

43—Hamden fine sandy loam, 0 to 2 percent slopes. This deep, moderately well drained, nearly level to very gently sloping soil is on uplands. Slopes are smooth and slightly convex. Most areas are 10 to 30 acres, but some are smaller.

Typically, the surface layer is dark grayish brown fine sandy loam about 9 inches thick. The subsurface layer is brown fine sandy loam about 9 inches thick. The subsoil is very pale brown loam to a depth of about 24 inches; mottled, light gray clay to a depth of about 32 inches; mottled, gray clay to a depth of about 48 inches; and mottled, light gray clay to a depth of 86 inches.

This soil is low in natural fertility and organic matter content. It is very strongly acid to medium acid in the surface layer, except where it has been limed. Permeability is moderately slow, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep. A water table is at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Bernow and Bosville soils. The included soils make up about 10 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage and the use of cover crops help to reduce runoff and to control erosion.

This soil has medium potential for native grass and high potential for tame pasture. Bermudagrass or bahia-

grass combined with clover is the most common mixture used for hay and pasture. Fertilizer helps to increase forage production, thereby controlling erosion. The quality of all grasses can be maintained or improved by controlling brush, preventing fires, and controlling grazing.

This soil has medium potential for woodland production. The main concern of management is wetness that restricts the use of equipment.

This soil has low potential for most urban uses. Wetness is the main limitation for septic tank absorption fields, sewage lagoons, sanitary landfills, dwellings, and small commercial buildings.

This soil is in capability subclass IIw, woodland group 3w, and the Sandy Savannah range site.

44—Hartsells fine sandy loam, 2 to 4 percent slopes. This moderately deep, well drained, very gently sloping to gently sloping soil is on hilltops. Slopes are smooth and slightly convex. Most areas are 40 to 80 acres, but some are smaller.

Typically, the surface layer is dark grayish brown fine sandy loam about 5 inches thick. The subsurface layer is brown fine sandy loam about 9 inches thick. The subsoil to a depth of 38 inches, is yellowish brown sandy clay loam with mottles in shades of red, brown, or yellow. Below this is hard sandstone.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep.

Included with this soil in mapping are soils that are 40 to 60 inches deep. Also included are a few intermingled areas of Counts and Hector soils. The included soils make up about 10 to 15 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion. Sown crops can be grown continuously if fertilizer is used and crop residue is returned to the soil.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for hay and pasture. Fertilizing increases forage production, thereby helping to control erosion. The quality of all grasses can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by fire.

This soil has low potential for woodland. It has no significant limitations for woodland management. This soil has medium potential for most urban uses. The moderate depth to sandstone is the main limitation for most urban uses.

This soil is in capability subclass IIe, woodland group 5o, and the Sandy Savannah range site.

45—Hartsells fine sandy loam, 4 to 6 percent slopes. This moderately deep, well drained, gently sloping to sloping soil is on foot slopes and hilltops. Slopes are smooth and slightly convex. Most areas are 20 to 40 acres, but some are smaller.

Typically, the surface layer is dark grayish brown fine sandy loam about 4 inches thick. The subsurface layer is yellowish brown fine sandy loam about 8 inches thick. The subsoil is yellowish brown sandy clay loam with mottles in shades of red, brown, or yellow in the lower part, and it extends to a depth of 34 inches. Below this is hard sandstone.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep.

Included with this soil in mapping are soils that are 40 to 60 inches deep. Also included are a few intermingled areas of Endsaw and Hector soils. The included soils make up about 15 to 20 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for hay and pasture. Fertilizing increases forage production, thereby helping to control erosion. The quality of all grasses can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by fire.

This soil has low potential for woodland. It has no significant limitations for woodland management. It has medium potential for most urban uses. The moderate depth to sandstone is the main limitation for most urban uses.

This soil is in capability subclass IIIe, woodland group 5o, and the Sandy Savannah range site.

46—Hartsells fine sandy loam, 2 to 6 percent slopes, eroded. This moderately deep, well drained, very gently sloping to sloping, eroded soil is on uplands. In about 40 percent of the area, the original surface layer and material from the subsoil are mixed by plowing. There are a few uncrossable gullies about 350 feet apart. Rills are common between the gullies. Slopes are

smooth and slightly convex. Most areas are 10 to 30 acres, but some are smaller.

Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsoil is yellowish brown sandy clay loam with mottles in shades of red or brown that extend to a depth of 27 inches. Below this is acid, hard sandstone.

This soil is low in natural fertility and organic matter content. It is strongly acid to extremely acid, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is moderately deep.

Included with this soil in mapping are soils that are 40 to 60 inches deep over sandstone. Also included are a few intermingled areas of Endsaw and Hector soils. The included soils make up about 20 to 25 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is severe where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has medium potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for hay and pasture. Fertilizing increases forage production, thereby helping to control erosion. The quality of all grasses can be maintained or improved by controlling brush, using suitable grazing practices, and protecting against damage by fire.

This soil has low potential for woodland. It has no significant limitations for woodland management. It has medium potential for most urban uses. The moderate depth to sandstone is the main limitation for most urban uses.

This soil is in capability subclass IVe, woodland group 5o, and the Sandy Savannah range site.

47—Hartsells and Hector soils, gullied. This map unit consists of moderately deep and shallow, well drained, very gently sloping and gently sloping soils on uplands. Slopes are 2 to 6 percent. These severely eroded soils are on narrow ridge crests and side slopes. Part of the original surface layer has been removed by erosion in about 50 percent of the area. In about 20 percent of the area, the original surface layer and material from the upper part of the subsoil have been mixed by tillage. Gullies are 200 to 400 feet apart, 1 foot to 4 feet deep, and 10 to 20 feet across. Hartsells and Hector soils are in an irregular pattern on the landscape. Areas of each soil are large enough to map separately, but because of present and predicted use, they were mapped as one unit. Most of the areas contain both soils, but a few areas contain only the Hartsells soils.

About 50 percent of the map unit is Hartsells soils. Typically, the surface layer is brown fine sandy loam about 5 inches thick. The subsoil, to a depth of 35 inches is mottled, strong brown sandy clay loam. Below this is hard sandstone.

Hartsells soils are low in natural fertility and organic matter content. They are strongly acid to extremely acid. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep.

About 30 to 40 percent of the map unit is Hector soils. Typically, the surface layer is brown fine sandy loam about 6 inches thick. The subsoil, to a depth of 15 inches, is strong brown fine sandy loam. Below this is hard sandstone bedrock.

Hector soils are low in natural fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is moderately rapid, and available water capacity is low. The root zone is shallow.

Included with these soils in mapping are areas of Endsaw and Counts soils. These soils make up 10 to 20 percent of the map unit.

The soils in this map unit have low potential for farming. Gullies and shallow depth to rock are limitations that are very difficult to overcome.

These soils have low potential for native grass and tame pasture. Most of the areas have been cultivated, but the soils are best suited to permanent vegetation. Tame pasture grass or native grass can be established if gullies are shaped, runoff from higher areas is diverted, critical areas are mulched, and fertilizer is applied.

The soils in this map unit have low potential for woodland. The very severe erosion hazard is the main limitation for woodland management. These soils have low potential for most urban uses. Very severe erosion and the moderate to shallow depth to sandstone are the main limitations.

These soils are in capability subclass VIe, and woodland group 5d. The Hartsells part is in the Eroded Sandy Savannah range site, and the Hector part is in the Eroded Shallow Savannah range site.

48—Heiden clay, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. Slopes are smooth and slightly convex. Areas are 10 to 40 acres.

Typically, the surface layer is very dark brown clay to a depth of about 14 inches and very dark grayish brown clay to about 24 inches. The next layer is dark olive clay to a depth of about 54 inches. The underlying material to a depth of 65 inches is coarsely mottled, light brownish gray and olive yellow shaly clay.

This soil is high in natural fertility and organic matter content. It is moderately alkaline throughout. Permeability is very slow, and available water capacity is high. These soils shrink and crack when dry and expand greatly when wet. The root zone is deep.

Included with this soil in mapping are intermingled areas of Burleson and Durant soils and a similar soil,

except the depth to limestone or shale is less than 40 inches. The included soils make up about 30 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has medium potential for row crops and small grain. The erosion hazard is moderate where cultivated crops are grown. When this soil is used for cropland, management practices are needed to improve tilth, reduce surface crusting, increase water intake, and reduce erosion. Returning large amounts of crop residue to the soil, terracing, and farming on the contour are also beneficial. Tillage should be timely and kept to a minimum.

This soil has high potential for native grass and tame pasture. The quality of all grasses can be maintained or improved by preventing fires, proper stocking, and controlling weeds. Fertilizing increases forage production on tame pastures and improves the quality of grass.

This soil has low potential for woodland and for most urban uses. Very high shrink-swell potential is the main limitation for dwellings, small commercial buildings, and roads and streets. Special design is needed to prevent cracking in building foundations. Very slow permeability is the main limitation for septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption field or by placing the absorption field in suitable fill.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Blackclay Prairie range site.

49—Helden soils, 8 to 20 percent slopes. These deep, well drained, sloping to moderately steep soils are on uplands. Slopes are smooth and slightly convex. Areas are in long, narrow bands of 30 to 200 acres below outcrops of limestone.

Typically, the surface layer, to a depth of 11 inches, is very dark brown clay and, to a depth of 14 inches, is very dark grayish brown clay. The next layer is olive brown clay to a depth of 38 inches. The underlying material to a depth of 60 inches is light olive brown clay.

These soils are high in natural fertility and organic matter content. They are moderately alkaline. Permeability is very slow, and available water capacity is high. These soils shrink and develop wide cracks when dry and expand considerably when wet. The root zone is deep.

Included with these soils in mapping, and making up 30 percent of the mapped area, are soils that are similar, except the surface layer and underlying layer are clay loam or silty clay loam and the underlying material is fine sandy loam. Also included, and making up 25 percent of the mapped area, are soils that are similar to Bernow soils, except gray mottles are at a depth of less than 30 inches. Tarrant soils and limestone outcrops make up about 10 percent of the mapped area.

These soils have low potential for farming. Slopes and the very severe erosion hazard are the main limitations.

These soils have high potential for native grass and tame pasture. Proper stocking and grazing, protecting against damage by fire, and controlling weeds help to maintain a good quantity of forage. Fertilizing tame pasture increases forage production and improves the quality of grass.

These soils have low potential for woodland. They also have low potential for most urban uses. Very high shrink-swell potential and slope are the main limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the main limitation for septic tank absorption fields. This limitation can be partially overcome by increasing the size of the absorption field or by placing the absorption field in suitable fill.

These soils are in capability subclass VIe. They were not assigned to a woodland group. They are in the Blackclay Prairie range site.

50—Kaufman clay. This deep, somewhat poorly drained, nearly level soil is on the flood plain of Clear Boggy Creek and its tributaries. On the main flood plain, it is on large, broad areas that are generally more than 100 acres. On small tributaries, it is on long, narrow areas of 5 to 10 acres.

Typically, the surface layer is black clay about 32 inches thick. Below this is mottled, very dark gray clay to a depth of 82 inches.

This soil is high in natural fertility and organic matter content. It is medium acid to mildly alkaline. Permeability is very slow, and available water capacity is high. The root zone is deep. This soil is subject to occasional flooding. A water table is at a depth of less than 3 1/2 feet during winter and spring. This soil shrinks and develops wide cracks when dry, and it expands greatly when wet.

Included with this soil in mapping are intermingled areas of Trinity and Gowton soils. Trinity soils make up less than 5 percent and Gowton soils about 15 percent of this map unit. Also included, and making up 10 percent of the mapped area are soils that are similar to the Kaufman soil but are silt loam to fine sandy loam at a depth below 40 inches. Separate areas of these included soils generally are less than 5 acres.

This soil has high potential for small grain and row crops. Wetness is a limitation to working this soil. Tillage operations should be timely and kept to a minimum. When this soil is used for cropland, large amounts of crop residue need to be returned to improve tilth, increase water intake, and prevent surface crusting.

This soil has high potential for tame pasture and native grass. Cool season grasses and legumes are better adapted for tame pasture, however, bermudagrass and clover are well suited. Fertilizing increases forage production, thereby helping to control erosion.

This soil has high potential for woodland. The main concerns of woodland management are wetness, plant competition, equipment limitations, and seedling mortality.

This soil has low potential for most urban uses. Flooding, wetness, and high shrink-swell potential are the main limitations for most urban uses.

This soil is in capability subclass IIIw and woodland group 2w. It was not assigned to a range site.

51—Kaufman and Gowton soils. This map unit consists of deep, somewhat poorly drained and well drained, nearly level, and slightly concave soils on flood plains of Clear Boggy Creek and its tributaries. These soils are in long, narrow areas along creeks and sloughs. The areas range from 200 to 1,000 feet in width but generally are less than 500 feet. Areas of each soil are too narrow to map separately, and because of predicted and present land use, it would not be practical. Both soils are in most mapped areas, but there are some areas in which one or the other does not occur. The Kaufman soils are in the lower, wetter parts of the flood plain, and the Gowton soils are in slightly higher, better drained positions on the landscape.

A typical area of this map unit is about 40 percent Kaufman soils; 30 percent Gowton soils; 20 percent stream banks, sloughs, and channels; and 10 percent Dela soils.

Typically, Kaufman soils have a black clay surface layer about 24 inches thick. The next layer to a depth of 66 inches is black clay with brown or gray mottles.

Kaufman soils are high in natural fertility and organic matter content. The surface layer is medium acid to mildly alkaline. Permeability is very slow, and available water capacity is high. These soils shrink and develop wide cracks when dry and expand considerably when wet. They are subject to frequent flooding. The root zone is deep. A water table is at a depth of less than 3 1/2 feet during winter and spring.

Gowton soils have a very dark grayish brown clay loam surface layer to a depth of about 28 inches. The underlying material is brown clay loam to a depth of 60 inches.

Gowton soils are high in natural fertility and organic matter content. The surface layer is medium acid to neutral. Permeability is moderate, and available water capacity is high. These soils are subject to frequent flooding. The root zone is deep.

The soils in this map unit have low potential for row crops and small grain. Flooding and wetness are the main limitations. These soils have high potential for native grass and tame pasture. Fertilizing tame pasture increases the quantity of grass. The quality of tame pasture grasses can be maintained or improved by controlling brush, preventing fires, and using proper stocking and grazing.

These soils have high potential for woodland. Wetness and flooding are the main limitations to equipment use in managing and harvesting trees. The limitations can be overcome by using special equipment and logging during the drier season. The soils in this map unit have low potential for most urban uses. Flooding and wetness are the main limitations.

These soils are in capability subclass Vw. The Kaufman part is in woodland group 2w, and the Gowton part is in woodland group 2o. These soils were not assigned to a range site.

52—Kiti-Rock outcrop complex, 1 to 12 percent slopes. This complex consists of small areas of the Kiti soil and Rock outcrop that are so intermingled that it was not practical to separate them at the scale selected for mapping. The shallow, well drained, very gently sloping to strongly sloping soil and the Rock outcrop are on broad, smooth, areas of the uplands. Areas of each component are 2 to 15 acres.

Kiti clay loam makes up about 50 to 70 percent of each mapped area. Typically, the surface layer is dark brown stony clay loam about 14 inches thick. Below this is hard, fractured limestone that is tilted 30 degrees from the horizontal.

This soil is high in natural fertility and organic matter content. The surface layer is neutral to moderately alkaline. Permeability is moderate, and available water capacity is low. The root zone is shallow.

Rock outcrop makes up about 30 to 50 percent of this map unit. It is hard limestone in long, narrow areas.

Included in a few mapped areas are soils that have a profile similar to the Kiti soil but the depth to limestone is more than 20 inches. These soils make up about 20 percent of the mapped area.

The soil in this complex has very low potential for farming. Stones and shallow depth to rock are limitations that are very difficult to overcome. This soil has a low potential for native grass and tame pasture. The outcrops of limestone prevent this soil from establishing tame pasture. The quality of native grass can be maintained or improved by preventing fires and by proper grazing and stocking. The soil in this complex has low potential for woodland and urban uses. The shallow depth to rock and outcrops of hard limestone are the main limitations for all urban uses.

This complex is in capability subclass VIIs. It was not assigned to a woodland group. The Kiti part is in the Edgerock range site, and the Rock outcrop part was not assigned to a range site.

53—Kiti-Rock outcrop complex, 20 to 45 percent slopes. This complex consists of small areas of the Kiti soil and Rock outcrop that are so intermingled that it was not practical to separate them at the scale selected for mapping. The shallow, well drained, steep to very steep soil and rock outcrop are in long, narrow areas of

the uplands. Areas of each component are 2 to 15 acres.

Kiti clay loam makes up about 40 to 60 percent of each mapped area. Typically, the surface layer is very dark brown stony clay loam about 16 inches thick. Below this is hard, fractured limestone that is tilted about 30 degrees from horizontal.

This soil is high in natural fertility and organic matter content. It is neutral to moderately alkaline. Permeability is moderate, and available water capacity is low. The root zone is shallow.

Rock outcrop makes up about 20 to 40 percent of each mapped area. It is hard limestone in long, narrow areas.

Included in mapping are soils that have a profile similar to the Kiti soil, but the depth to limestone is more than 20 inches. These soils make up 10 to 25 percent of the mapped area.

The soil in this complex has low potential for farming. Stones and depth to rock are limitations that are difficult to overcome. This soil has low potential for native grass and tame pasture. The outcrops of limestone prevent this soil from establishing tame pasture. The quality of native grass can be maintained or improved by proper stocking and grazing and by preventing fires. The soil in this complex has low potential for woodland and urban uses. The shallow depth to rock, slope, and outcrops of hard limestone are the main limitations for all urban uses.

This complex is in capability subclass VIIs. It was not assigned to a woodland group. The Kiti part is in the Edgerock range site, and the Rock outcrop part was not assigned to a range site.

54—Larue loamy fine sand, 0 to 3 percent slopes. This deep, well drained, nearly level to very gently sloping soil is on uplands. Slopes are broad and smooth. Most areas are 50 to 80 acres, but some are smaller.

Typically, the surface layer is brown loamy fine sand about 10 inches thick. The subsurface layer is pale brown loamy fine sand about 16 inches thick. The upper part of the subsoil is strong brown sandy clay loam to a depth of about 65 inches. The lower part of the subsoil is coarsely mottled strong brown, light gray, and red sandy clay loam that extends to a depth of about 72 inches.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are soils that have sandstone at a depth of 40 to 60 inches. Also included are a few intermingled areas of Bernow and Pickton soils. The included soils make up about 10 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has medium potential for row crops and small grain (fig. 5). Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Soil blowing is a problem if the surface is bare during the windy season. Minimum tillage, the use of cover crops, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases forage production, thereby helping to control erosion. The quality of all grasses can be maintained or improved by controlling weeds and brush, preventing fires, and using proper grazing.

This soil has medium potential for woodland. The main concerns of woodland management are plant competition, equipment limitation, and seedling mortality.

This soil has high potential for most urban uses. It has no significant limitations for dwellings, small commercial buildings, and roads and streets. Seepage is the main problem where this soil is used for sewage lagoons.

This soil is in capability subclass IIIs, woodland group 4s, and the Deep Sand Savannah range site.

55—Larue loamy fine sand, 3 to 8 percent slopes. This deep, well drained, gently sloping to sloping soil is on uplands. Slopes are broad, smooth, and slightly convex. Most areas are 20 to 40 acres, but some are smaller.

Typically, the surface layer is brown loamy fine sand about 15 inches thick. The subsurface layer is pale brown loamy fine sand about 19 inches thick. The upper part of the subsoil, to a depth of about 54 inches, is strong brown sandy clay loam. The lower part of the subsoil is strong brown sandy clay loam, mottled in shades of red, brown, or gray. It extends to a depth of about 72 inches.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are soils that have sandstone at a depth of 40 to 60 inches. Also included are a few intermingled areas of Bernow and Pickton soils. The included soils make up about 15 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. Erosion is a severe hazard where cultivated crops are grown. Soil blowing is a problem if the surface is bare during the windy season. Minimum

tillage, the use of cover crops, and contour farming help to reduce runoff and to control erosion.

This soil has high potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases the amount of forage, thereby helping to control erosion. The quality of all grasses can be maintained or improved by controlling weeds and brush, preventing fires, and using proper stocking and grazing.

This soil has medium potential for woodland. The main concerns of woodland management are plant competition, seedling mortality, and equipment limitation. This soil has high potential for most urban uses. It has no significant limitations for dwellings, small commercial buildings, and roads and streets. Seepage is the main limitation for sewage lagoons.

This soil is in capability subclass IVe, woodland group 4s, and the Deep Sand Savannah range site.

56—Lightning silt loam. This deep, somewhat poorly drained, nearly level soil is mainly on the flood plain of Muddy Boggy Creek and its tributaries. Slopes are smooth to slightly concave. Most areas are 5 to 30 acres, but some are 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is grayish brown silt loam about 7 inches thick. The subsoil is mottled, dark grayish brown silty clay to a depth of about 22 inches; mottled dark gray and gray silty clay to a depth of about 62 inches; and coarsely mottled dark gray and yellowish brown silty clay to a depth of 80 inches.

Lightning soils are low in natural fertility and organic matter content. They are strongly acid to neutral in the surface layer. Permeability is very slow, and available water capacity is high. These soils generally are wet in fall and spring and become dry and hard during summer. They are subject to occasional flooding. A water table is at a depth of less than 2 feet during winter and spring. The root zone is deep.

Included with this soil in mapping are a few intermingled areas of Guyton soils which make up about 10 percent of the mapped area. Also included, and making up 30 percent of the mapped area, are soils similar to the Lightning soil, except the subsoil is dominantly grayish brown, dark grayish brown, or light brownish gray. Separate areas of these included soils are generally less than 5 acres.

This soil has medium potential for small grain and row crops. Its potential is limited because of wetness, low fertility, and surface crusting. The erosion hazard is slight. A drainage system, returning large amounts of crop residue to the soil, and proper fertilization are needed to increase yields.

This soil has medium potential for tame pasture and high potential for native grass. Fescue and clover are best adapted to this soil for tame pasture; however, bermudagrass and clover can be grown. Maintaining the fertility level and pasture management are important practices for tame pasture. The quality of grass can be maintained or improved by using proper stocking and grazing, preventing fires, and controlling weeds and brush.

This soil has medium potential for woodland. The main concerns of woodland management are plant competition, equipment limitation, and seedling mortality. This soil has low potential for most urban uses. Flooding and wetness are the main limitations for urban use.

This soil is in capability subclass IIIw and woodland group 3w. It was not assigned to a range site.

57—Parsons silt loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on uplands in prairie areas. Slopes are broad and smooth with a few mounds that are 1 foot to 3 feet high and 10 to 20 feet wide. Most areas are more than 100 acres, but some are 15 acres.

Typically, the surface layer is very dark grayish brown silt loam about 8 inches thick. The subsurface layer is mottled, grayish brown silt loam about 6 inches thick. The upper part of the subsoil, to a depth of about 32 inches, is dark gray clay with red and strong brown mottles. The middle part of the subsoil, to a depth of about 54 inches, is grayish brown clay with red and strong brown mottles. The lower part of the subsoil is coarsely mottled gray and strong brown clay that extends to a depth of about 74 inches.

This soil is medium in fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is very slow, and available water capacity is high. This soil has good tilth. The root zone is deep. A water table is at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of a soil that is similar, but the combined thickness of the surface and subsurface layers is more than 16 inches. Also included are some areas of Dennis soils. These included soils make up about 15 to 20 percent of this map unit, but separate areas generally are less than 3 acres. Soils on mounds make up about 5 percent of the area.

This soil has medium potential for small grain and row crops. The erosion hazard is slight. Management practices are needed to improve tilth, reduce surface crusting, and erosion. The cropping system should include crops that produce large amounts of crop residue that can be returned to the soil to improve tilth, increase water intake, and reduce surface crusting.

This soil has medium potential for tame pasture and high potential for native grass. Bermudagrass or bahiagrass is the base grass most commonly used in combination with clover for tame pasture. Proper pasture management includes fertilization, which is needed to main-

tain production of the grasses and clover. The quality of all grasses can be maintained or improved by using proper stocking and grazing, preventing fires, and controlling weeds.

This soil has low potential for woodland and for most urban uses. High shrink-swell potential, wetness, and low strength are the main limitations for urban uses. Special design is needed to overcome these limitations for foundations and septic tank filter fields. Very slow permeability is the main limitation for septic tank absorption fields. Sewage lagoons can be used.

This soil is in capability subclass IIs. It was not assigned to a woodland group. It is in the Claypan Prairie range site.

58—Parsons silt loam, 1 to 3 percent slopes. This deep, somewhat poorly drained, very gently sloping soil is on upland prairies. Slopes are smooth and slightly convex. Areas are 5 to 30 acres.

Typically, the surface layer is very dark grayish brown silt loam about 9 inches thick. The subsurface layer is mottled, light gray silt loam about 5 inches thick. The upper part of the subsoil is mottled very dark grayish brown clay to a depth of about 29 inches. The middle part of the subsoil is mottled, dark brown clay to about 44 inches. The lower part of the subsoil is coarsely mottled gray and strong brown clay to a depth of about 72 inches.

This soil is medium in fertility and organic matter content. The surface layer is strongly acid to slightly acid. Permeability is very slow, and available water capacity is high. This soil has good tilth. The root zone is deep. A water table is at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Dennis and Eram soils. These included soils make up about 10 percent of the mapped area, but separate areas are less than 5 acres.

This soil has medium potential for row crops and small grain. The erosion hazard is moderate where cultivated crops are grown. Management practices are needed to improve tilth and reduce surface crusting and erosion. Crops that produce large amounts of residue need to be grown in the cropping system. Returning crop residue to the soil improves tilth, increases water intake, and reduces crusting and erosion. Terraces and contour tillage help to reduce erosion. Sown crops can be grown without being on terraces if fertilizer is used and crop residue is returned to the soil.

This soil has high potential for native grass and medium potential for tame pasture. Bermudagrass or bahiagrass combined with clover is used mainly for tame pasture on this soil. Proper pasture management that includes fertilization is needed to maintain production of the grasses and clover. The quality of all grasses can be maintained or improved by using proper stocking and grazing, preventing fires, and controlling weeds.

This soil has low potential for woodland and for most urban uses. High shrink-swell potential, wetness, and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the main limitation for septic tank absorption fields.

This soil is in capability subclass IIIe. It was not assigned to a woodland group. It is in the Claypan Prairie range site.

59—Parsons silt loam, 1 to 3 percent slopes, eroded. This deep, somewhat poorly drained, very gently sloping, eroded soil is on uplands. About 50 percent of the original surface layer has been removed by erosion. There are a few uncrossable gullies separated by many small rills. In about 20 percent of the area, the clay subsoil is exposed. Slopes are smooth and slightly convex on foot slopes below steeper areas of Eram or Dennis soils. Areas are 5 to 30 acres.

Typically, the surface layer is very dark grayish brown silt loam about 7 inches thick. The subsoil, to a depth of about 25 inches, is mottled, very dark gray clay; mottled, very dark grayish brown clay to a depth of about 40 inches; mottled, olive brown clay to a depth of about 52 inches; and mottled, yellowish brown clay to a depth of about 80 inches.

This soil is low in fertility and organic matter content. Permeability is very slow, and available water capacity is high. This soil has poor tilth because erosion has exposed the subsoil in some areas. The root zone is deep. A water table is at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Included with this soil in mapping are soils that are similar but have a black silt loam or silty clay loam surface layer and a black clay subsoil. Also included are a few intermingled areas of Dennis and Eram soils. These included soils make up about 20 percent of this map unit, but some areas are generally less than 5 acres.

This soil has low potential for row crops and small grain. The erosion hazard is severe where cultivated crops are grown. Management practices are needed to improve tilth, increase water intake, and reduce surface crusting and erosion. Crops that produce large amounts of residue need to be grown. Returning crop residue to the soil is a management practice that improves tilth, increases water intake, and reduces surface crusting and erosion. Terraces and contour tillage help to reduce erosion. Sown crops can be grown without being on terraces if fertilizer is used and crop residue is returned to the soil.

This soil has medium potential for tame pasture and high potential for native grass. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Proper pasture management that includes fertilization is needed to maintain production of grasses and clover. The quality of all grasses can be

maintained or improved by preventing fires, controlling weeds, and proper stocking and grazing.

This soil has low potential for woodland and for most urban uses. High shrink-swell potential, wetness, and low strength are the main limitations for dwellings, small commercial buildings, and roads and streets. Very slow permeability is the main limitation for septic tank absorption fields.

This soil is in capability subclass IVe. It was not assigned to a woodland group. It is in the Claypan Prairie range site.

60—Pickton loamy fine sand, 0 to 3 percent slopes. This deep, well drained, nearly level to gently sloping soil is on ridgetops. Slopes are smooth to gently undulating. Most areas are 10 to 30 acres, but some are smaller.

Typically, the surface layer is yellowish brown loamy fine sand about 20 inches thick. The subsurface layer is very pale brown loamy fine sand to a depth of about 52 inches. The subsoil, to a depth of about 82 inches, is strong brown sandy clay loam, mottled in shades of red, brown, and gray.

This soil is low in natural fertility and organic matter content. It is medium acid or slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is low. This soil can be worked throughout a wide range in moisture content. The root zone is deep. A water table is at a depth of 4 to 6 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Larue and Bernow soils. The included soils make up about 10 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has low potential for row crops and small grain because of low natural fertility and low available water capacity. Wind erosion is a problem if the soil surface is bare during the windy season. Where cultivated crops are grown, minimum tillage, the use of cover crops, and returning crop residue to the soil help to maintain organic matter and to control erosion.

This soil has medium potential for tame pasture and low potential for native grass. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases plant growth, thereby helping to control soil erosion.

This soil has low potential for woodland production. Its main limitation is high seedling mortality because of droughtiness and plant competition.

This soil has high potential for most urban uses. It has no significant limitation for dwellings without basements, small commercial buildings, and roads and streets. Seepage is the main limitation for sewage lagoons and sanitary landfills.

This soil is in capability subclass IIIs, woodland group 4s, and the Deep Sand Savannah range site.

61—Rexor loam. This deep, well drained, nearly level soil is on flood plains of Muddy Boggy Creek and its tributaries. Slopes are broad and smooth. Most areas on the main flood plain are generally more than 100 acres; but on the smaller tributaries, there are long, narrow areas of 5 to 10 acres.

Typically, the surface layer is brown loam about 10 inches thick. The upper part of the subsoil is brown silty clay loam to about 34 inches. The middle part of the subsoil is brown silt loam to a depth of about 50 inches. The lower part of the subsoil is strong brown loam that extends to a depth of about 75 inches.

This soil is medium in natural fertility and organic matter content. It is very strongly acid to medium acid, except where it has been limed. Permeability is moderate, and available water capacity is high. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep. This soil is subject to occasional flooding. A water table is at a depth of 3 to 4 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Dela and Guyton soils. The included soils make up about 15 percent of this map unit, but separate areas generally are less than 3 acres.

This soil has high potential for row crops and small grain. The erosion hazard is slight. Good tilth can be maintained by returning crop residue to the soil. Minimum tillage and the use of cover crops help to maintain tilth and to reduce surface crusting.

This soil has high potential for tame pasture and medium potential for native grass. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizer helps to improve the quantity of forage, thereby helping to control erosion. Proper grazing and stocking, preventing burning, and controlling brush maintain or improve the quality of grass.

This soil has high potential for woodland. It has no significant limitations for woodland management. This soil has low potential for most urban uses. Flooding is the main limitation. The hazard of flooding can only be reduced by major flood control measures.

This soil is in capability subclass IIw, and woodland group 2o. It was not assigned to a range site.

62—Rexor and Dela soils. This map unit consists of deep, well drained and moderately well drained, nearly level soils on flood plains. These soils are in long, narrow areas about 200 to 500 feet wide along creeks. This map unit consists of Rexor soils, and Dela soils are closely associated but in an irregular pattern. The Rexor soils are in slightly higher, more well drained positions than the Dela soils. Areas of each soil are large enough to map separately, but because of present and predicted use, they were not separated in mapping. Both soils are in most mapped areas, but there are a few areas in which one or the other does not occur.

A typical area of this map unit is about 40 to 50 percent Rexor soils, 30 to 40 percent Dela soils, and 5 to 10 percent each of Boggy, Guyton, and Lightning soils. The stream banks and channels of the smaller streams are included.

Typically, Rexor soils have a brown loam surface layer about 12 inches thick. The subsoil, to a depth of about 48 inches, is yellowish brown silt loam. The underlying material to a depth of 60 inches is yellowish brown silt loam and brown clay loam.

Rexor soils are medium in natural fertility and organic matter content. They are medium acid to very strongly acid. Permeability is moderate, and available water capacity is high. These soils are subject to frequent flooding. A water table is at a depth of 3 to 4 feet during winter and spring. The root zone is deep.

Typically, Dela soils have a grayish brown fine sandy loam surface layer about 12 inches thick. The underlying material to a depth of 60 inches is brown fine sandy loam that has gray mottling below a depth of about 24 inches.

The Dela soils are high in natural fertility and organic matter. The surface layer is strongly acid to slightly acid. Permeability is moderately rapid, and available water capacity is medium. These soils are subject to frequent flooding. A water table is at a depth of 3 to 5 feet during winter and spring. The root zone is deep.

The soils in this map unit have low potential for farming. Wetness and flooding are the main limitations, which can be reduced by major flood control and drainage measures.

These soils have high potential for native grass and tame pasture. Bermudagrass, bahiagrass, or fescue combined with clover is the most common mixture used for tame pasture. Fertilizing increases forage production. The quality of tame pasture grasses can be maintained or improved by proper stocking and grazing, controlling brush, and preventing fires.

These soils have high potential for woodland. Wetness and flooding are the main limitations to equipment use in managing and harvesting the trees. This limitation can be overcome by using special equipment and logging during the drier seasons. These soils have low potential for most urban uses. Flooding is the main limitation.

These soils are in capability subclass Vw. The Rexor part is in woodland group 2w, and the Dela part is in woodland group 2o. These soils were not assigned to a range site.

63—Saffell gravelly fine sandy loam, 1 to 5 percent slopes. This deep, well drained, very gently sloping to gently sloping soil is on uplands. Slopes are broad, smooth, and slightly convex. Most areas are 10 to 30 acres, but some are smaller.

Typically, the surface layer is brown gravelly fine sandy loam about 8 inches thick. The subsurface layer is strong brown gravelly fine sandy loam about 6 inches thick. The upper part of the subsoil is yellowish red gravelly sandy clay loam to a depth of about 38 inches. The middle part of the subsoil, to a depth of about 48 inches, is red gravelly sandy clay loam. The lower part of the subsoil is strong brown very gravelly sandy clay loam that extends to a depth of about 60 inches.

This soil is low in natural fertility and organic matter content. It is strongly acid to slightly acid in the surface layer, except where it has been limed. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range in moisture content. The root zone is deep.

Included with this soil in mapping are intermingled areas of Bernow and Bosville soils. The included soils make up about 10 percent of this map unit, but separate areas generally are less than 5 acres.

This soil has medium potential for row crops and small grain. Good tilth can be maintained by returning crop residue to the soil. The erosion hazard is moderate where cultivated crops are grown. Minimum tillage, the use of cover crops, terracing, and contour farming help to reduce runoff and to control erosion.

This soil has medium potential for tame pasture and low potential for native grass. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing improves the quantity of grass, thereby helping to control erosion. Proper stocking, grazing properly, controlling brush, and preventing fires help to improve or maintain the quality of forage.

This soil has low potential for woodland. The main concern of woodland management is seedling mortality. This soil has high potential for most urban uses. It has no significant limitations for dwellings, roads and streets, septic tank absorption fields, and sanitary landfills. Seepage is the main problem for sewage lagoons.

This soil is in capability subclass IIIe, woodland group 5f, and the Sandy Savannah range site.

64—Stigler very fine sandy loam, 0 to 1 percent slopes. This deep, moderately well drained, nearly level soil is on uplands. Slopes are broad and smooth. Most areas are 10 to 60 acres, but some are smaller.

Typically, the surface layer is grayish brown very fine sandy loam about 16 inches thick. The subsurface layer is light brownish gray very fine sandy loam about 8 inches thick. The upper part of the subsoil to a depth of 46 inches, is mottled, brown clay. The lower part of the subsoil is coarsely mottled light gray, strong brown, and pale brown silty clay that extends to a depth of about 74 inches.

This soil is low in natural fertility and organic matter content. The surface layer is very strongly acid or strongly acid unless it has been limed. Permeability is very slow, and available water capacity is high. This soil is often wet in fall and spring, delaying seedbed prepara-

tion and planting dates. The root zone is deep. A water table is at a depth of 2 to 3 feet during winter and spring.

Included with this soil in mapping are soils on mounds that are 1 foot to 3 feet high and 40 to 80 feet in diameter. These soils make up about 8 percent of the map unit. They have a profile similar to the Stigler soil, but the combined surface layer and subsurface layer is 40 to 60 inches thick. Also included are a few intermingled areas of Wrightsville and Hamden soils. These inclusions make up about 15 percent of the map unit, but some areas generally are less than 5 acres.

This soil has medium potential for row crops and small grain. It has a slight erosion hazard where cultivated crops are grown. Its potential is limited because of wetness and low fertility. Crop yields can be improved by installing surface drainage and fertilizing properly. Large amounts of crop residue should be returned to the soil to improve tilth, increase water intake, prevent surface crusting, and reduce the erosion hazard in the steeper areas.

This soil has high potential for native grass and tame grass pasture. Bermudagrass, bahiagrass, or fescue combined with clover is generally grown. Proper tame pasture management that includes fertilization maintains a high level of production. The quality of all grasses can be maintained or improved by proper stocking, controlling brush, and preventing fires.

The potential for woodland is low. The main limitation in woodland management is plant competition. This soil has low potential for most urban uses. The high content of clay is a limitation for trench sanitary landfills. Wetness and very slow permeability are limitations for septic tank absorption fields, and wetness is a limitation for area sanitary landfills. Low strength and high shrink-swell potential are the main limitations for dwellings, small commercial buildings, and roads and streets.

This soil is in capability subclass IIw, woodland group 4o, and the Loamy Savannah range site.

65—Tarrant soils, 1 to 8 percent slopes. These shallow, well drained, very gently sloping to sloping soils are on uplands. Slopes are smooth and slightly convex. Most areas are 50 to 200 acres, but some are smaller.

These soils have variable surface textures that include cobbly clay, cobbly silty clay, stony clay, or stony silty clay. In a typical profile, the surface layer is very dark grayish brown cobbly clay about 14 inches thick. Below this is hard limestone bedrock.

These soils are high in natural fertility and organic matter content. They are moderately alkaline. Permeability is moderately slow, and available water capacity is low. The root zone is shallow.

Included with these soils in mapping are similar soils that have a clay loam surface layer. Also included are a few intermingled areas of Claremore and Catoosa soils. The included soils make up about 10 percent of this map unit, but separate areas generally are less than 5 acres.

These soils have low potential for farming. Stones and shallow depth to rock are limitations that are very difficult to overcome. These soils have low potential for native grass and tame pasture. Tame pasture grass is very difficult to establish because of the stony and cobbly, shallow soils. The quality of native grass can be maintained or improved by proper stocking and grazing and by preventing fires. These soils have low potential for woodland and most urban uses. The shallow depth to rock is the main limitation for urban uses.

These soils are in capability subclass VIIs. They were not assigned to a woodland group. They are in the Very Shallow range site.

66—Trinity clay. This deep, somewhat poorly drained, nearly level soil is on the flood plains of Caney and Delaware Creeks. Slopes are smooth or slightly concave. Areas are 5 to 30 acres.

Typically, the surface layer is black clay to a depth of about 24 inches, very dark gray clay to a depth of about 50 inches, and black clay to a depth of about 70 inches. The underlying material to a depth of 85 inches is dark gray clay.

This soil is high in natural fertility and organic matter content. The surface layer is moderately alkaline. Permeability is very slow, and available water capacity is high. This soil is subject to occasional flooding. A water table is at a depth of less than 3 feet during winter and spring. The root zone is deep.

Included with this soil in mapping are intermingled areas of Kaufman and Gowton soils. The included soils make up 10 to 20 percent of this map unit, but separate areas are generally less than 5 acres.

This soil has high potential for row crops and small grain. High clay content and wetness limit the length of time in which this soil can be tilled. Tillage operations should be timely and kept to a minimum. To obtain the highest level of production, this soil needs protection from overflow, a drainage system installed, and large amounts of crop residue returned to the soil in order to increase the water intake rate and to improve tilth.

This soil has medium potential for tame pasture and native grass. Cool season grasses and legumes are best adapted, but bermudagrass and clover are well suited. The grasses in tame pasture can be improved by fertilizing. The quality of all grasses can be maintained or improved by proper stocking and grazing, preventing fires, and controlling brush.

This soil has medium potential for hardwood. The main concerns of woodland management are plant competition, seedling mortality, and equipment limitation.

This soil has low potential for most urban uses. The main limitations for septic tank absorption fields, sanitary landfills, dwellings, and small commercial buildings are flooding and a very high shrink-swell potential.

This soil is in capability subclass IIIw and woodland group 3w. It was not assigned to a range site.

67—Udorthents. This map unit is near areas of Bernow, Carnasaw, Durant, Endsaw, Saffell, and Tarrant soils. In these areas, soil material, gravel, and limestone fragments have been excavated for building roads, dams, foundations, and similar structures. The excavated areas are 5 to 30 feet deep, 300 to 2,000 feet long, and 150 to 600 feet wide. They have nearly vertical sides and very gently sloping to sloping bottoms. The soil material consists of various combinations of sand, loamy fine sand, loam, sandy clay loam, clay loam, and clay. Reaction is mostly medium acid to mildly alkaline.

Areas of this map unit are suited to native grasses, improved bermudagrass, and to use as wildlife habitat. The erosion hazard is severe if a suitable cover is not maintained. The main management concerns are leveling the steep slopes, controlling erosion, and maintaining tilth and fertility. Intensive management is needed to establish or to improve and maintain stands of plant cover. Establishing desirable plant cover, controlling grazing, and adding plant food are needed in places.

This map unit is in capability subclass VIIs. It was not assigned to a range site or a woodland group.

68—Wrightsville silt loam, 0 to 1 percent slopes. This deep, poorly drained, nearly level soil is on uplands. Most areas are 5 to 30 acres, but a few areas are more than 100 acres.

Typically, the surface layer is dark grayish brown silt loam about 7 inches thick. The subsurface layer is light gray loam about 5 inches thick. The upper part of the subsoil, to a depth of about 18 inches, is dark gray clay with vertical streaks and tongues of light gray silt loam. The middle part of the subsoil is mottled, gray clay to a depth of about 30 inches and mottled, dark grayish brown silty clay to a depth of about 44 inches. The lower part of the subsoil is mottled, gray silty clay loam to a depth of about 56 inches. The underlying material is mottled, light gray silty clay loam to a depth of about 78 inches.

This soil is low in natural fertility and organic matter content. It is extremely acid to strongly acid in the surface layer where it has not been limed. Permeability is very slow, and available water capacity is high. It is generally wet in fall and spring and becomes hard and crusty when dry. The root zone is deep. A water table is at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Included with this soil in mapping are a few intermingled areas of Stigler and Hamden soils. The included soils make up 10 to 15 percent of this map unit, but separate areas are generally less than 3 acres. Soils on mounds that are 6 to 18 inches high and 30 feet in diameter make up 5 percent of the area.

This soil has medium potential for row crops and small grain. The erosion hazard is slight. Wetness, low fertility, and surface crusting are limitations on this soil. Large amounts of plant residue, proper fertilization, and a system of surface drains are needed to increase crop yields.

This soil has medium potential for tame pasture and low potential for native grass. Fescue, bermudagrass, and bahiagrass combined with clover is generally grown on this soil. Maintaining the fertility level and managing pasture are important practices. The quality of tame pasture grasses can be maintained or improved by controlling brush, preventing fires, and proper stocking and grazing.

This soil has low potential for woodland. The main concerns of management are seedling mortality and equipment limitation. This soil has low potential for most urban uses. High shrink-swell potential, low strength, and wetness are the main limitations for dwellings, small commercial buildings, amd roads and streets. Wetness and very slow permeability are main limitations for septic tank absorption fields. Wetness is the main limitation for sanitary landfills. Sewage lagoons can be used.

This soil is in capability subclass IIIw and woodland group 3w. It was not assigned to a range site.

69—Yanush association, hilly. This association consists of deep, well drained, strongly sloping to moderately steep soils. Slopes are about 10 to 25 percent. These soils are in long, narrow areas and on the lower side slopes of hills. Most areas are 50 to 100 acres, but some are smaller.

Typically, these soils have a very dark grayish brown cherty silt loam surface layer about 4 inches thick. The subsurface layer is brown cherty silt loam about 8 inches thick. The upper part of the subsoil, to a depth of about 34 inches, is red cherty silty clay loam. The lower part of the subsoil is yellowish red cherty silty clay loam that extends to a depth of about 66 inches. Below this is vertically tilted chert beds.

These soils are low in natural fertility and organic matter content. They are medium acid or slightly acid in the surface layer, except where they have been limed. Permeability is moderate, and available water capacity is low. The root zone is deep.

Included with these soils in mapping are soils that are 40 to 60 inches deep to chert. Also included are a few intermingled areas of Bigfork soils. The included soils make up about 15 percent of this map unit, but separate areas generally are less than 5 acres.

These soils have low potential for row crops and small grain. Slope is the main limitation. The soils have low potential for native grass and tame pasture. Bermudagrass or bahiagrass combined with clover is the most common mixture used for tame pasture. Fertilizing increases forage production. The quality of native and tame pasture grasses can be maintained or improved by proper stocking and grazing, controlling brush, and preventing fires.

These soils have low potential for woodland. The main concerns of woodland management are equipment limi-

tation, seedling mortality, and controlling erosion. These soils have low potential for most urban uses. Slope is the main limitation.

This association is in capability subclass VIe, woodland group 5f, and the Smooth Chert Savannah range site.

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

Odos G. Henson, conservation agronomist, Soil Conservation Service, helped to 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, including some not commonly grown in the survey area, 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.

Cultivated soils in this county need management that conserves moisture, controls erosion, improves fertility, supplies organic matter, and provides good tilth. Some of the management practices are discussed below.

Soils are tilled to prepare a seedbed and to control weeds. Excessive tillage destroys tilth and speeds up decomposition of organic matter.

Minimum tillage is accomplished by (1) using a long term cropping system with perennial grasses or deep-rooted legumes, (2) using herbicides instead of cultivation for weed control, and (3) reducing the number of operations in preparing the seedbed, planting, and cultivating.

Crop residue management can be accomplished by leaving crop residue on the surface or working it partly into the surface to protect the soil from erosion. Organic matter improves the tilth of the surface layer.

Erosion is the main problem on cropland. If the slope is more than 2 percent, erosion is a hazard. Bernow soils, for example, have slopes of 2 percent or more. Loss of the surface layer through erosion is damaging. Productivity is reduced as the surface layer is lost. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as the Bosville soils. Erosion also reduces productivity on soils that tend to be droughty, such as Pickton soils. Erosion on farmland results in sediment entering streams. A conservation cropping system is planned and managed to reduce soil loss.

Soil drainage is the main management need on some of the acreage used for crops and pasture. Unless artificially drained, poorly drained soils are so wet that crops

are damaged during most years. Examples of poorly drained soils are Guyton and Wrightsville soils.

Soil fertility is low on most of the uplands. Most plants respond to fertilizer and lime. Some of the field crops suited to the survey area are wheat, grain sorghum, soybeans, and peanuts.

Management of soils for tame pasture plants

General guidelines for managing soils for tame pasture plants are described in this section. Those desiring more detailed information about management of soils can refer to the section "Soil maps for detailed planning."

Much of the acreage in the county is in tame pasture plants. The trend is to convert cropland and woodland to pasture. To a lesser degree, range is also being converted to pasture.

The main grass is improved bermudagrass. Some of the better pastures of bermudagrass are overseeded with legumes, which provide additional plant food that increases the quality and quantity of forage.

Some bermudagrass pastures are overseeded with fescue. This mixture is especially adapted to soils on flood plains where additional moisture is available. The mixture provides grazing in nearly all months and furnishes added protein for livestock during the months when bermudagrass is dormant.

Fescue is an important grass in the county (fig. 6). It provides a sufficient quantity of forage for grazing on soils that have large amounts of available moisture. Fescue is used in the pasture program with other forages to furnish grazing and additional protein late in fall and late in spring. To maintain a vigorous stand, the soil needs to be fertilized early in spring and early in fall and should not be grazed during summer.

Bahiagrass, a deep rooted, warm season perennial grass, is adapted to the county. It is better adapted to soils that have low fertility than most perennial summer grasses, however, it responds well to soils that have high levels of fertility, especially those having nitrogen. It is best adapted to deep, well drained, loamy or sandy soils. Bahiagrass can be grazed about the same time of year as bermudagrass.

Weeping lovegrass is grown to a limited extent in the county. It is a warm season perennial bunch grass adapted to well drained, loamy and sandy soils. It begins growing earlier in spring and remains green later in fall than bermudagrass. It becomes less palatable to cattle as it matures. This grass responds well to fertilizer, especially nitrogen.

Some areas of cropland are used for forage plants that supplement the permanent grasses. Small grains in the pasture program provide grazing and additional protein for livestock late in fall and late in spring. They need to be seeded and fertilized late in summer or early in fall in order to obtain the maximum amount of forage. Small grains can be grazed until maturity or until livestock can be removed in spring to allow the plants to grow a seed crop for harvest. Wheat, oats, barley, and rye are the main small grains used for grazing.

Sudangrass, an annual grass, is also used on some areas of cropland to supplement permanent grasses. It can be used in the pasture program to provide grazing during summer, or the forage can be harvested for hay. In some areas, Sudangrass is allowed to grow until frost and is grazed in winter. Fertilizer should be used for maximum growth.

The kind of soil and the adapted plants are a concern in good tame pasture management. Good pasture can be achieved by maintaining the desired kind and stand of plants. Plants must have vigor to keep a proper balance in the stand. Grazing needs to be adjusted according to the growth and vigor of pasture plants.

Proper grazing and rotation grazing help to lengthen the life of most tame pasture plants. Deferred grazing is beneficial during the time that tame pasture plants are under the most stress. It allows plants to regain vigor by helping to maintain a large root system where food can be stored for the next growing season. Total production of forage will be increased.

A fertilizer program that contributes the proper elements insures more vigorous pasture plants. This helps to increase forage production and to lengthen the lifespan of the plants. Plant nutrients can be added by using commercial fertilizers or legumes that furnish nitrogen to the plants. The acidity of the soil needs to be adjusted to the kinds of plants desired in the sand. Large amounts of plant nutrients, especially nitrogen, are needed when legumes are not grown with the grass.

The desired kind of pasture plants can be maintained in the stand only by controlling the invasion of undesirable plants. Weeds need to be controlled. Brush control is essential on soils that support trees. A properly used mowing or spraying program helps to reduce weeds and brush.

A pasture program can be planned so that forage is available during every month of the year. A study of the growth habits of the different plants is necessary to assure adequate forage each month. The months in which various kinds of forage plants grow are indicated in figure 7, and the percentage of growth for each kind of plant is also illustrated. For example, bermudagrass makes 22 percent of its yearly growth for grazing during the month of June.

Soils vary in their capacity to produce forage for grazing. Hamden soils produce more forage than Bates soils primarily because Hamden soils furnish more available moisture to the plant. The total yearly production of various kinds of pasture plants on each soil is given in animal-unit-months (AUM) in table 5. An animal-unit-month is 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. For example, bermudagrass on Hamden fine sandy loam, 0 to 2

percent slopes, furnishes grazing for one animal unit for 7.5 months during the year.

In planning a pasture program, one must consider the total yearly production of the pasture plant in AUM (table 5) and the growth the plant will make for a certain month (fig. 7). As illustrated in fig. 7, bermudagrass furnishes 22 percent of its annual forage during June. Hamden soils provide grazing for 1.6 animals in June since its yearly production is 7.5 AUM (22 percent X 7.5 AUM = 1.6 AUM). Therefore, a 50-acre pasture would furnish grazing for 80 animals (50 acres X 1.6 AUM = 80 AUM) during June. Soil Conservation Service or County Extension Office personnel can help plan a pasture program for your farm.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 6. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

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 6.

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.

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown; that good quality irrigation water is uniformly applied in proper amounts as needed; and that tillage is kept to a minimum.

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 6 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 classes and subclasses

Capability classes and subclasses show, 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. In this survey, only the class and subclass levels are used. 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*, 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 subclass is identified in the description of each soil mapping unit in the section "Soil maps for detailed planning."

Rangeland

Ernest C. Snook, range conservationist, Soil Conservation Service, helped prepare this section.

About 85 percent of Atoka County is range (fig. 8). More than half of the farm income is derived from livestock, principally cattle. Cow-calf-steer operations are dominant.

The native vegetation in many parts of the survey area has been greatly depleted by continued excessive use. Much of the acreage that was once open grassland is now covered with brush and weeds. The amount of forage produced may be less than half of that originally produced. Productivity of the range can be increased by using management practices that are effective for specific kinds of soil and range sites. If the soil is being managed for woodland but the understory is being utilized by livestock, refer to table 9 for the potential of producing understory vegetation.

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 7 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 7.

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. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

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 most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community are re-established. Controlling brush and minimizing soil erosion are also important management concerns. If sound range management based on the soil survey information and rangeland inventories is applied, the potential is good for increasing the productivity of range in the area.

Woodland management and productivity

Norman E. Smola, forester, Soil Conservation Service, helped prepare this section.

The information given in this section is helpful to woodland owners and operators in carrying out plans for establishing and maintaining tree resources.

Natural stands of trees are throughout Atoka County. The principal forest cover types are shortleaf pine-oak, which is in the northeastern part of the county; oak-hickory, which is in the southeastern part of the county; and post-oak-blackjack oak, which is in the western part of the county. Elm-ash-hackberry is the principal bottomland forest type in Atoka County.

The value of wood products is substantial. Other values of woodland are grazing, wildlife habitat, recreation, natural beauty, and watershed protection.

Table 8 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Map unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination 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.

In table 8 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 *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Common 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.

Woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some types of forest, under proper management, can produce enough understory vegetation to support grazing of livestock or wildlife, or both.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees, the density of the canopy, and the depth and condition of the forest litter. The density of the forest canopy affects the amount of light that understory plants receive during the growing season.

Table 9 shows, for each soil suitable for woodland, the potential for producing understory vegetation. The table also lists the common names of the characteristic vegetation that grows on a specified soil and the percentage composition, by air-dry weight, of each kind of plant. The kind and percentage of understory plants listed in the table are those to be expected where canopy density is most nearly typical of forests that yield the highest production of wood crops.

The total production of understory vegetation is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the soil moisture is above average during the optimum part of the growing season; in a normal year soil moisture is average; and in an unfavorable year it is below average.

Engineering

Charles E. Bollinger, assistant state conservation engineer, Soil Conservaton Service, and Jesse L. McMasters, area engineer, 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 sea-

sonal 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 surrounding 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 degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties 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.

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 assess-

ment 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

Jerome F. Sykora, 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 affect 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 (fig. 9). 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.

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.

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.

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.

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.

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.

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.

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.

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants.

Wetland habitat consists of open, marshy or swampy, shallow water areas where water-tolerant plants grow.

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 Atterberg 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.

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.

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.

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.

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 (*3*). 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 map units, of each soil series are described in the section "Soil maps for detailed planning."

Agan series

The Agan series consists of deep, moderately well drained, very slowly permeable, nearly level to very gently sloping soils that formed in material weathered from granite. These soils are on broad, smooth areas of the uplands. They have a perched water table at a depth of less than 2 feet during winter and spring.

Agan soils are near the Chigley, Parsons, and Durant soils. Chigley soils are in higher positions on the landscape, have an A2 horizon, and do not have vertic properties. Parsons soils are in about the same positions on the landscape, have an A2 horizon, and formed in material weathered from shale. Durant soils are in higher positions on the landscape, have a mollic epipedon, and a B1 horizon.

Typical pedon of Agan loam, 0 to 2 percent slopes, 2,400 feet east and 1,200 feet north of the southwest corner of sec. 21, T. 3 S., R. 9 E.:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) loam; massive; friable; few granite gravel; slightly acid; abrupt wavy boundary.

B21t—7 to 14 inches; very dark grayish brown (10YR 3/2) clay; moderate medium blocky structure; very firm; continuous clay films on faces of peds; few granite gravel; neutral; gradual wavy boundary.

B22t—14 to 40 inches; very dark grayish brown (2.5Y 3/2) gravelly clay; few fine faint brown mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; 15 percent by volume of granite gravel less than 3 inches in diameter; mildly alkaline; gradual wavy boundary.

B23t—40 to 50 inches; dark grayish brown (2.5Y 4/2) gravelly clay; common medium distinct light olive brown (2.5Y 5/4) mottles; weak coarse blocky structure; very firm, continuous clay film on faces of peds; about 15 percent by volume of granite gravel less than 3 inches in diameter; mildly alkaline; gradual wavy boundary.

B3—50 to 65 inches; gray (10YR 6/1) very gravelly clay, many medium distinct brownish yellow (10YR 6/6) mottles; weak coarse blocky structure; very firm; 60 to 75 percent by volume of granite gravel; moderately alkaline.

The solum is more than 60 inches thick. The A horizon has hue of 10YR, value of 2 to 4, and chroma of 1 or 2. The content of gravel by volume ranges from 0 to 10 percent. Reaction is medium acid to neutral.

The B horizon has hue of 10YR or 2.5Y, value of 3 or 4, and chroma of 1 to 3. It has mottles in shades of gray, brown, or yellow in the lower part. It is clay, silty clay, or gravelly clay. The B21t and B22t horizons are slightly acid to mildly alkaline. The B23t and B3 horizons are mildly alkaline or moderately alkaline.

Bates series

The Bates series consists of moderately deep, well drained, moderately permeable, very gently sloping to gently sloping soils. Bates soils formed in material weathered from acid sandstone. These soils are on uplands in the northern part of the county.

Bates soils are similar to Hartsells soils. They are near Coweta, Dennis, and Eram soils. Coweta soils are in a similar position on the landscape and have a solum that is 10 to 20 inches thick. Dennis soils are in a similar position on the landscape and are in a fine family. Eram soils are in a lower position on the landscape and are in a fine family. Hartsells soils do not have a mollic epipedon.

Typical pedon of Bates fine sandy loam, 1 to 3 percent slopes, 900 feet west and 200 feet north of the southeast corner of sec. 28, T. 2 S., R. 9 E.:

A1—0 to 12 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak medium granular structure; very friable; slightly acid; gradual smooth boundary.

B1—12 to 20 inches; yellowish brown (10YR 5/4) loam; weak medium subangular blocky structure; friable; strongly acid; gradual smooth boundary.

B2t—20 to 35 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; firm; continuous clay films on faces of peds; strongly acid; abrupt smooth boundary.

Cr—35 to 38 inches; soft sandstones with thin beds of soft shale.

The solum thickness ranges from 20 to 40 inches. This soil is slightly acid to strongly acid. The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 2 or 3.

The B1 horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. It is loam or fine sandy loam. The B2t horizon has hue of 10YR or 7.5YR, value of 3 to 5, and chroma of 3 to 6. Mottles in shades of red or brown generally are present in the lower part. This horizon is sandy clay loam or clay loam.

Bernow series

The Bernow series consists of deep, well drained, moderately permeable, nearly level to strongly sloping soils that formed in loamy sediment (fig. 10). These soils are on broad areas of the uplands in the southern part of the county.

Bernow soils are near and adjacent to Bosville, Hamden, Larue, and Romia soils. Bosville soils are in the fine family. Hamden soils have gray mottles in the upper part of the argillic horizon and are more clayey in the lower part of the pedon. Larue soils have a sandy A horizon that is 20 to 40 inches thick.

Typical pedon of Bernow fine sandy loam, 1 to 3 percent slopes, 100 feet west and 2,000 feet north of the southeast corner of sec. 7, T. 3 S., R. 12 E.:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; friable; slightly acid; clear smooth boundary.

A2—6 to 15 inches; pale brown (10YR 6/3) fine sandy loam; weak fine granular structure; friable; slightly acid; clear smooth boundary.

B21t—15 to 36 inches; brownish yellow (10YR 6/8) sandy clay loam; common medium faint light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; firm; thin clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—36 to 50 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct yellowish red (5YR 4/6) and pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; thin clay films on faces of peds; strongly acid; gradual smooth boundary.

B&A'2—50 to 65 inches; yellowish brown (10YR 5/6) sandy clay loam; with about 15 percent A'2 occurring as vertical streaks of light gray (10YR 6/1) clean sand grains; many coarse distinct yellowish red (5YR 4/6) mottles; weak coarse subangular blocky structure; firm; patchy clay films on faces of peds; very strongly acid.

The solum ranges from 60 to 80 inches in thickness. Depth to bedrock is more than 6 feet. The A horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 2 to 4. Reaction is neutral to medium acid in unlimed areas.

The B horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 4 to 8. It has mottles in shades of red, yellow, or brown; and gray mottles are common in the lower part. The B horizon is clay loam, loam, or sandy clay loam. Reaction is medium acid to very strongly acid. In most pedons the A'2 horizon has vertical streaks or pockets of clean sand grains below a depth of 40 inches. Some pedons contain up to 3 percent plinthite in the lower part.

Bigfork series

The Bigfork series consists of moderately deep, well drained, moderately permeable, steep soils that formed in material weathered from chert or novaculite. These soils are on long, narrow ridge crests of uplands.

Bigfork soils are near the Yanush soils. Yanush soils are on the lower parts of slopes and they have a thicker solum than the Bigfork soils.

Typical pedon of Bigfork cherty silt loam, from an area of Bigfork-Yanush association, steep, 1,400 feet east and 800 feet south of the northwest corner of sec. 21, T. 1 S., R. 12 E.:

A1—0 to 5 inches; grayish brown (10YR 5/2) cherty silt loam; moderate medium granular structure; friable; 45 percent coarse fragments of chert by volume; slightly acid; clear smooth boundary.

B2t—5 to 35 inches; brown (7.5YR 5/4) cherty silty clay loam; weak medium subangular blocky structure; firm; patchy clay films on faces of peds; 40 percent coarse fragments of chert by volume; strongly acid; abrupt irregular boundary.

R—35 to 40 inches; vertically tilted chert beds.

Solum thickness and depth to hard bedrock range from 20 to 40 inches. The A1 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. It contains coarse fragments ranging from 40 to 60 percent by volume with 10 to 20 percent by volume being less than 3 inches in diameter. Reaction in the A1 horizon is strongly acid to slightly acid.

The B2t horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 to 5; and chroma of 4 to 8. Texture, exclusive of coarse fragments, is silty clay loam or clay loam. Coarse fragments more than 3 inches in diameter range from 25 to 60 percent by volume. Coarse fragments less than 3 inches in diameter range from 15 to 30 percent by volume. Reaction in the B2t horizon is medium acid to very strongly acid.

The R horizon is chert or nonvaculite tilted 20 degrees to 60 degrees from horizontal.

Boggy series

The Boggy series consists of deep, somewhat poorly drained, moderately permeable, nearly level soils that formed in loamy sediment. These soils are on broad flood plains. They have an apparent water table within a depth of 2 feet during winter and spring.

Boggy soils are near the Dela, Guyton, and Rexor soils. Dela and Rexor soils are on higher elevations on the flood plain and do not have the high water table of the Boggy soils. In addition, Rexor soils are in a fine-silty family. Guyton soils are at higher elevations in concave positions on the flood plain and have a fine-silty argillic horizon.

Typical pedon of Boggy fine sandy loam, 1,500 feet west and 2,000 feet south of the northeast corner of sec. 19, T. 3 S., R. 11 E.:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine granular structure; friable; medium acid; clear smooth boundary.

A12—4 to 12 inches; light brownish gray (10YR 6/2) fine sandy loam; many medium distinct yellowish brown (10YR 5/6) and common medium distinct brown (7.5YR 5/4) mottles; weak medium granular structure; friable; slightly acid; clear smooth boundary.

C1—12 to 16 inches; gray (10YR 5/1) fine sandy loam; many medium distinct yellowish brown (10YR 5/8) mottles; massive; very friable; medium acid; clear smooth boundary.

C2—16 to 20 inches; dark grayish brown (10YR 4/2) loam; common medium distinct reddish brown (5YR 4/3) mottles; massive; very friable; thin strata white fine sand; medium acid; clear smooth boundary.

C3—20 to 32 inches; dark grayish brown (10YR 4/2) loam; few fine faint brown mottles; moderate medium subangular blocky structure; friable; strongly acid; gradual smooth boundary.

C4—32 to 50 inches; gray (10YR 5/1) loam; few fine distinct brown (10YR 4/3) mottles; massive; friable; medium acid; gradual smooth boundary.

C5—50 to 72 inches; gray (10YR 6/1) loam; massive; friable; medium acid.

The A horizon has hue of 7.5YR or 10YR, value of 3 to 6, and chroma of 1 or 2 in more than 50 percent of the horizon but includes chroma of 3 in some pedons. Where value is less than 3.5, the horizon is less than 6 inches thick. Mottles are in shades of brown or gray. Thickness of the A horizon ranges from 12 to 32 inches. Reaction is slightly acid or medium acid.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma 1 or 2 in more than 50 percent of the horizon but includes chroma of 3 in some pedons. Mottles are in shades of brown or gray. Reaction is medium acid or strongly acid.

Bosville series

The Bosville series consists of deep, moderately well drained, very slowly permeable, very gently sloping to strongly sloping soils that formed in loamy and clayey sediments. These soils are on broad areas on the uplands in the southern part of the county. Bosville soils have a perched water table at a depth of 1 foot to 2 feet during winter and spring.

Bosville soils are adjacent to the Bernow, Hamden, Larue, Romia, and Saffell soils. They are similar to the Counts soils. Bernow and Hamden soils are in a fine-loamy family. Counts soils have an argillic horizon that has hue of 10YR or 2.5Y. Larue soils have an A horizon that is 20 to 40 inches thick. Romia soils have a solum that is 20 to 40 inches thick. Saffell soils are in a loamy-skeletal family.

Typical pedon of Bosville fine sandy loam, 3 to 5 percent slopes, 900 feet north and 500 feet east of the southwest corner of sec. 3, T. 3 S., R. 11 E.:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; friable; slightly acid; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) fine sandy loam; weak medium granular structure; very friable; medium acid; abrupt wavy boundary.

B21t—6 to 22 inches; yellowish red (5YR 5/8) clay; common medium distinct pale brown (10YR 6/3) mottles; strong medium blocky structure; very firm; continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—22 to 40 inches; red (2.5YR 4/6) clay; common medium distinct pale brown (10YR 6/3) and light gray (10YR 7/1) mottles; strong medium blocky structure; very firm; continuous clay films on faces of peds; very strongly acid; gradual smooth boundary.

B23t—40 to 72 inches; yellowish red (5YR 5/6) clay; many coarse prominent light gray (10YR 7/1) mottles; weak coarse blocky structure; very firm; patchy clay films; very strongly acid.

The solum thickness ranges from 60 to more than 80 inches. The A1 horizon has hue of 10YR or 7.5YR, value of 3 or 4, and chroma of 2 or 3. Reaction is medium acid or strongly acid except where limed.

The A2 horizon has hue of 10YR or 7.5YR, value of 4 to 6, and chroma of 2 to 6. Reaction is medium acid or strongly acid except where limed.

The B2t horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 4 to 6; and chroma of 4 to 8. It has mottles in shades of gray, brown, or yellow; and the size and the amount of gray mottles increase with depth. This horizon is clay or silty clay. Reaction is medium acid to very strongly acid.

Burleson series

The Burleson series consists of deep, moderately well drained, very slowly permeable, nearly level to very gently sloping soils that formed in clayey sediment. These soils are on smooth areas of the uplands in the southwestern part of the county.

Burleson soils are near the Catoosa, Claremore, Durant, Heiden, and Tarrant soils and are adjacent to the Heiden soils. Catoosa, Claremore, and Tarrant soils are on ridge crests in higher positions on the landscape, and they are shallow or moderately deep over limestone. Durant soils are in similar positions on the landscape and have a loam A horizon and an argillic horizon. Heiden soils have an A horizon of higher chroma.

Typical pedon of Burleson clay, 1 to 3 percent slopes, 2,400 feet west and 1,000 feet north of the southeast corner of sec. 35, T. 4 S., R. 9 E.:

A11—0 to 12 inches; black (N 2/0) clay; moderate fine blocky structure; very firm; neutral; gradual wavy boundary.

A12—12 to 24 inches; black (10YR 2/1) clay; moderate medium blocky structure; very firm; shiny faces of peds; intersecting slickensides below a depth of 20 inches; calcareous, mildly alkaline; gradual wavy boundary.

AC1—24 to 48 inches; dark gray (10YR 4/1) clay; distinct grooved, intersecting slickensides; very firm; few soft bodies of calcium carbonate; calcareous, mildy alkaline; diffuse wavy boundary.

AC2—48 to 73 inches; olive yellow (2.5Y 6/6) clay, with streaks of gray (5Y 6/1); massive; very firm; calcareous, moderately alkaline.

The thickness of the A and AC horizons is extremely variable. The thickness of the A horizon ranges from 6 to 48 inches and averages about 20 inches.

The A horizon has hue of 10YR or 2.5Y, value of 2 or 3, chroma of less than 1.5. Reaction is slightly acid to moderately alkaline. The microlows are generally slightly acid.

The AC horizon has hue of 2.5Y or 5Y, value of 4 to 6, and chroma of 1 to 6 with gray streaks and mottles in most pedons. Calcium carbonate bodies are few too common. Reaction is mildly alkaline or moderately alkaline. Calcareous shale or limestone is at a depth of 60 to 100 inches.

Carnasaw series

The Carnasaw series consists of deep, well drained, slowly permeable, gently sloping to steep soils that formed in colluvium and material weathered from shale and sandstone. These soils are on broad areas of the uplands.

Carnasaw soils are similar to Endsaw soils. They are near the Clebit, Hector, and Hartsells soils. Clebit and Hector are shallow soils that formed in material weathered from sandstone and are on convex ridges. Endsaw soils have a Cr horizon of shale that is tilted less than 20 degrees from the horizontal. These soils are in a similar position on the slope but are north of the Choctaw fault. Hartsells soils have a less clayey B horizon and also have broad slopes.

Typical pedon of Carnasaw gravelly loam, from an area of Carnasaw-Clebit association, moderately steep, 700 feet north and 100 feet west of the southeast corner of sec. 4, T. 1 S., R. 13 E.:

A1—0 to 4 inches; brown (10YR 4/3) gravelly loam; moderate medium granular structure; very friable; 15 percent gravel and 5 percent stones; medium acid; clear wavy boundary.

A2—4 to 7 inches; pale brown (10YR 6/3) loam; weak medium granular structure; very friable; 10 percent gravel and 2 percent stones; strongly acid; clear wavy boundary.

B21t—7 to 24 inches; red (2.5YR 4/6) clay; common medium distinct light yellowish brown (10YR 6/4) mottles; strong medium blocky structure; very firm; continuous clay films on faces of peds; very strongly acid; clear wavy boundary.

B22t—24 to 42 inches; yellowish red (5YR 4/6) clay; many medium distinct light brownish gray (10YR 6/2) mottles in the lower part; moderate medium blocky structure; very firm; continuous clay films on faces of peds; very strongly acid; gradual wavy boundary.

Cr—42 to 60 inches; reddish brown (5YR 5/4), soft shale; shale tilts at about 40 degrees; mildly alkaline.

The solum ranges from 30 to 60 inches in thickness. Depth to shale ranges from 30 to 60 inches. The A and B horizons contain 0 to 8 percent stones and 0 to 20 percent gravel.

The A1 horizon has hue of 7.5YR or 10YR, value of 3 or 4, chroma of 2 or 3. The A2 horizon has hue of 10YR or 7.5YR, value of 5 or 6, and chroma of 3 to 6. Reaction in the A1 and A2 horizons is medium acid or strongly acid unless limed.

The B21t horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 5 or 6; and chroma of 6 to 8. It is silty clay loam, clay loam, or clay; and reaction is strongly acid or very strongly acid.

The B22t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 to 8. Mottles are in shades of brown or yellow. Texture is silty clay or clay, and reaction is strongly acid or very strongly acid.

Some pedons have a B3 horizon with hue of 5YR or 7.5YR, value of 4 to 6, and chroma of 6 to 8. Mottles are

in shades of gray. Texture is silty clay or clay, and reaction is strongly acid or very strongly acid.

The Cr horizon is weathered shale that is tilted 20 to 40 degrees.

Catoosa series

The Catoosa series consists of moderately deep, well drained, moderately permeable, very gently sloping soils that formed in material weathered from limestone. These soils are on smooth ridge crests in the southwestern part of the county.

Catoosa soils are near Burleson, Claremore, and Tarrant soils. Bates soils formed in material weathered from sandstone. Burleson soils are clayey and are in a lower position on the landscape. Claremore soils are less than 20 inches thick and are in similar positions on the landscape. Tarrant are shallow, skeletal soils that also are on smooth ridge crests.

Typical pedon of Catoosa loam, in an area of Claremore-Catoosa complex, 1 to 3 percent slopes, 950 feet west and 500 feet north of the southeast corner of sec. 28, T. 4 S., R. 10 E.:

A1—0 to 12 inches; dark brown (7.5YR 3/2) loam; moderate medium granular structure; friable; neutral; gradual smooth boundary.

B2t—12 to 32 inches; brown (7.5YR 4/4) clay loam; moderate medium subangular blocky structure; firm; continuous clay films on faces of peds; slightly acid; abrupt smooth boundary.

R—32 to 40 inches; hard limestone.

The solum thickness and depth to bedrock range from 20 to 40 inches. The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 or 3. Reaction is slightly acid or medium acid, and in limed areas it is neutral.

The B2t horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 3 or 4; and chroma of 4 to 6. It is silty clay loam or clay loam, and reaction is strongly acid to neutral.

Chigley series

The Chigley series consists of deep, moderately well drained, moderately slowly permeable, very gently sloping to strongly sloping soils that formed in material weathered from granite. These soils are on uplands in the southwestern part of the county. They have a perched water table at a depth of 3 to 4 feet during winter and spring.

Chigley soils are near the Agan soils. Agan soils do not have an A2 horizon, have vertic properties, and are in lower positions on the landscape.

Typical pedon of Chigley fine sandy loam, 1 to 3 percent slopes, 500 feet south and 100 feet west of the northeast corner of sec. 17, T. 3 S., R. 9 E.:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) fine sandy loam; moderate medium granular structure; friable; 10 percent gravel by volume; slightly acid; clear wavy boundary.

A2—4 to 8 inches; pale brown (10YR 6/3) gravelly fine sandy loam; weak medium granular structure; friable; 20 percent gravel by volume; medium acid; abrupt wavy boundary.

B21t—8 to 22 inches; strong brown (7.5YR 5/6) clay; many coarse prominent yellowish red (5YR 5/6) mottles; moderate medium blocky structure; very firm; 10 percent gravel by volume; continuous clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—22 to 34 inches; red (2.5YR 4/6) clay; common medium distinct yellowish red (5YR 5/6) mottles; weak coarse blocky structure; very firm; 10 percent gravel by volume; continuous clay films on faces of peds; neutral; gradual wavy boundary.

B3—34 to 50 inches; yellowish brown (10YR 5/6) gravelly clay; many coarse distinct brown (10YR 5/3) mottles; weak coarse blocky structure; very firm; 15 percent gravel by volume; patchy clay films on faces of peds; mildly alkaline; gradual wavy boundary.

C—50 to 72 inches; brownish yellow (10YR 6/6) gravelly clay loam; common medium distinct brown (10YR 5/3) mottles; massive; very firm; shaly in lower 2 inches; fragments of gravel make up about 25 percent by volume; moderately alkaline.

R—72 to 74 inches; hard granite.

Solum thickness ranges from 40 to 60 inches. Depth to bedrock is more than 60 inches. The A1 horizon has hue of 10YR, value of 3 to 6, and chroma of 2 or 3. The A2 horizon has hue of 10YR or 7.5YR, value of 5 to 7, and chroma of 3 or 4. The A1 horizon or A2 horizon contain 10 to 25 percent gravel. In unlimed areas, reaction is medium acid or slightly acid.

The B21t horizon has hue of 5YR or 7.5YR, value of 5 or 6, and chroma of 4 to 6. It is mottled in shades of red or brown. This horizon is clay, sandy clay, or clay loam, and reaction is strongly acid to slightly acid.

The B22t horizon has hue of 2.5YR, 5YR, or 10YR; value of 4 to 6; and chroma of 4 to 6; or it is mottled in shades of brown or red. It is clay, sandy clay, or clay loam; and reaction is medium acid to neutral.

The B3 horizon has hue of 5YR, 7.5YR, or 10YR; value of 5 or 6; and chroma of 3 to 6; or it is coarsely mottled in shades of yellow, gray, brown, or red. It is clay, sandy clay, or clay loam; and reaction is slightly acid or neutral. Gravel content in the B horizon ranges from 10 to 35 percent by volume.

Some pedons have a C horizon that has colors and textures similar to those in the B3 horizon. Gravel content ranges from 25 to 50 percent by volume, and reaction is neutral to moderately alkaline.

Claremore series

The Claremore series consists of shallow, well drained, moderately permeable, very gently sloping soils that formed in material weathered from limestone. These soils are on smooth ridge crests of uplands in the southwestern part of the county.

Claremore soils are near the Burleson and Tarrant soils and are adjacent to the Catoosa soils. Burleson soils are clayey and in the lower positions on the landscape. Tarrant soils are skeletal, do not have an argillic horizon, and are also on smooth ridge crests. Catoosa soils are 20 to 40 inches thick.

Typical pedon of Claremore loam, in an area of Claremore-Catoosa complex, 1 to 3 percent slopes, 750 feet west and 500 feet north of the southeast corner of sec. 28, T. 4 S., R. 10 E.:

A1—0 to 8 inches; dark brown (7.5YR 3/2) loam, moderate medium granular structure; friable; neutral; gradual smooth boundary.
B2t—8 to 18 inches; dark reddish brown (5YR 3/4) clay loam; moderate medium subangular blocky structure; firm; continuous clay films on faces of peds; slightly acid; abrupt smooth boundary.
R—18 to 30 inches; hard, fractured limestone.

The solum thickness and depth to bedrock range from 10 to 20 inches. The A horizon has hue of 5YR, 7.5YR, or 10YR; value of 2 or 3; and chroma of 2 or 3. Reaction is medium acid or slightly acid, and in limed areas it is neutral.

The B2t horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 3 or 4; and chroma of 4 to 6. It is silty clay loam or clay loam, and reaction is medium acid or slightly acid.

Clebit series

The Clebit series consists of shallow, well drained, moderately rapidly permeable, gently sloping to steep soils that formed in material weathered from sandstone. These soils are on long, narrow ridges of uplands.

The Clebit soils are similar to Hector soils and differ by having a greater content of gravel. They are near the deeper Carnasaw soils.

Typical pedon of Clebit stony fine sandy loam, from an area of Carnasaw-Clebit association, moderately steep, 1,100 feet north and 300 feet east of the southwest corner of sec. 19, T. 2 S., R. 13 E.:

A1—0 to 5 inches; brown (10YR 5/3) stony fine sandy loam; weak medium granular structure; very friable; coarse fragments of sandstone make up 40 percent by volume; strongly acid; clear smooth boundary.
B2—5 to 16 inches; pale brown (10YR 6/3) very gravelly fine sandy loam; weak fine and medium granular structure; very friable; coarse fragments make up about 45 percent by volume of gravel and stones; very strongly acid; abrupt irregular boundary.
R—16 to 20 inches; yellowish, hard tilted sandstone.

Thickness of solum and depth to bedrock range from 10 to 20 inches. Coarse fragments in the solum range from 35 to 60 percent.

The A horizon has hue of 10YR, value of 3 to 5, and chroma of 2 or 3. The fine earth fraction is fine sandy loam or loam. Reaction is strongly acid to slightly acid.

The B horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 to 6. Some pedons have red, brown, or yellow mottles. The fine earth fraction of this horizon is loam or fine sandy loam. Reaction is very strongly acid to slightly acid.

The R horizon is grayish, yellowish, or brownish hard sandstone that is tilted more than 20 degrees from the horizontal.

Counts series

The Counts series consists of deep, somewhat poorly drained, very slowly permeable, nearly level soils that formed in clayey sediment or in material weathered from shale. They are on smooth uplands. The Counts soils have a perched water table at a depth of 1 foot to 2 feet during winter and spring.

The Counts soils are similar to the Bosville soils and are adjacent to Stigler soils. Bosville soils have an argillic horizon that has hue of 7.5YR or redder. Stigler soils do not have the abrupt texture change between the A and B horizons and have an A horizon that is more than 20 inches thick.

Typical pedon of Counts loam, 0 to 1 percent slopes, 300 feet west and 100 feet south of the northeast corner of sec. 28, T. 1 N., R. 15 E.:

A1—0 to 8 inches; dark grayish brown (10YR 4/2) loam; weak fine granular structure; friable; slightly acid; clear smooth boundary.
A2—8 to 15 inches; grayish brown (10YR 5/2) loam; weak fine granular structure; friable; strongly acid; abrupt wavy boundary.
B21t—15 to 30 inches; yellowish brown (10YR 5/6) clay; many medium distinct gray (10YR 6/1) and few fine distinct yellowish red mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; strongly acid; gradual smooth boundary.
B22t—30 to 50 inches; brownish yellow (10YR 6/6) clay; many coarse distinct light gray (10YR 7/1) mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; neutral; gradual wavy boundary.
B23t—50 to 70 inches; yellowish brown (10YR 6/6) clay; many coarse distinct gray (5Y 5/1) mottles; weak

coarse blocky structure; very firm; thin patchy clay films on faces of peds; mildly alkaline.

Solum thickness is more than 60 inches. Thickness of the A1 and A2 horizons ranges from 12 to 18 inches.

The A1 horizon has hue of 10YR, value of 3 to 5, and chroma of 2. The A2 horizon has hue of 10YR or 2.5Y, value of 5 or 6 moist, and chroma of 2 or 3. Reaction of the A1 and A2 horizons is strongly acid or medium acid except where limed.

The B horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 3 to 8. Mottles are in shades of red, brown, or gray. Reaction is very strongly acid to medium acid in the upper part and medium acid to mildly alkaline in the lower part.

Coweta series

The Coweta series consists of shallow, well drained, moderately permeable, very gently sloping to gently sloping soils that formed in material weathered from sandstone. These soils are on hill crests of uplands in the northern part of the county.

Coweta soils are near the Bates and Eram soils. Bates soils have a solum that is 20 to 40 inches thick, and are in similar positions on the landscape. Eram soils have a solum thickness of 20 to 40 inches, have a clayey argillic horizon, and are in a lower position on the slope.

Typical pedon of Coweta fine sandy loam, in an area of Bates-Coweta complex, 2 to 5 percent slopes, 1,980 feet west and 1,450 feet south of the northwest corner of sec. 10, T. 2 S., R. 10 E.:

A1—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam; weak medium granular structure; friable; slightly acid; clear smooth boundary.

B2—11 to 16 inches; yellowish brown (10YR 5/4) gravelly clay loam; weak fine subangular blocky structure; friable; 20 to 30 percent sandstone fragments by volume; medium acid; gradual smooth boundary.

Cr—16 to 22 inches; light brownish yellow (10YR 6/4) loam; few fine faint strong brown (7.5YR 5/6) mottles; massive; 50 to 60 percent interbedded sandstone and shale fragments in the upper part and grades to sandstone interbedded with shale in the lower part; strongly acid.

Solum thickness and depth to interbedded sandstone and shale range from 10 to 20 inches. Reaction of the solum is strongly acid to slightly acid.

The A horizon has hue of 7.5YR or 10YR, value of 3, and chroma of 2 or 3. Fragments of sandstone less than 3 inches in diameter range from 0 to 10 percent by volume.

The B horizon has hue of 5YR, 7.5YR, or 10YR; value of 3 to 5; and chroma of 2 to 8. It is loam or clay loam with fragments of sandstone less than 3 inches in diameter that range from 15 to 30 percent by volume.

The Cr horizon is interbedded sandstone and shale.

Dela series

The Dela series consists of deep, moderately well drained, moderately rapidly permeable, nearly level soils that formed in loamy and sandy sediments. These soils are on broad flood plains. They have an apparent water table at a depth of 3 to 5 feet during winter and spring.

Dela soils are near Boggy, Guyton, and Rexor soils. Boggy soils have a high water table and are on the lower elevations on the flood plain. Rexor and Guyton soils are in a fine-silty family, do not have stratified texture in the pedon, and are in higher positions on the landscape.

Typical pedon of Dela fine sandy loam 1,700 feet east and 1,400 feet south of the northwest corner of sec. 2, T. 4 S., R. 13 E.:

Ap—0 to 8 inches; brown (10YR 5/3) fine sandy loam; weak medium granular structure; friable; medium acid; clear smooth boundary.

A1—8 to 18 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; friable; medium acid; clear smooth boundary.

C1—18 to 38 inches; brown (10YR 5/3) fine sandy loam; massive; friable; slightly acid; gradual smooth boundary.

C2—38 to 55 inches; dark grayish brown (10YR 4/2) loam; few fine faint grayish brown (10YR 5/2) mottles; massive; friable; slightly acid; gradual smooth boundary.

C3—55 to 72 inches; yellowish brown (10YR 5/4) very fine sandy loam; massive; friable; slightly acid.

The A horizon has hue of 10YR, value of 4 or 5, and chroma of 2 to 4. Reaction is strongly acid to slightly acid.

The C horizon has hue of 7.5YR or 10YR, value of 4 to 7, and chroma of 2 to 6. It has mottles with chroma of 2 or less below a depth of 24 inches. Texture is loam, very fine sandy loam, or fine sandy loam. Reaction is strongly acid to slightly acid.

Dennis series

The Dennis series consists of deep, moderately well drained, slowly permeable, very gently sloping or gently sloping soils that formed in material weathered from shales. These soils are on prairie uplands. They have a perched water table at a depth of 2 to 3 feet during winter and spring.

Dennis soils are near and in a position similar to the Bates, Durant, Eram, and Parsons soils. Bates and Eram soils have a solum that is 20 to 40 inches thick. Durant soils have vertic properties and calcium carbonate in the

lower part of the B horizon. Parsons soils have an abrupt texture change between the A and B horizons.

Typical pedon of Dennis loam, 1 to 3 percent slopes, 1,400 feet north and 1,300 feet west of the southeast corner of sec. 28, T. 2 S., R. 9 E.:

A11—0 to 12 inches; very dark grayish brown (10YR 3/2) loam; moderate medium granular structure; friable; slightly acid; gradual smooth boundary.

A12—12 to 16 inches; dark brown (10YR 3/3) loam; moderate medium granular structure; friable; slightly acid; clear smooth boundary.

B1—16 to 25 inches; dark yellowish brown (10YR 4/4) clay loam; few fine faint strong brown mottles; moderate medium subangular blocky structure; friable; medium acid; gradual smooth boundary.

B21t—25 to 35 inches; brown (10YR 5/3) clay; many medium distinct red (2.5YR 4/6) or strong brown (7.5YR 5/8) and common medium distinct dark grayish brown (10YR 4/2) mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—35 to 48 inches; strong brown (7.5YR 5/6) clay; many coarse distinct gray (10YR 6/1) mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—48 to 72 inches; coarsely mottled reddish yellow (7.5YR 6/8) and gray (10YR 6/1) clay; weak coarse blocky structure; very firm; thin patchy clay films on faces of peds; mildly alkaline.

The solum is more than 60 inches thick. The A horizon has hue of 10YR, value of 2 or 3, and chroma of 2 or 3. Reaction is strongly acid or medium acid but ranges to slightly acid or neutral in limed areas.

The B1 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 3 or 4. Reaction is very strongly acid to medium acid. The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 or 5; and chroma of 3 to 6. It is mottled in shades of brown, yellow, gray, or red. Reaction is strongly acid to slightly acid. The B3 horizon is coarsely mottled in shades of red, gray, yellow, or brown. Reaction is medium acid to mildly alkaline.

Durant series

The Durant series consists of deep, moderately well drained, very slowly permeable, very gently sloping soils that formed in calcareous shales or clay beds. The Durant soils are on broad, smooth areas of the uplands.

Durant soils are near the Agan and Burleson soils and are adjacent to the Dennis and Parsons soils. Agan soils are on lower slopes and do not have a mollic epipedon. Burleson soils are on similar slopes and are clayey throughout. Dennis soils do not have the vertic properties of Durant soils. Parsons soils have an abrupt texture change between the A and B horizons.

Typical pedon of Durant loam, 1 to 3 percent slopes, 300 feet west and 100 feet south of the northeast corner of sec. 29, T. 3 S., R. 9 E.:

A1—0 to 9 inches; very dark brown (10YR 2/2) loam; moderate fine granular structure; friable; medium acid; gradual smooth boundary.

B1—9 to 12 inches; dark brown (10YR 3/3) silty clay loam; moderate fine subangular blocky structure; firm; medium acid; gradual smooth boundary.

B21t—12 to 24 inches; olive brown (2.5Y 4/4) clay; common fine prominent red mottles; moderate medium subangular blocky structure; very firm; thin continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—24 to 48 inches; light olive brown (2.5Y 5/6) clay; many medium distinct olive gray (5Y 5/2) mottles; moderate medium blocky structure; very firm; thin continuous clay films on faces of peds; neutral; gradual smooth boundary.

B3—48 to 70 inches; light olive brown (2.5Y 5/6) clay; many medium distinct gray (5Y 5/1) mottles; weak coarse blocky structure; very firm; fine concretions of calcium carbonate and few fine black concretions; moderately alkaline.

The solum thickness ranges from 50 to more than 60 inches. The depth to calcium carbonate concretions ranges from 30 to 50 inches. The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 2 or 3. Reaction is medium acid or slightly acid.

The B1 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. It is clay loam, silty clay loam, or clay; and reaction is strongly acid to slightly acid.

The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 or 5; and chroma of 2 to 6. It is mottled in shades of red, brown, or gray. Reaction is medium acid to neutral.

The B3 horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 to 6; and chroma of 2 to 6. It is mottled in shades of red, brown, or gray; and reaction is slightly acid to moderately alkaline.

Endsaw series

The Endsaw series consists of deep, well drained, slowly permeable, gently sloping to very steep soils that formed in colluvium and material weathered from shale. These soils are on uplands in the western part of the county.

Endsaw soils are similar to Carnasaw soils. They are near the Hartsells and Hector soils. Carnasaw soils have a Cr horizon of shale laminated with layers of sandstone tilted more than 20 degrees from the horizontal. Hartsells

and Hector soils are on ridge crests of uplands and are formed in material weathered from sandstone.

Typical pedon of Endsaw fine sandy loam, from an area of Endsaw-Hector complex, 8 to 30 percent slopes, 2,280 feet north and 700 feet east of the southwest corner of sec. 29, T. 1 N., R. 12 E.:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; very friable; fragments of sandstone less than 75 millimeters in diameter make up 10 percent by volume; medium acid; clear smooth boundary.

A2—4 to 9 inches; yellowish brown (10YR 5/4) fine sandy loam; weak medium granular structure; very friable; fragments of sandstone less than 75 millimeters in diameter make up 10 percent by volume; medium acid; clear smooth boundary.

B21t—9 to 28 inches; red (2.5YR 4/6) clay; moderate fine blocky structure; very firm; thick clay films on faces of peds; fragments of sandstone less than 75 millimeters in diameter make up 2 percent by volume; very strongly acid; clear smooth boundary.

B22t—28 to 40 inches; yellowish red (5YR 5/6) clay; with many coarse prominent yellowish brown (10YR 5/6) mottles; weak medium blocky structure; very firm; thick clay films on faces of peds; fragments of sandstone less than 75 millimeters in diameter make up 2 percent by volume; very strongly acid; clear smooth boundary.

B3—40 to 48 inches; mottled yellowish red (5YR 5/6), gray (10YR 5/1), and yellowish brown (10YR 5/6) clay; weak coarse blocky structure; very firm; few clay films on faces of peds; very strongly acid; gradual wavy boundary.

Cr—48 to 60 inches; pale yellow (5Y 8/3) soft shale; slightly acid; tilted 10 degrees from the horizontal.

The solum thickness and depth to shale range from 40 to 60 inches. Reaction is medium acid or strongly acid in the A horizon, strongly acid or very strongly acid in the B2t and B3 horizons, and slightly acid to very strongly acid in the Cr horizon. Coarse fragments of sandstone range from 5 to 40 percent in the A horizon and from 0 to 15 percent in the B horizon.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. The fine earth fraction is loam or fine sandy loam. The A2 horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 to 6. Its fine earth fraction is loam or fine sandy loam. The B2t horizon has hue of 5YR or 2.5YR, value of 4 or 5, and chroma of 6 to 8. Its fine earth fraction is clay or silty clay. The Cr horizon is grayish or yellowish shale that is tilted from 0 to 20 degrees from the horizontal.

Eram series

The Eram series consists of moderately deep, moderately well drained, slowly permeable, very gently sloping to moderately steep soils that formed from material weathered from shale. These soils are on broad areas of the uplands in the northern part of the county. They have a perched water table at a depth of 2 or 3 feet during winter and spring.

Eram soils are near the Bates and Coweta soils and are adjacent to the Dennis and Talihina soils. Bates and Coweta soils are in higher positions on the landscape and are loamy soils that formed in material weathered from sandstone. Dennis soils have a solum that is more than 60 inches thick. Talihina soils are steeper and have a solum that is less than 20 inches thick.

Typical pedon of Eram clay loam, 3 to 5 percent slopes, 700 feet south and 100 feet west of the northeast corner of sec. 36, T. 1 S., R. 11 E.:

A1—0 to 11 inches; very dark grayish brown (10YR 3/2) clay loam; moderate medium granular structure; friable; slightly acid; clear smooth boundary.

B2t—11 to 22 inches; very dark grayish brown (2.5Y 3/2) clay; common fine distinct yellowish red mottles; moderate medium blocky structure; very firm; thin continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B3—22 to 33 inches; olive brown (2.5Y 4/4) clay; common medium faint light olive brown (2.5Y 5/4) mottles; weak coarse blocky structure; very firm; neutral; gradual smooth boundary.

Cr—33 to 40 inches; gray and olive clay shale.

The solum ranges from 20 to 40 inches in thickness. The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 or 3. In unlimed areas, reaction is medium acid or slightly acid. The B horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 2 to 4. Reaction is strongly acid to neutral. The Cr horizon is gray and olive shale, and reaction is neutral or alkaline.

Gowton series

The Gowton series consists of deep, well drained, moderately permeable, nearly level soils that formed in loamy sediment along Clear Boggy Creek and its tributaries or local creeks that drain mainly prairie soils. These soils are on smooth flood plains.

The Gowton soils are near the Kaufman and Trinity soils. Kaufman and Trinity soils are generally in positions that are farther from the stream channel, and they have a very fine control section.

Typical pedon of Gowton clay loam, 500 feet west and 500 feet north of the southeast corner of sec. 27, T. 3 S., R. 9 E.:

Ap—0 to 7 inches; very dark brown (10YR 2/2) clay loam; weak medium granular structure; friable; medium acid; abrupt smooth boundary.
A11—7 to 31 inches; very dark brown (10YR 2/2) clay loam; moderate medium granular structure; friable; slightly acid; gradual smooth boundary.
A12—31 to 38 inches; very dark grayish brown (10YR 3/2) clay loam; few fine faint distinct yellowish brown mottles; weak medium subangular blocky structure; firm; slightly acid; diffuse smooth boundary.
C—38 to 68 inches; grayish brown (10YR 5/2) clay loam; few fine faint yellowish brown mottles; massive; firm; few fine black concretions; slightly acid.

The A horizon has hue of 10YR or 7.5YR, value of 2 or 3, and chroma of 1 or 2. Reaction ranges from medium acid to neutral. Thickness ranges from 24 to 40 inches.

The C horizon has hue of 10YR or 7.5YR, value of 4 or 5, and chroma of 2 to 4. Most pedons have thin strata of fine sandy loam and loam. Reaction is slightly acid to mildly alkaline. A few pedons are calcareous in the lower part of the C horizon.

Guyton series

The Guyton series consists of deep, poorly drained, slowly permeable, nearly level soils that formed in loamy alluvial sediment. These soils are in broad areas on flood plains of the Muddy Boggy Creek and its tributaries. They have an apparent water table at a depth of less than 1.5 feet during winter and spring.

Guyton soils are on the same flood plain as Boggy, Dela, Rexor, Lightning, and Wrightsville soils. Boggy soils have a coarse-loamy control section and are in lower positions on the landscape. Dela soils are better drained, sandier, and are in a lower position closer to the stream channel. Lightning soils are in similar positions on the landscape but are more clayey. Rexor soils are better drained, less gray, and generally are in slightly higher positions on the landscape. Wrightsville soils have a fine control section and are in higher positions.

Typical pedon of Guyton silt loam, 900 feet south and 1,300 feet west of the northeast corner of sec. 2, T. 4 S., R. 13 E.:

Ap—0 to 8 inches; grayish brown (10YR 5/2) silt loam; weak fine granular structure; friable; medium acid; clear smooth boundary.
A2g—8 to 17 inches; gray (10YR 5/1) silt loam; few fine strong brown mottles; weak medium subangular blocky structure; friable; strongly acid; clear irregular boundary.
B&A—17 to 22 inches; gray (10YR 5/1) silty clay loam; weak medium subangular blocky structure; friable; thin patchy clay films on faces of peds; tongues of light brownish gray (10YR 6/2) silt loam make up about 15 percent of the horizon; very strongly acid; gradual smooth boundary.
B21tg—22 to 32 inches; light gray (10YR 6/1) silt loam; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; thin patchy clay films on faces of peds; few fine hard black concretions; very strongly acid; diffuse smooth boundary.
B22tg—32 to 47 inches; light gray (10YR 6/1) silty clay loam; many medium distinct yellowish brown (10YR 5/6) mottles; weak coarse subangular blocky structure; firm; numerous fine hard black concretions; thin patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.
B3tg—47 to 80 inches; light gray (10YR 6/1) silty clay loam; many coarse distinct strong brown (7.5YR 5/6) mottles; weak coarse subangular blocky structure; firm; thin patchy clay films on faces of peds; strongly acid.

The solum is more than 60 inches thick. The A horizon has hue of 10YR or 2.5Y, value of 4 to 6, and chroma of 2 or 3. Reaction is medium acid to very strongly acid. The A2g horizon has hue of 10YR or 2.5Y, value of 5 to 7, and chroma of 1 or 2. Reaction is very strongly acid or strongly acid.

The B2tg horizon has hue of 10YR or 2.5Y, value of 5 or 6, and chroma of 1 or 2. It has mottles in shades of brown that increase in size and amount with depth. This horizon is silt loam or silty clay loam, and reaction is very strongly acid to medium acid. The B3tg horizon has the same color and texture as the B2tg horizon. Reaction is strongly acid to mildly alkaline.

Hamden series

The Hamden series consists of deep, moderately well drained, moderately slowly permeable, nearly level or very gently sloping soils that formed in material weathered from interbedded sandstone and clay. These soils are on uplands in the southern part of the county. Hamden soils have a perched water table at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Hamden soils are near the Bernow and Larue soils and are adjacent to the Bosville soils. Bernow and Larue soils are in similar positions on the landscape, have less clay in the lower part of the B horizon, and are not as wet. Bosville soils have a fine control section.

Typical pedon of Hamden fine sandy loam, 0 to 2 percent slopes, 1,320 feet west and 200 feet south of the northeast corner of sec. 3, T. 3 S., R. 11 E.:

Ap—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam; moderate medium granular structure; friable; medium acid; abrupt smooth boundary.

A2—9 to 18 inches; brown (10YR 5/3) fine sandy loam; many medium distinct light brownish gray (10YR 6/2) mottles; weak medium granular structure; friable; strongly acid; clear smooth boundary.

B21t—18 to 24 inches; very pale brown (10YR 7/3) loam; few medium distinct yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; firm; thin clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—24 to 32 inches; light gray (10YR 7/2) clay loam; many medium distinct yellowish red (5YR 5/6) and common fine distinct light brownish gray mottles; moderate medium blocky structure; firm; continuous clay films on faces of peds; strongly acid; gradual wavy boundary.

B23t—32 to 48 inches; gray (10YR 6/1) clay; many medium prominent yellowish red (5YR 5/6) and common medium distinct strong brown (7.5YR 5/6) mottles; strong medium blocky structure; very firm; continuous clay films on faces of peds; strongly acid; gradual smooth boundary.

B24t—48 to 86 inches; light gray (10YR 7/1) clay; many coarse distinct yellowish brown (10YR 5/8) mottles; moderate coarse blocky structure; very firm; continuous clay films on faces of peds; medium acid above a depth of 64 inches and mildly alkaline below.

The solum is more than 60 inches thick. Depth to bedrock is more than 6 feet. Thickness of the A1 or A2 horizon ranges from 6 to 20 inches.

The A horizon has hue of 10YR, value of 4 to 6, and chroma of 2 or 3. Reaction is medium acid to very strongly acid. The A2 horizon has hue of 10YR, value of 5 to 7, and chroma of 2 or 3. It has mottles in shades of brown or gray, and reaction is medium acid to very strongly acid.

The B21t horizon or B22t horizon has hue of 10YR, value of 5 to 7, and chroma of 3 to 6. In most pedons, the B22t horizon has chroma of 2. It has mottles in shades of brown, red, or gray. It is loam, clay loam, or sandy clay loam; and reaction is medium acid to very strongly acid. The B23t horizon or B24t horizon has hue of 10YR, value of 5 to 7, and chroma of 1. It is mottled in shades of red, brown, or gray; and reaction is strongly acid to mildly alkaline.

Hartsells series

The Hartsells series consists of moderately deep, well drained, moderately permeable, very gently sloping to sloping soils that formed in material weathered from sandstone. These soils are on ridgetops of uplands.

Hartsells soils are similar to Bates soils and are near the Counts soils. They are adjacent to Carnasaw, Endsaw, and Hector soils. Bates soils have a mollic epipedon. Counts soils are in nearly level areas, are more than 60 inches deep, and have a clayey control section. Hector soils are less than 20 inches thick. Carnasaw and Endsaw soils have a clayey control section.

Typical pedon of Hartsells fine sandy loam, 2 to 4 percent slopes, 2,200 feet east and 400 feet north of the southwest corner of sec. 7, T. 2 S., R. 13 E.:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak medium granular structure; very friable; medium acid; clear smooth boundary.

A2—5 to 14 inches; brown (10YR 5/3) fine sandy loam; weak medium granular structure; very friable; strongly acid; clear smooth boundary.

B2t—14 to 26 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; friable; thin continuous clay films on faces of peds; 5 percent sandstone fragments from 1/2 inch to 3 inches in diameter; very strongly acid; gradual smooth boundary.

B3—26 to 38 inches; yellowish brown (10YR 5/6) sandy clay loam; many medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable; patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

R—38 to 44 inches; acid, hard sandstone.

The solum ranges from 20 to 40 inches in thickness. Coarse fragments of sandstone range from 0 to 10 percent, but they range to 35 percent in the B3 horizon.

The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2 or 3. Reaction is extremely acid to strongly acid. The A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 3 to 6. Reaction is extremely acid to strongly acid.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 4 to 6. Mottles are in shades of red, brown, or yellow. This horizon is sandy clay loam or clay loam. Reaction is extremely acid to strongly acid.

Hector series

The Hector series consists of shallow, well drained, moderately rapidly permeable, very gently sloping to very steep soils that formed in material weathered from sandstone. These soils are on broad ridge crests of uplands in the northern part of the county.

Hector soils are near the Carnasaw soils and are adjacent to the Endsaw and Hartsells soils. Carnasaw soils are in lower positions on the landscape. Carnasaw and Endsaw soils are deeper soils with a clayey argillic horizon. Hartsells soils are deeper soils with a loamy argillic horizon.

Typical pedon of Hector fine sandy loam, from an area of Endsaw-Hector complex, 8 to 30 percent slopes, 1,100 feet north and 300 feet east of the southwest corner of sec. 19, T. 2 S., R. 13 E.:

A1—0 to 3 inches; brown (10YR 4/3) fine sandy loam; weak medium granular structure; very friable; about 10 percent coarse fragments of sandstone; strongly acid; clear smooth boundary.

A2—3 to 6 inches; brown (10YR 5/3) fine sandy loam; weak medium granular structure; very friable; about 10 percent coarse fragments of sandstone; strongly acid; clear smooth boundary.

B2—6 to 18 inches; strong brown (7.5YR 5/6) loam; weak medium subangular blocky structure; friable; about 10 percent coarse fragments of sandstone; very strongly acid; abrupt irregular boundary.

R—18 to 22 inches; hard fractured sandstone.

Thickness of the solum and depth to bedrock ranges from 10 to 20 inches. The solum contains 5 to 35 percent coarse fragments.

The A1 horizon has hue of 7.5YR or 10YR, value of 3 or 4, and chroma of 2 or 3. Reaction is strongly acid to slightly acid. The A2 horizon has hue of 10YR, value of 4 to 6, and chroma of 2 to 4. Reaction is strongly acid to slightly acid.

The B2 horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 or 5; and chroma of 3 to 6. It is loam or fine sandy loam. Reaction is strongly acid or very strongly acid.

Heiden series

The Heiden series consists of deep, well drained, very slowly permeable, gently sloping to moderately steep soils that formed in material weathered from shaly clay. These soils are on uplands in the southwestern part of the county.

Heiden soils are adjacent to Burleson soils and are near Tarrant soils. Burleson soils are less sloping and have an A horizon with lower chroma. Tarrant soils are on ridge crests and are shallow over limestone.

Typical pedon of Heiden clay, 3 to 5 percent slopes, 700 feet west and 600 feet north of the southeast corner of sec. 31, T. 4 S., R. 9 E.:

A11—0 to 14 inches; very dark brown (10YR 2/2) clay; moderate fine blocky structure; very firm; shiny faces on peds; calcareous; moderately alkaline; gradual wavy boundary.

A12—14 to 24 inches; very dark grayish brown (10YR 3/2) clay; moderate medium blocky structure; common intersecting slickensides; tilted parallelepipeds; common fine calcium carbonate concretions; very firm; calcareous; moderately alkaline; diffuse wavy boundary.

AC1—24 to 38 inches; dark olive (5Y 3/3) clay; moderate coarse blocky structure; common intersecting slickensides; tilted parallelepipeds; very firm; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

AC2—38 to 54 inches; dark olive (5Y 3/4) clay; weak coarse blocky structure; common intersecting slickensides; very firm; calcareous; moderately alkaline; gradual smooth boundary.

C—54 to 65 inches; coarsely mottled light brownish gray (2.5Y 6/2) and olive yellow (2.5Y 6/6) shaly clay; calcareous; moderately alkaline.

The combined thickness of the A and AC horizons ranges from about 40 to 60 inches. The A horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 or 3; and chroma of 1.5 to 3. The AC horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 to 5; and chroma of 2 to 6.

Kaufman series

The Kaufman series consists of deep, somewhat poorly drained, very slowly permeable, nearly level soils that formed in mostly clayey sediment. They are on broad flood plains, mainly on Clear Boggy Creek and its tributaries. These soils have a water table at a depth of less than 3 1/2 feet during winter and spring.

Kaufman soils are near the Gowton and Trinity soils. Gowton soils are near the stream channel and are less clayey. Trinity soils are in higher parts of the flood plain and are calcareous throughout the pedon.

Typical pedon of Kaufman clay, 3,000 feet south and 100 feet west of the northeast corner of sec. 5, T. 4 S., R. 11 E.:

A11—0 to 18 inches; black (10YR 2/1) clay; few fine faint dark grayish brown (2.5Y 4/2) mottles; moderate medium blocky structure; very firm; slightly acid; diffuse wavy boundary.

A12—18 to 32 inches; black (10YR 2/1) clay; few fine distinct very dark grayish brown (2.5Y 3/2) mottles; moderate coarse blocky structure; common intersecting slickensides; very firm; neutral; diffuse wavy boundary.

AC1g—32 to 66 inches; very dark gray (10YR 3/1) clay; common medium faint dark grayish brown (2.5Y 4/2) mottles; moderate medium and coarse blocky structure; common intersecting slickensides; very firm; mildly alkaline; diffuse wavy boundary.

AC2g—66 to 82 inches; very dark gray (10YR 3/1) clay; common medium faint dark grayish brown (2.5Y 4/2) mottles; moderate medium and coarse blocky structure; very firm; common intersecting slickensides; mildly alkaline.

Reaction is medium acid to mildly alkaline. The soil is calcareous below a depth of 24 inches in a few areas. The depth to a horizon that has value of 4 or more is more than 20 inches.

The A horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 or 3; and chroma of 0 or 1. The waviness of the

boundary between the A and ACg horizons varies from 6 to 20 inches.

The ACg horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 to 5; and chroma of 0 or 1. It is mottled in shades of yellow, brown, or olive. Some pedons have strata of silt loam and fine sandy loam at a depth of more than 40 inches.

Kiti series

The Kiti series consists of shallow, well drained, moderately permeable, very gently sloping to steep soils that formed in material weathered from hard limestone. These soils are on broad ridge crests of uplands.

Kiti soils are similar to Tarrant soils. Tarrant soils are in a clayey-skeletal family.

Typical pedon of Kiti stony clay loam, from an area of Kiti-Rock outcrop complex, 1 to 12 percent slopes, 1,800 feet south and 200 feet east of the northeast corner of sec. 33, T. 3 S., R. 9 E.:

A1—0 to 14 inches; dark brown (10YR 3/3) stony clay loam; moderate medium granular structure; friable; 40 percent limestone fragments greater than 3 inches in diameter and 10 percent fragments less than 3 inches in diameter; neutral.

R—14 to 22 inches; hard fractured limestone; tilted 30 degrees.

Thickness of the A horizon and depth to bedrock ranges from 4 to 20 inches. The A horizon has hue of 7.5YR or 10YR, value of 2 to 3, and chroma of 2 or 3. It is silty clay loam or clay loam that contains 5 to 10 percent fragments of limestone that are less than 3 inches in diameter and 30 to 55 percent fragments that are greater than 3 inches in diameter. Reaction is neutral to moderately alkaline.

The R layer is hard, tilted limestone. It is tilted 20 to 85 degrees from the horizontal.

Larue series

The Larue series consists of deep, well drained, moderately permeable, very gently sloping to sloping soils that formed in material weathered from loamy and sandy sediments. These soils are on broad areas of the uplands in the southern part of the county.

Larue soils are adjacent to Bernow, Bosville, Hamden, and Pickton soils. Bernow and Hamden soils have a fine sandy loam A horizon that is less than 20 inches thick. Bosville soils have a clayey argillic horizon. Pickton soils have an A horizon that is more than 40 inches thick.

Typical pedon of Larue loamy fine sand, 0 to 3 percent slopes, 2,200 feet east and 2,200 feet north of the southwest corner of sec. 11, T. 4 S., R. 14 E.:

A1—0 to 10 inches; brown (10YR 5/3) loamy fine sand; weak medium granular structure; very friable; slightly acid; clear smooth boundary.

A2—10 to 26 inches; pale brown (10YR 6/3) loamy fine sand; weak fine granular structure; very friable; medium acid; gradual smooth boundary.

B21t—26 to 38 inches; strong brown (7.5YR 5/6) sandy clay loam; fine medium distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; friable; thin clay films on faces of peds; strongly acid; gradual smooth boundary.

B22t—38 to 50 inches; strong brown (7.5YR 5/6) sandy clay loam; moderate medium subangular blocky structure; friable; thin clay films on faces of peds; strongly acid; gradual smooth boundary.

B23t—50 to 65 inches; strong brown (7.5YR 5/6) sandy clay loam; common medium distinct light gray (10YR 7/2) mottles; weak medium subangular blocky structure; friable; patchy clay films on faces of peds; few pockets of clean sand grains; very strongly acid; gradual smooth boundary.

B24t—65 to 72 inches; coarsely mottled strong brown (7.5YR 5/6), light gray (10YR 7/2), and red (2.5YR 4/6) sandy clay loam; weak coarse subangular blocky structure; friable; strongly acid.

The solum ranges from 60 to 80 inches or more in thickness. Depth to bedrock is more than 6 feet. The A horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 3 or 4. Reaction is medium acid to slightly acid. The B21t horizon or B22t horizon has hue of 2.5YR, 5YR, or 7.5YR; value of 4 or 5; and chroma of 6 to 8. Reaction is medium acid to strongly acid.

Lightning series

The Lightning series consists of deep, somewhat poorly drained, very slowly permeable, nearly level soils that formed in loamy and clayey sediments. These soils are on flood plains of Muddy Boggy Creek and its tributaries. They have a perched water table at a depth of less than 2 feet during winter and spring.

Lightning soils are near the Guyton soils. The Guyton soils are in a similar position on the landscape and have a fine-silty control section.

Typical pedon of Lightning silt loam, 100 feet north and 2,000 feet east of the southwest corner of sec. 33, T. 1 N., R. 14 E.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; medium acid; abrupt smooth boundary.

A2—7 to 14 inches; grayish brown (10YR 5/2) silt loam; few fine faint dark gray mottles; weak fine granular structure; friable; strongly acid; clear wavy boundary.

B1g—14 to 22 inches; dark grayish brown (10YR 4/2) silty clay; few fine distinct dark gray and dark yellow-

ish brown mottles; moderate medium blocky structure; very firm; clay films on faces of peds; strongly acid; diffuse wavy boundary.

B21tg—22 to 38 inches; dark gray (10YR 4/1) silty clay; common fine distinct gray and dark yellowish brown mottles; moderate medium blocky structure; very firm; clay films on faces of peds; medium acid; gradual wavy boundary.

B22tg—38 to 62 inches; gray (10YR 5/1) silty clay; many medium distinct yellowish brown (10YR 5/6) and few fine distinct very dark gray mottles; weak coarse blocky structure; very firm; patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

B3—62 to 80 inches; coarsely mottled dark gray (10YR 4/1) and yellowish brown (10YR 5/6) silty clay; massive; very firm; neutral.

The solum thickness is more than 40 inches. The Ap or A1 horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction is strongly acid to neutral. The A2 horizon has value of 5 to 7. It is absent where the A horizon is less than 8 inches thick. Reaction is very strongly acid to slightly acid.

The B1g horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. It is mottled in shades of gray, brown, or red. Reaction is very strongly acid to slightly acid. The B21tg horizon has hue of 10YR, value of 3 to 6, and chroma of 1. Reaction is very strongly acid to slightly acid. The B22tg horizon and B3 horizon are similar to the B21t horizon in color and texture. Reaction is medium acid to mildly alkaline.

Parsons series

The Parsons series consists of deep, somewhat poorly drained, very slowly permeable, nearly level to very gently sloping soils that formed in material weathered from clayey shale or clayey sediment (fig. 11). These soils are on smooth areas of the uplands. They have a perched water table at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Parsons soils are adjacent to Agan, Dennis, and Durant soils. Agan soils do not have an A2 horizon, have vertic properties, and formed in material weathered from granite. Dennis and Durant soils have a mollic epipedon.

Typical pedon of Parsons silt loam, 0 to 1 percent slopes, 120 feet north and 1,320 feet east of the southwest corner of sec. 24, T. 1 N., R. 14 E.:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; friable; medium acid; clear smooth boundary.

A2—8 to 14 inches; grayish brown (10YR 5/2) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium granular structure; friable; strongly acid; abrupt wavy boundary.

B21t—14 to 32 inches; dark gray (10YR 4/1) clay; many medium prominent red (2.5YR 4/8) and common medium distinct strong brown (7.5YR 5/8) mottles; moderate medium blocky structure; very firm; thin continuous clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—32 to 54 inches; grayish brown (2.5Y 5/2) clay; common coarse distinct strong brown (7.5YR 5/6) and common medium distinct red (2.5YR 4/8) mottles; moderate coarse blocky structure; very firm; continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—54 to 74 inches; coarsely mottled gray (10YR 5/1) and strong brown (7.5YR 5/6) clay; weak coarse blocky structure; very firm; thin patchy clay films on faces of peds; neutral.

The solum thickness is 40 to more than 60 inches. The A1 and A2 horizons are less than 16 inches thick. The A1 horizon has hue of 10YR, value of 3 or 4, and chroma of 2. The A2 horizon has hue of 10YR, value of 4 or 5, and chroma of 1 or 2. Reaction in the A1 and A2 horizons is strongly acid to slightly acid.

The B2t horizon has hue of 10YR or 2.5Y, value of 3 to 5, and chroma of 1 or 2. Mottles in shades of brown, red, or gray are few in the upper part; but the lower part is coarsely mottled. Reaction is strongly acid to slightly acid. The B3 horizon has colors similar to those in the B2t horizon. Reaction is strongly acid to mildly alkaline.

Pickton series

The Pickton series consists of deep, well drained, moderately permeable, nearly level to very gently sloping soils that formed in sandy and loamy sediments. These soils are on uplands in the southern part of the county. They have a perched water table at a depth of 4 to 6 feet during winter and spring.

Pickton soils are adjacent to the Larue soils. Larue soils have an A horizon that is 20 to 40 inches thick.

Typical pedon of Pickton loamy fine sand, 0 to 3 percent slopes, 2,400 feet north and 1,500 feet east of the southwest corner of sec. 21, T. 4 S., R. 14 E.:

A1—0 to 20 inches; yellowish brown (10YR 5/4) loamy fine sand; single grain; loose; medium acid; clear smooth boundary.

A2—20 to 52 inches; very pale brown (10YR 7/4) loamy fine sand; single grain; loose; medium acid; clear wavy boundary.

B2t—52 to 72 inches; strong brown (7.5YR 5/6) sandy clay loam; many coarse prominent red (2.5YR 4/6) and many coarse distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; firm; thin patchy clay films on faces of peds; few pockets of clean sand grains; slightly acid; gradual smooth boundary.

B3—72 to 82 inches; strong brown (7.5YR 5/8) loam; many coarse distinct yellowish red (5YR 5/6) and many coarse distinct light brownish gray (10YR 6/2) mottles; weak medium subangular blocky structure; friable; coated sand grains; few pockets of clean sand grains; slightly acid.

The solum ranges from 65 to 100 inches or more in thickness. The A horizon ranges from 40 to 60 inches in thickness. The A1 horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. Reaction is medium acid or slightly acid. The A2 horizon has hue of 7.5YR or 10YR, value of 5 to 7, and chroma of 3 or 4. Reaction is medium acid or slightly acid.

The B horizon has hue of 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 2 to 6. It has mottles in shades of red, yellow, gray, or brown. The gray mottles are at a depth below 60 inches. This horizon is loam or sandy clay loam. Reaction is very strongly acid to slightly acid.

Rexor series

The Rexor series consists of deep, well drained, moderately permeable, nearly level soils that formed in loamy sediment. These soils are in broad areas on the flood plain of Muddy Boggy Creek and its tributaries. They have a water table at a depth of 3 or 4 feet during winter and spring.

Rexor soils are near the Boggy, Dela, and Guyton soils. Boggy soils are on the lower elevations on the flood plain and are somewhat poorly drained soils that have a coarse-loamy control section. Dela soils are in low positions on the flood plain and have a coarse-loamy control section. Guyton soils are in a slightly lower position, are poorly drained, and have chroma of 1 or 2 in the argillic horizon.

Typical pedon of Rexor loam, 1,900 feet east and 300 feet north of the southwest corner of sec. 22, T. 1 S., R. 12 E.:

A1—0 to 10 inches; brown (10YR 4/3) loam; moderate medium granular structure; friable; neutral; clear smooth boundary.

B21t—10 to 34 inches; brown (7.5YR 4/4) silty clay loam; common coarse distinct pale brown (10YR 6/3) mottles; moderate medium subangular blocky structure; firm; thin continuous clay films on faces of peds; medium acid; diffuse smooth boundary.

B22t—34 to 50 inches; brown (7.5YR 4/4) silt loam; common coarse distinct pale brown (10YR 6/3) and few fine distinct gray mottles; weak coarse subangular blocky structure; firm; patchy clay films on faces of peds; medium acid; gradual smooth boundary.

B3—50 to 75 inches; strong brown (7.5YR 5/6) loam; structureless; thin strata pale brown fine sandy loam in lower part; medium acid.

The solum ranges from 40 to 80 inches in thickness. The A horizon has hue of 7.5YR and 10YR, value of 3 or 4, and chroma of 2 or 3. Reaction is very strongly acid to medium acid, but it is neutral in areas that have been limed.

The B horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 3 to 6. It is clay loam, silty clay loam, silt loam, or loam. Reaction is very strongly acid to medium acid.

The B3 horizon has hue of 7.5YR or 10YR, value of 5 or 6, and chroma of 3 to 6. It is loam or silt loam, and reaction is very strongly acid to medium acid.

Romia series

The Romia series consists of deep, well drained, moderately permeable, strongly sloping soils that formed in material weathered from sandstone. The Romia soils are on smooth side slopes of uplands.

Romia soils are adjacent to Bernow and Bosville soils. Bernow and Bosville soils are not underlain by sandstone at a depth of 40 to 60 inches. Also, Bosville soils have a clayey B2t horizon.

Typical pedon of the Romia soils, from an area of Bernow-Romia complex, 8 to 12 percent slopes, 1,020 feet north and 1,600 feet west of the southeast corner of sec. 10, T. 4 S., R. 10 E.:

A1—0 to 6 inches; dark brown (10YR 3/3) fine sandy loam; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A2—6 to 14 inches; brown (10YR 5/3) fine sandy loam; weak fine granular structure; friable; medium acid; clear smooth boundary.

B21t—14 to 32 inches; yellowish red (5YR 4/8) clay loam; moderate medium subangular blocky structure; firm; strongly acid; gradual smooth boundary.

B22t—32 to 44 inches; yellowish red (5YR 5/8) sandy clay loam; few medium distinct red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; very strongly acid; clear smooth boundary.

Cr—44 to 58 inches; red soft sandstone.

Solum thickness and depth to sandstone range from 40 to 60 inches. The A1 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. Gravel content ranges from 0 to 15 percent. Reaction is slightly acid to strongly acid. The A2 horizon has hue of 5YR, 7.5YR, or 10YR; value of 5 or 6; and chroma of 2 to 4. It is similar to the A1 horizon in gravel content and in reaction.

The B2t horizon has hue of 2.5YR or 5YR, value of 4 to 6, and chroma of 4 to 8. In some pedons, grayish mottles are below a depth of 30 inches. This horizon is sandy clay loam or clay loam, and gravel content ranges from 0 to 15 percent. Reaction is medium acid to very

strongly acid. The Cr layer is rippable sandstone. It is laminated with bands of ironstone in some areas.

Saffell series

The Saffell series consists of deep, well drained, moderately permeable, very gently sloping to gently sloping soils that formed in loamy sediment. These soils are on smooth ridge crests of uplands.

Saffell soils are near the Bosville and Bernow soils. Bernow and Bosville soils have less than 35 percent gravel in the control section. Bosville soils are in a fine family.

Typical pedon of Saffell gravelly fine sandy loam, 1 to 5 percent slopes, 1,000 feet south and 800 feet east of the northwest corner of sec. 31, T. 2 S., R. 12 E.:

A1—0 to 8 inches; brown (10YR 4/3) gravelly fine sandy loam; weak fine granular structure; friable; about 30 percent gravel by volume; neutral; gradual smooth boundary.

A2—8 to 14 inches; strong brown (7.5YR 4/4) gravelly fine sandy loam; weak fine granular structure; friable; about 30 percent gravel by volume; slightly acid; gradual smooth boundary.

B21t—14 to 38 inches; yellowish red (5YR 5/6) gravelly sandy clay loam; moderate medium subangular blocky structure; firm; about 40 percent gravel by volume; patchy clay films on faces of peds; medium acid; gradual smooth boundary.

B22t—38 to 48 inches; red (2.5YR 4/6) gravelly sandy clay loam; moderate medium subangular blocky structure; very firm; 50 percent gravel by volume; patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—48 to 60 inches; strong brown (7.5YR 5/6) very gravelly sandy clay loam; massive; firm; 80 percent gravel by volume; slightly acid.

The solum thickness ranges from 35 to 60 inches. The content of gravel increases with depth. The A horizon has hue of 7.5YR or 10YR, value of 4 or 5, and chroma of 2 to 4. The content of gravel ranges from 15 to 40 percent. Reaction is strongly acid to slightly acid.

The B horizon has hue of 2.5YR, 5YR, 7.5YR, or 10YR; value of 4 to 6; and chroma of 4 to 8. It is gravelly or very gravelly clay loam or sandy clay loam. Gravel content ranges from 35 to 65 percent. Reaction is strongly acid to slightly acid.

The Saffell soils in this survey area are taxadjuncts to the Saffell series. They differ by having a higher soil reaction and higher base saturation than described in the range for the series. These differences do not greatly affect use, behavior, and management of these soils.

Stigler series

The Stigler series consists of deep, moderately well drained, very slowly permeable, nearly level soils that formed in clayey and loamy sediments. These soils are on smooth areas of the uplands. They have a perched water table at a depth of 2 or 3 feet during winter and spring.

Stigler soils are adjacent to Counts and Wrightsville soils. Counts soils have an abrupt texture change between the A and B horizons. Wrightsville soils have tonguing of the A2 horizon into the B horizon.

Typical pedon of Stigler very fine sandy loam, 0 to 1 percent slopes, 1,250 feet west and 1,100 feet north of the southeast corner of sec. 30, T. 3 S., R. 14 E.:

A1—0 to 16 inches; grayish brown (10YR 5/2) very fine sandy loam; few fine faint brown mottles; weak fine granular structure; friable; slightly acid; clear smooth boundary.

A2—16 to 24 inches; light brownish gray (10YR 6/2) very fine sandy loam; few medium distinct strong brown (7.5YR 5/6) mottles; weak fine granular structure; friable; very strongly acid; clear wavy boundary.

B21tg—24 to 46 inches; brown (10YR 5/3) clay; many coarse distinct red (2.5YR 5/6), gray (10YR 5/1), and strong brown (7.5YR 5/6) mottles; moderate medium blocky structure; firm; continuous clay films on faces of peds; strongly acid; gradual wavy boundary.

B22tg—46 to 74 inches; coarsely mottled light gray (10YR 7/1), strong brown (7.5YR 5/6), and pale brown (10YR 6/3) silty clay; weak coarse blocky structure; very firm; patchy clay film on faces of peds; few clean sand grains; few fine black concretions; strongly acid.

The solum is more than 60 inches thick. The A horizon ranges from 16 to 30 inches in thickness. The A1 horizon has hue of 10YR, value of 4 or 5, and chroma of 2. The A2 horizon has hue of 10YR, value of 5 or 6, and chroma of 2 to 4. In unlimed areas, reaction of the A1 and A2 horizons is very strongly acid or strongly acid.

The B2t horizon has hue of 7.5YR, 10YR, or 2.5Y; value of 4 to 6; and chroma of 3 or 4. It is mottled in shades of brown, red, or gray. This horizon is clay, silty clay, or clay loam. Reaction is very strongly acid to medium acid.

Talihina series

The Talihina series consists of shallow, moderately well drained, slowly permeable, sloping to moderately steep soils that formed in material weathered from shale. These soils are on broad areas of the uplands, mainly in the northern part of the county. They have a perched

water table at a depth of 1/2 foot to 2 feet during winter and spring.

Talihina soils are similar to Tarrant soils. They are adjacent to the Eram soils. Tarrant soils formed in material weathered from limestone. Eram soils are 20 to 40 inches deep.

Typical pedon of Talihina clay loam, from an area of Eram-Talihina complex, 5 to 20 percent slopes, 1,800 feet east and 700 feet south of the northwest corner of sec. 8, T. 2 S., R. 11 E.:

A1—0 to 7 inches; very dark grayish brown (2.5Y 3/2) clay loam; moderate medium granular structure; firm; fragments of sandstone, 6 to 18 inches in diameter, make up about 5 percent; medium acid; gradual smooth boundary.

B2—7 to 16 inches; dark grayish brown (2.5Y 4/2) clay; common medium distinct yellowish brown (10YR 5/4) mottles; weak medium blocky structure; very firm; strongly acid; gradual smooth boundary.

Cr1—16 to 24 inches; olive gray (5Y 4/2) soft shale; medium acid; gradual smooth boundary.

Cr2—24 to 33 inches; olive (5Y 5/3) bedded shale; neutral.

The solum ranges from 10 to 20 inches in thickness. The A horizon has hue of 2.5Y or 10YR, value of 2 or 3, and chroma of 2 or 3. The content of fragments of sandstone with a diameter of more than 3 inches ranges from 0 to 10 percent. Reaction is strongly acid to slightly acid.

The B horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 to 5; and chroma of 2 to 4. This horizon is clay, silty clay, or silty clay loam. Reaction is strongly acid to mildly alkaline.

The C horizon has hue of 5Y, 2.5Y, or 10YR; value of 4 to 6; and chroma of 1 to 4. It is shale or shale and sandstone. Reaction is neutral to moderately alkaline.

Tarrant series

The Tarrant series consists of shallow, well drained, moderately slowly permeable, very gently sloping to sloping soils that formed in material weathered from limestone. These soils are on ridge crests of uplands in the southwestern part of the county.

Tarrant soils are near Burleson and Heiden soils and are adjacent to Catoosa and Claremore soils. They are similar to the Kiti soils. Burleson and Heiden soils are in lower positions on the landscape and are deep, clayey soils. Catoosa soils are moderately deep, fine-silty soils, and Claremore soils are shallow and have a loamy argillic horizon. Kiti soils are loamy-skeletal soils that formed in material weathered from limestone.

Typical pedon of Tarrant cobbly clay, from an area of Tarrant soils, 1 to 8 percent slopes, 1,900 feet south and 1,800 feet west of the northeast corner of sec. 31 T. 4 S., R. 10 E.:

A11—0 to 8 inches; very dark grayish brown (10YR 3/2) cobbly clay; strong medium granular structure; firm; about 35 percent fragments of limestone by volume; calcareous; moderately alkaline; clear wavy boundary.

A12ca—8 to 14 inches; very dark grayish brown (10YR 3/2) cobbly clay; moderate medium granular structure; firm; about 75 percent fragments of limestone by volume; calcareous; moderately alkaline.

R—14 to 22 inches; hard fractured limestone.

The solum thickness and depth to bedrock range from 6 to 20 inches. The A horizon has hue of 7.5YR or 10YR, value of 2 or 3, and chroma of 2 or 3. Many pedons have chroma of 1 in the upper 6 inches. This horizon is cobbly or stony silty clay or clay. The amount of coarse fragments ranges from 35 to 80 percent by volume, and fragments larger than 3 inches in diameter range from 25 to 40 percent by volume.

The Tarrant soils in this survey area are taxadjuncts to the Tarrant series. They differ by being moist for longer periods of time than described in the range for the series. In about 40 percent of the pedons, the color in the upper part of the A horizon has chroma of 1. These differences do not greatly affect use, behavior, and management of these soils.

Trinity series

The Trinity series consists of deep, somewhat poorly drained, very slowly permeable, nearly level soils that formed in clayey sediment. These soils are on smooth flood plains. They have a perched water table at a depth of less than 3 feet during winter and spring.

Trinity soils are near Kaufman and Gowton soils. Gowton soils generally are in positions near the stream channel and have a fine-loamy control section. Kaufman soils are in the lower part of the flood plain and are not calcareous in the upper 24 inches of the pedon.

Typical pedon of Trinity clay, 100 feet south and 1,250 feet east of the northwest corner of sec. 10, T. 4 S., R. 10 E.:

Ap—0 to 6 inches; black (10YR 2/1) clay; moderate fine and medium granular structure; very firm; calcareous; moderately alkaline; clear smooth boundary.

A11—6 to 24 inches; black (10YR 2/1) clay; weak coarse blocky structure; very firm; intersecting slickensides in lower part; calcareous; moderately alkaline; diffuse smooth boundary.

A12—24 to 50 inches; very dark gray (5Y 3/1) clay; weak coarse blocky structure; very firm; intersecting slickensides; calcareous; moderately alkaline; diffuse smooth boundary.

A13—50 to 70 inches; black (5Y 2/1) clay; few fine distinct olive brown mottles; weak coarse blocky structure; very firm; intersecting slickensides; calcareous; moderately alkaline; diffuse smooth boundary.
C—70 to 85 inches; dark gray (5Y 4/1) clay; many coarse distinct olive brown (2.5Y 4/4) mottles; massive; very firm; few fine black concretions; calcareous; moderately alkaline.

The solum is more than 60 inches thick. It is calcareous. Reaction is mildly alkaline or moderately alkaline. The A horizon has hue of 10YR, 2.5Y, or 5Y; value of 2 or 3; and chroma of 1. It has mottles in shades of olive, yellow, or brown. The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 3 to 5; and chroma of 1. It has mottles in shades of brown, yellow, or olive.

Wrightsville series

The Wrightsville series consists of deep, poorly drained, very slowly permeable, nearly level soils that formed in clayey and loamy sediments. These soils are on broad, smooth areas on the uplands, mainly in the southeastern part of the county. They have a perched water table at a depth of 1/2 foot to 1 1/2 feet during winter and spring.

Wrightsville soils are near the Guyton soils and are adjacent to the Stigler soils. Guyton soils are in lower positions on the landscape and are in a fine-silty family. Stigler soils have an A horizon that is 16 to 30 inches thick.

Typical pedon of Wrightsville silt loam, 0 to 1 percent slopes, 100 feet east and 100 feet south of the northwest corner of sec. 27, T. 4 S., R. 12 E.:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) silt loam; weak fine granular structure; friable; neutral; abrupt smooth boundary.
A2g—7 to 12 inches; light gray (10YR 7/1) loam; few fine faint brown mottles; weak medium granular structure; friable; neutral; abrupt irregular boundary.
Bg&Ag—12 to 18 inches; dark gray (10YR 4/1) clay and 15 percent tongues, 1/2 inch to 2 inches wide, of light gray (10YR 7/2) silt loam (Ag part); few medium distinct yellowish brown (10YR 5/4) mottles; moderate medium blocky structure; clay films on faces of peds; very firm; medium acid; gradual wavy boundary.
B21tg—18 to 30 inches; gray (10YR 5/1) clay; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; light gray silt coating on faces of some peds; medium acid; gradual wavy boundary.
B22tg—30 to 44 inches; dark grayish brown (10YR 4/2) silty clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; very firm; continuous clay films on faces of peds; white silt coats on faces of some peds; medium acid; gradual wavy boundary.
B3g—44 to 56 inches; gray (10YR 6/1) silty clay loam; many coarse distinct yellowish brown (10YR 5/8) mottles; weak coarse blocky structure; very firm; strongly acid; gradual smooth boundary.
C—56 to 78 inches; light gray (5Y 7/1) silty clay loam; many coarse distinct yellowish brown (10YR 5/8) mottles; massive; very firm; strongly acid.

The solum ranges from 40 to 70 inches in thickness. The Ap or A1 horizon has hue of 10YR, value of 3 to 5, and chroma of 2. The A2g horizon has value of 1 or 2, and has higher value than the Ap horizon. In unlimed areas, reaction in the Ap or A2g horizon is very strongly acid or strongly acid.

The B horizon has hue of 10YR, 2.5Y, or 5Y; value of 4 to 6; and chroma of 1 or 2. It has mottles in shades of brown. This horizon is silty clay loam, silty clay, or clay. Reaction is very strongly acid to medium acid.

The C horizon has hue of 10YR, 2.5Y, or 5Y; value of 5 to 7; and chroma of 1 or 2. It has the same texture and reaction as the B horizon.

The Wrightsville soils in this soil survey area are taxadjuncts to the Wrightsville series. They differ by having a slightly higher reaction in the B2t horizon and by being slightly darker in color in most parts of the B horizon than described in the range for the series. These differences do not greatly affect behavior, use, and management of these soils.

Yanush series

The Yanush series consists of deep, well drained, moderately permeable, strongly sloping to steep soils that formed in colluvial outwash material weathered from chert and novaculites. These soils are on long, narrow side slopes and foot slopes of uplands.

Yanush soils are near the Bigfork soils. Bigfork soils are on long, narrow ridge crests and have a solum that is 20 to 40 inches thick.

Typical pedon of Yanush cherty silt loam, from an area of Yanush association, hilly, 2,000 feet east and 300 feet south of the northwest corner of sec. 21, T. 12 S., R. 1 E.:

A1—0 to 4 inches; very dark grayish brown (10YR 3/2) cherty silt loam; moderate medium granular structure; friable; chert fragments make up 20 percent by volume; medium acid; clear smooth boundary.
A2—4 to 12 inches; brown (10YR 5/3) cherty silt loam; weak medium granular structure; friable; chert fragments make up 20 percent by volume; medium acid; clear smooth boundary.
B21t—12 to 34 inches; red (2.5YR 4/6) cherty silty clay loam; moderate medium subangular blocky struc-

ture; firm; chert fragments make up 40 percent by volume; patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

B22t—34 to 66 inches; yellowish red (5YR 5/6) cherty silty clay loam; moderate medium subangular blocky structure; firm; chert fragments make up 55 percent by volume; patchy clay films on faces of peds; strongly acid; abrupt irregular boundary.

R—66 to 70 inches; vertically tilted chert beds.

The solum is more than 60 inches thick. The A1 horizon has hue of 7.5YR or 10YR, value of 3 to 5, and chroma of 2 to 4. Chert fragments range from 20 to 30 percent by volume. Reaction is medium acid or slightly acid.

The A2 horizon has hue of 7.5YR or 10YR, value of 4 to 6, and chroma of 2 to 4. It has a similar texture and content of chert as the A1 horizon, and reaction is strongly acid to slightly acid.

The B21t horizon has hue of 5YR or 2.5YR, value of 4 to 6, and chroma of 4 to 6. Chert fragments that are less than 3 inches in diameter range from 30 to 60 percent by volume. Reaction is very strongly acid or medium acid.

The B22t horizon has hue of 2.5YR or 5YR, value of 4 or 5, and chroma of 4 to 6. Chert fragments range from 30 to 70 percent by volume. Reaction is very strongly acid to medium acid.

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" (*4*).

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 Entisol.

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 Fluvent (*Fluv*, meaning fluvial, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of 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 Udifluvents (*Udi*, meaning Udic horizons, plus *fluvent*, the suborder of Entisols that have an Udic 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 Udifluvents.

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 coarse-loamy, siliceous, nonacid, thermic, Typic Udifluvents.

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.

References

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

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(3) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. Supplements replacing pp. 173-188 issued May 1962.
(4) United States Department of Agriculture. 1975. Soil taxonomy: a basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

Glossary

ABC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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

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

Alkali (sodic) soil. A soil having so high a degree of alkalinity (pH 8.5 or higher), or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

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 map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Low	0 to 4
Medium	4 to 6
High	More than 6

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.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

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

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.

Chiseling. Tillage with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emergency tillage to control soil blowing.

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 map 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 earth-moving 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.

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

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

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.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

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.

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.

Graded stripcropping. Growing crops in strips that grade toward a protected waterway.

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.

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.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

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.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

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.

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 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.

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.

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.

Miscellaneous areas. Areas that have little or no natural soil, are too nearly inaccessible for orderly examination, or cannot otherwise be feasibly classified.

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 single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

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 differencees are too small to justify separate series.

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

Piping. 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.

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

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.

Saprolite (geology). Soft, earthy, clay-rich, thoroughly decomposed rock formed in place by chemical weathering of igneous and metamorphic rock. In soil survey, the term saprolite is applied to any unconsolidated residual material underlying the soil and grading to hard bedrock below.

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.

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.

Slick spot. Locally, a small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

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.

Slow refill. The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium adsorption ratio (SAR) of a saturation extract, or the ratio of Na^{+} to Ca^{++} Mg^{++}. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

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* (0.005 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 characteristics 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 grain* (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.

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.

ILLUSTRATIONS

Figure 1.—Cotton on Burleson clay, 0 to 1 percent slopes.

Figure 2.—Parallel terraces that are spaced for row equipment on Burleson clay, 1 to 3 percent slopes.

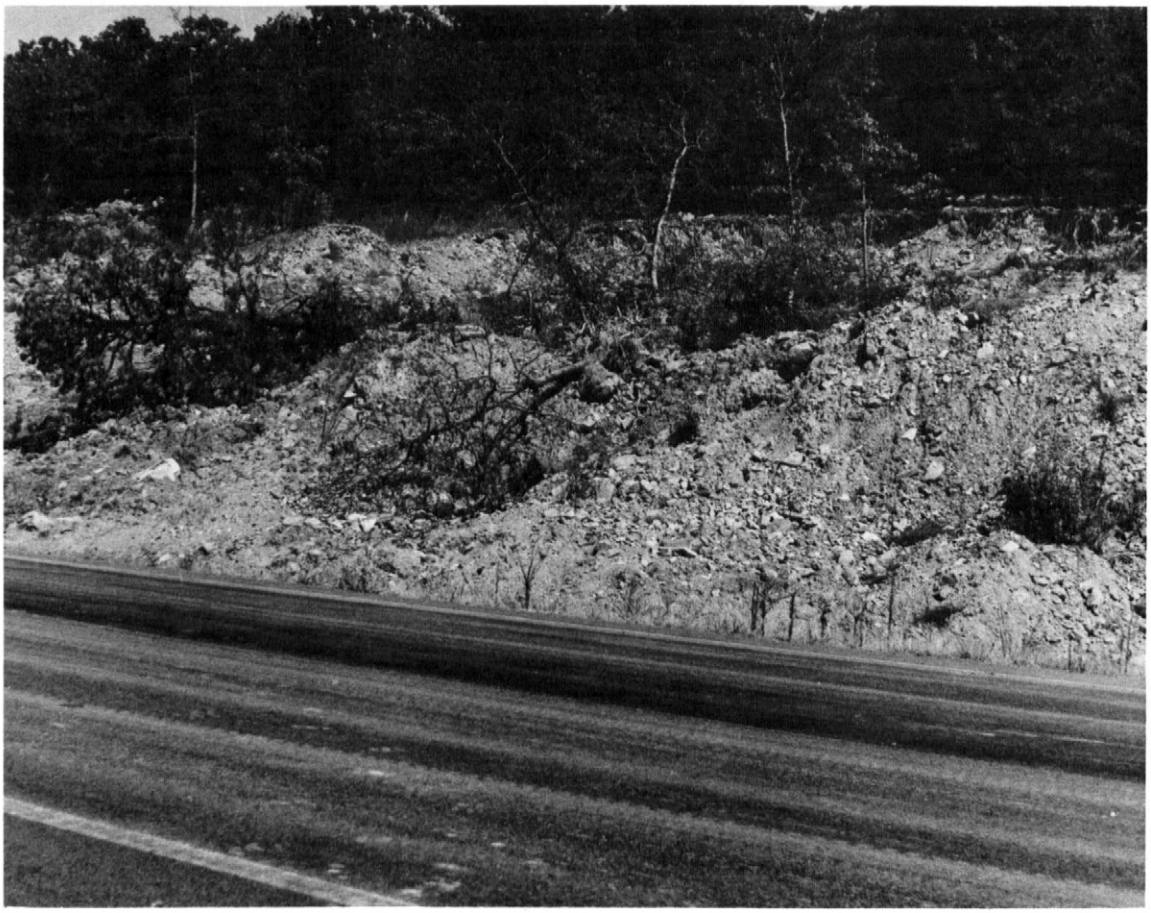

Figure 3.—Slides can occur in areas where cuts for roads are in the tilted shale, underlying the Carnasaw-Clebit association, moderately steep.

Figure 4.—Peanut harvest on Dela fine sandy loam.

Figure 5.—Peanuts on Larue loamy fine sand, 0 to 3 percent slopes.

Figure 6.—Guyton silt loam produces an ample amount of ladino clover and fescue grass. This soil was recently cleared of trees and brush.

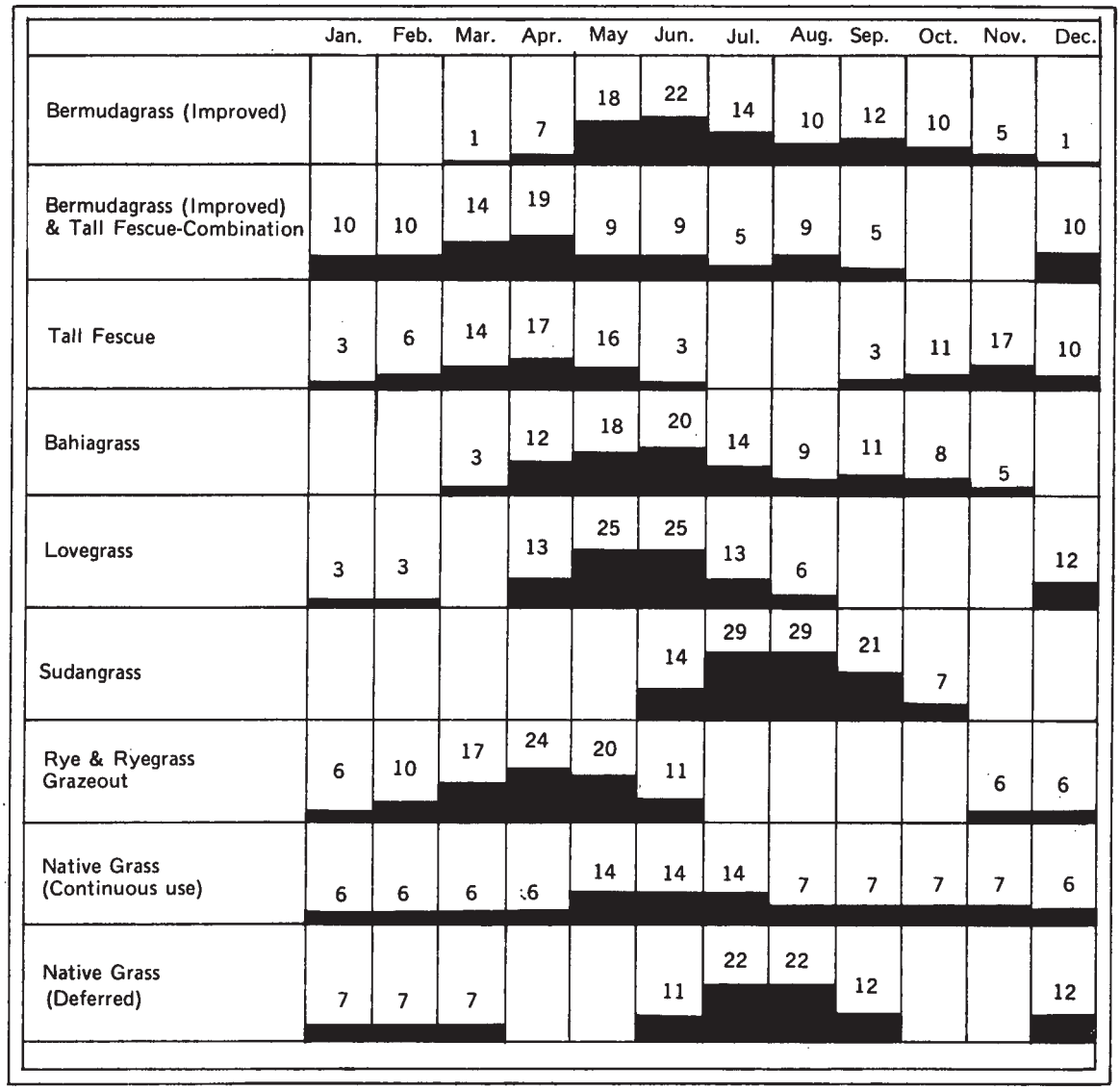

Figure 7.—Maximum percentage of yearly forage growth that can be safely grazed each month.

Figure 8.—Native grass meadow on Burleson clay, 1 to 3 percent slopes.

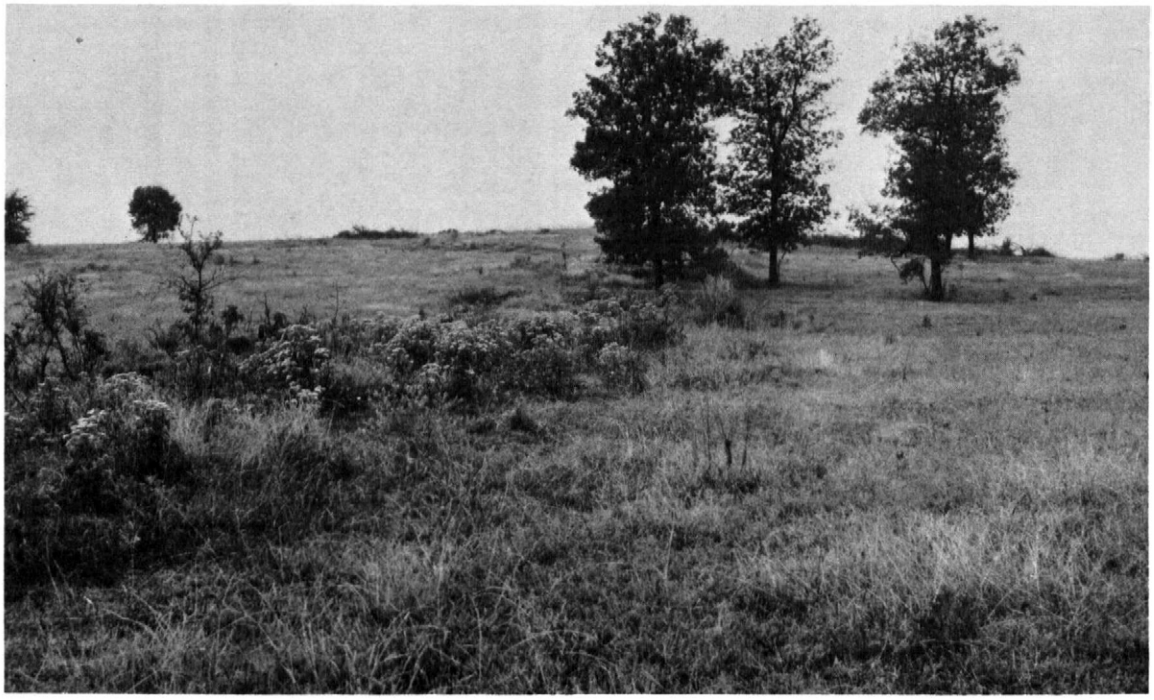

Figure 9.—Remnant of brush windrow for wildlife habitat on Bernow fine sandy loam, 5 to 8 percent slopes.

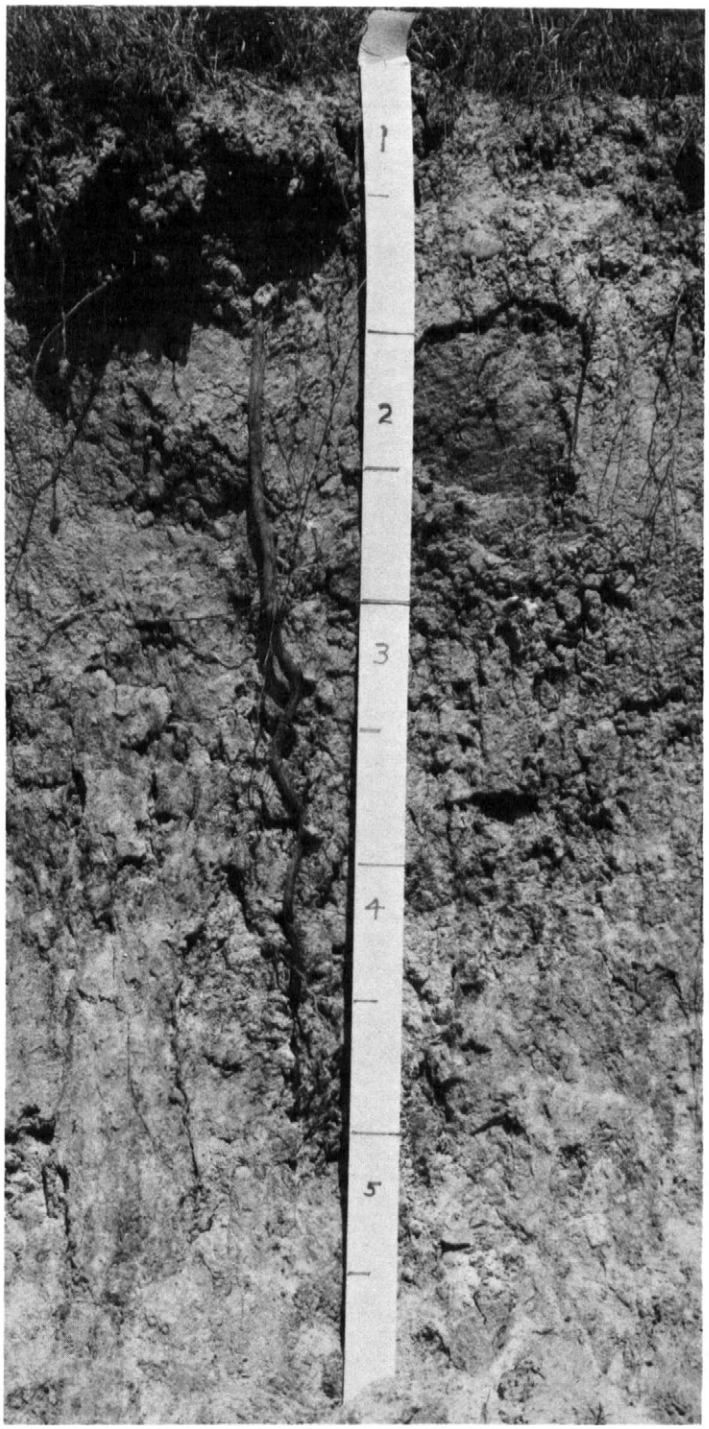

Figure 10.—This profile shows the mottling in the lower part of the argillic horizon in a Bernow soil.

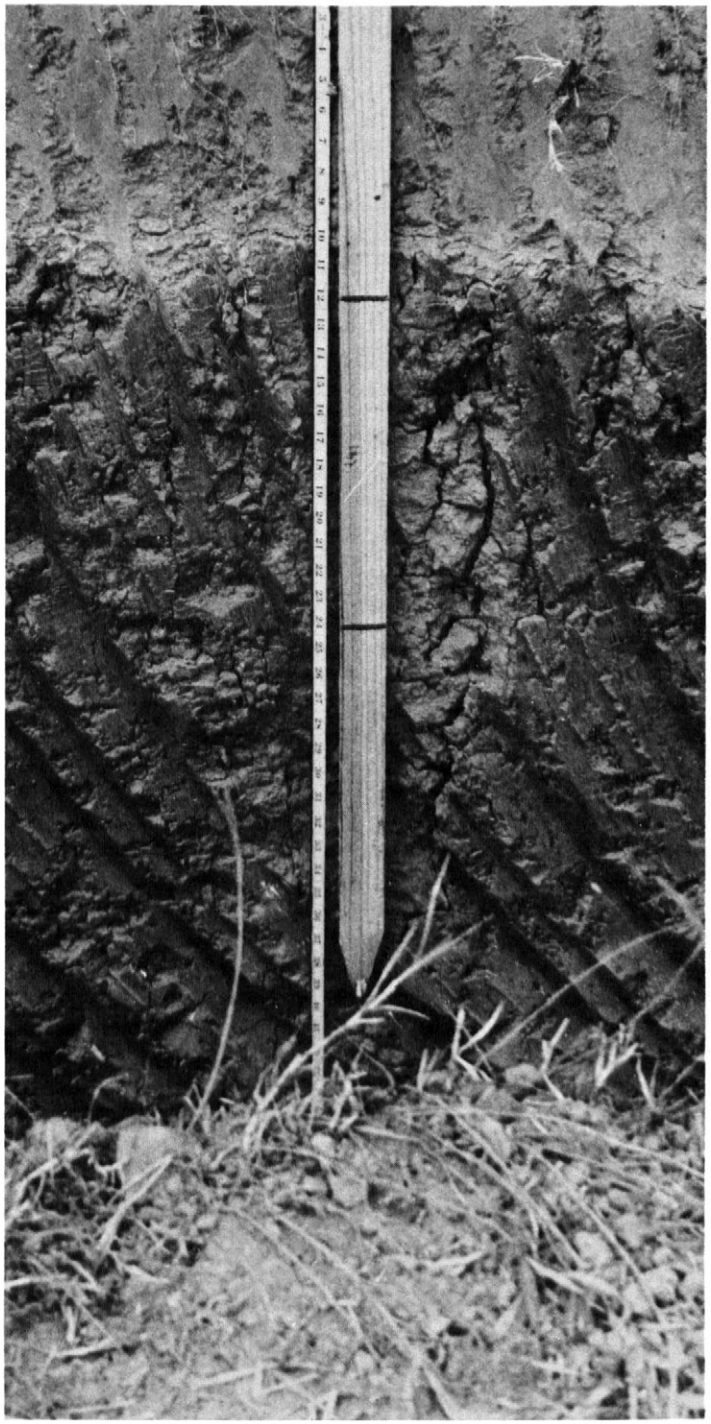

Figure 11.—This profile shows the wavy boundary of the A2 horizon in a Parsons soil.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Recorded in the period 1956 to 1974 at Atoka, Oklahoma]

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----	52.3	28.7	40.5	78	3	9	1.66	.61	2.50	3	1.5
February---	57.7	33.1	45.4	80	11	38	2.29	.85	3.45	4	.8
March------	65.8	40.6	53.2	87	17	215	3.19	1.30	4.70	5	.3
April------	74.8	51.6	63.3	88	30	399	5.07	2.55	7.12	6	.0
May--------	81.4	59.4	70.4	92	41	632	4.84	2.64	6.63	6	.0
June-------	88.0	66.3	77.2	99	52	816	4.09	1.92	5.85	5	.0
July-------	93.4	69.9	81.7	104	58	983	2.49	1.02	3.67	3	.0
August-----	93.0	68.5	80.8	104	56	955	2.61	.86	4.00	4	.0
September--	85.9	62.5	74.2	98	42	726	6.06	3.57	8.48	5	.0
October----	77.1	51.7	64.4	93	32	446	4.08	1.13	6.42	4	.0
November---	65.0	40.4	52.7	82	19	159	2.79	.88	4.31	4	.1
December---	55.5	32.2	43.9	76	8	37	2.22	1.07	3.15	4	.2
Year-----	74.2	50.4	62.3	105	3	5,415	41.39	32.06	50.18	53	2.9

[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 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1956 to 1974 at Atoka, Oklahoma]

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 24	April 3	April 17
2 years in 10 later than--	March 18	March 28	April 13
5 years in 10 later than--	March 6	March 17	April 4
First freezing temperature in fall:			
1 year in 10 earlier than--	October 28	October 28	October 18
2 years in 10 earlier than--	November 6	November 2	October 24
5 years in 10 earlier than--	November 24	November 11	November 2

TABLE 3.--GROWING SEASON LENGTH

[Recorded in the period 1956 to 1974 at Atoka, Oklahoma]

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	228	211	192
8 years in 10	240	221	198
5 years in 10	262	238	212
2 years in 10	285	256	225
1 year in 10	296	265	232

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Agan loam, 0 to 2 percent slopes	930	0.1
2	Bates fine sandy loam, 1 to 3 percent slopes	850	0.1
3	Bates fine sandy loam, 3 to 5 percent slopes	845	0.1
4	Bates fine sandy loam, 2 to 5 percent slopes, eroded	1,125	0.2
5	Bates-Coweta complex, 2 to 5 percent slopes	2,335	0.4
6	Bernow fine sandy loam, 0 to 1 percent slopes	1,935	0.3
7	Bernow fine sandy loam, 1 to 3 percent slopes	32,825	5.2
8	Bernow fine sandy loam, 3 to 5 percent slopes	14,955	2.4
9	Bernow fine sandy loam, 1 to 5 percent slopes, eroded	7,235	1.1
10	Bernow fine sandy loam, 5 to 8 percent slopes	14,340	2.3
11	Bernow-Romia complex, 8 to 12 percent slopes	38,115	6.0
12	Bernow soils, gullied	21,410	3.4
13	Bigfork-Yanush association, steep	1,600	0.3
14	Boggy fine sandy loam	18,180	2.9
15	Bosville fine sandy loam, 1 to 3 percent slopes	3,345	0.5
16	Bosville fine sandy loam, 3 to 5 percent slopes	5,230	0.8
17	Bosville fine sandy loam, 5 to 12 percent slopes	16,160	2.5
18	Burleson clay, 0 to 1 percent slopes	1,115	0.2
19	Burleson clay, 1 to 3 percent slopes	5,565	0.9
20	Carnasaw-Clebit complex, 3 to 5 percent slopes	7,055	1.1
21	Carnasaw-Clebit complex, 5 to 8 percent slopes	12,925	2.0
22	Carnasaw-Clebit association, moderately steep	111,770	17.5
23	Carnasaw-Clebit association, steep	33,035	5.2
24	Chigley fine sandy loam, 1 to 3 percent slopes	645	0.1
25	Chigley-Rock outcrop complex, 1 to 12 percent slopes	1,895	0.3
26	Claremore-Catoosa complex, 1 to 3 percent slopes	3,185	0.5
27	Counts loam, 0 to 1 percent slopes	4,890	0.8
28	Dela fine sandy loam	10,065	1.6
29	Dennis loam, 1 to 3 percent slopes	9,150	1.4
30	Dennis loam, 2 to 5 percent slopes, eroded	11,505	1.8
31	Dennis and Eram soils, 2 to 8 percent slopes, severely eroded	6,160	1.0
32	Durant loam, 1 to 3 percent slopes	1,670	0.3
33	Durant loam, 1 to 3 percent slopes, eroded	1,935	0.3
34	Endsaw-Hector complex, 2 to 5 percent slopes	6,480	1.0
35	Endsaw-Hector complex, 5 to 8 percent slopes	6,900	1.1
36	Endsaw-Hector complex, 8 to 30 percent slopes	19,000	3.0
37	Endsaw-Hector complex, 30 to 50 percent slopes	1,460	0.2
38	Eram clay loam, 3 to 5 percent slopes	15,000	2.4
39	Eram clay loam, 5 to 8 percent slopes	5,580	0.9
40	Eram-Talihina complex, 5 to 20 percent slopes	21,920	3.5
41	Gowton clay loam	7,195	1.1
42	Guyton silt loam	17,435	2.7
43	Hamden fine sandy loam, 0 to 2 percent slopes	7,470	1.2
44	Hartsells fine sandy loam, 2 to 4 percent slopes	5,175	0.8
45	Hartsells fine sandy loam, 4 to 6 percent slopes	4,655	0.7
46	Hartsells fine sandy loam, 2 to 6 percent slopes, eroded	3,015	0.5
47	Hartsells and Hector soils, gullied	640	0.1
48	Heiden clay, 3 to 5 percent slopes	1,105	0.2
49	Heiden soils, 8 to 20 percent slopes	1,400	0.2
50	Kaufman clay	12,975	2.0
51	Kaufman and Gowton soils	3,670	0.6
52	Kiti-Rock outcrop complex, 1 to 12 percent slopes	1,275	0.2
53	Kiti-Rock outcrop complex, 20 to 45 percent slopes	655	0.1
54	Larue loamy fine sand, 0 to 3 percent slopes	10,525	1.7
55	Larue loamy fine sand, 3 to 8 percent slopes	7,205	1.1
56	Lightning silt loam	2,710	0.4
57	Parsons silt loam, 0 to 1 percent slopes	7,660	1.2
58	Parsons silt loam, 1 to 3 percent slopes	2,310	0.4
59	Parsons silt loam, 1 to 3 percent slopes, eroded	1,865	0.3
60	Pickton loamy fine sand, 0 to 3 percent slopes	820	0.1
61	Rexor loam	8,245	1.3
62	Rexor and Dela soils	20,000	3.2
63	Saffell gravelly fine sandy loam, 1 to 5 percent slopes	890	0.1
64	Stigler very fine sandy loam, 0 to 1 percent slopes	2,355	0.4
65	Tarrant soils, 1 to 8 percent slopes	6,195	1.0
66	Trinity clay	1,860	0.3
67	Udorthents	700	0.1
68	Wrightsville silt loam, 0 to 1 percent slopes	4,100	0.6
69	Yanush association, hilly	975	0.2
	Water	9,480	1.5
	Total	634,880	100.0

TABLE 5.--YIELDS PER ACRE OF PASTURE

[All yields were estimated for a high level of management. Absence of a yield figure indicates that the grass is seldom grown or is not suited. All yields are given in animal-unit months]

Soil name and map symbol	Improved bermudagrass	Improved bermudagrass and tall fescue combination	Tall fescue	Bahiagrass	Weeping lovegrass	Sudangrass	Rye and ryegrass graze out
1---- Agan	5.5	---	---	5.0	---	---	---
2---- Bates	6.0	---	---	5.0	7.0	3.8	4.3
3---- Bates	5.5	---	---	5.0	6.0	3.6	---
4---- Bates	5.5	---	---	5.0	6.0	3.6	---
5*---- Bates	5.0	---	---	5.0	6.0	---	---
6---- Bernow	7.5	---	---	6.5	7.5	3.6	4.3
7---- Bernow	7.5	---	---	6.5	7.5	3.6	4.3
8---- Bernow	7.0	---	---	6.0	7.0	2.5	4.1
9---- Bernow	5.5	---	---	5.0	5.5	---	---
10---- Bernow	6.0	---	---	5.5	7.0	---	---
11*---- Bernow	5.0	---	---	4.5	5.0	---	---
12---- Bernow	4.5	---	---	4.0	4.5	---	---
13*---- Bigfork	---	---	---	---	---	---	---
14---- Boggy	10.5	10.5	10.5	---	---	---	---
15---- Bosville	6.5	---	---	6.0	6.0	2.4	4.1
16---- Bosville	6.5	---	---	6.0	6.0	---	---
17---- Bosville	5.5	---	---	5.5	6.0	---	---
18---- Burleson	5.5	5.5	5.0	5.0	---	3.8	4.1
19---- Burleson	5.5	5.5	5.0	5.0	---	3.6	3.8
20*---- Carnasaw	4.5	---	---	4.5	---	---	---
21*---- Carnasaw	4.0	---	---	4.0	---	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF PASTURE--Continued

Soil name and map symbol	Improved bermudagrass	Improved bermudagrass and tall fescue combination	Tall fescue	Bahiagrass	Weeping lovegrass	Sudangrass	Rye and ryegrass graze out
22*---- Carnasaw	---	---	---	---	---	---	---
23*---- Carnasaw	---	---	---	---	---	---	---
24---- Chigley	5.0	---	---	4.5	4.5	---	---
25*---- Chigley	---	---	---	---	---	---	---
26*---- Claremore	5.5	---	---	5.0	6.0	---	---
27---- Counts	6.5	6.0	5.5	6.0	---	3.6	3.8
28---- Dela	7.5	7.5	7.0	7.0	8.0	4.0	4.3
29---- Dennis	7.0	6.5	6.0	6.0	7.5	3.8	4.6
30---- Dennis	6.0	---	---	5.5	6.5	---	3.8
31*---- Dennis	5.0	---	---	5.0	5.5	---	---
32---- Durant	6.0	---	---	5.5	6.5	3.6	4.1
33---- Durant	6.0	---	---	5.5	6.5	3.6	3.8
34*---- Endsaw	4.5	---	---	4.5	---	---	---
35*---- Endsaw	4.0	---	---	4.0	---	---	---
36*---- Endsaw	---	---	---	---	---	---	---
37*---- Endsaw	---	---	---	---	---	---	---
38---- Eram	5.0	---	---	5.0	5.0	---	---
39---- Eram	4.5	---	---	4.5	---	---	---
40*---- Eram	3.5	---	---	3.5	---	---	---
41---- Gowton	7.5	7.5	7.0	7.0	8.0	4.0	4.3
42---- Guyton	6.5	7.0	7.0	6.0	---	3.2	3.8

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF PASTURE--Continued

Soil name and map symbol	Improved bermudagrass	Improved bermudagrass and tall fescue combination	Tall fescue	Bahiagrass	Weeping lovegrass	Sudangrass	Rye and ryegrass graze out
43---------- Hamden	7.5	7.0	6.0	6.5	8.0	3.8	4.1
44---------- Hartsells	6.0	---	---	5.0	6.5	3.6	4.1
45---------- Hartsells	5.5	---	---	5.0	6.0	3.2	3.8
46---------- Hartsells	5.0	---	---	4.5	5.5	---	---
47*---------- Hartsells	4.0	---	---	4.0	4.5	---	---
48---------- Heiden	5.5	5.0	4.5	5.0	---	3.4	3.3
49---------- Heiden	3.5	---	---	3.5	---	---	---
50---------- Kaufman	7.5	7.5	7.0	6.5	---	3.6	3.8
51*---------- Kaufman	7.0	6.5	7.0	6.0	---	---	---
52*---------- Kiti	---	---	---	---	---	---	---
53*---------- Kiti	---	---	---	---	---	---	---
54---------- Larue	6.0	---	---	6.0	6.5	3.8	3.9
55---------- Larue	6.0	---	---	6.0	6.5	---	---
56---------- Lightning	6.0	6.0	6.0	5.0	---	3.4	3.6
57---------- Parsons	6.0	5.5	5.5	5.0	---	2.0	3.8
58---------- Parsons	6.0	6.0	5.5	5.5	---	3.6	3.8
59---------- Parsons	6.0	6.0	5.5	5.5	---	---	---
60---------- Pickton	6.0	---	---	6.0	6.5	---	---
61---------- Rexor	7.5	7.5	7.0	7.0	8.0	4.0	4.3
62*---------- Rexor	7.0	6.5	6.0	6.0	---	---	---
63---------- Saffell	4.0	---	---	4.0	4.5	---	---

See footnote at end of table.

TABLE 5.--YIELDS PER ACRE OF PASTURE__Continued

Soil name and map symbol	Improved bermudagrass	Improved bermudagrass and tall fescue combination	Tall fescue	Bahiagrass	Weeping lovegrass	Sudangrass	Rye and ryegrass graze out
64---------- Stigler	7.0	7.0	6.0	6.5	---	3.6	3.8
65---------- Tarrant	---	---	---	---	---	---	---
66---------- Trinity	7.0	7.0	7.0	6.0	---	3.6	3.8
67---------- Udorthents	---	---	---	---	---	---	---
68---------- Wrightsville	6.5	7.0	7.0	6.0	---	3.2	3.6
69---------- Yanush	3.5	---	---	3.5	---	---	---

*This map unit is made up of two or more dominant kinds of soil. See description of the map unit for behavior characteristics and composition of the whole map unit.

TABLE 6.--YIELDS PER ACRE OF CROPS

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Wheat	Grain sorghum	Soybeans	Peanuts	Cotton lint	Alfalfa hay
	Bu	Bu	Bu	Lb	Lb	Ton
1---------- Agan	25	40	---	---	250	---
2---------- Bates	30	55	25	1,400	400	---
3---------- Bates	20	50	20	1,200	325	---
4---------- Bates	20	45	20	1,000	---	---
5---------- Bates	15	35	20	900	---	---
6---------- Bernow	30	60	25	1,500	475	---
7---------- Bernow	30	55	25	1,400	450	---
8---------- Bernow	25	50	20	1,300	400	---
9---------- Bernow	20	40	15	1,000	350	---
10---------- Bernow	20	40	15	900	350	---
11---------- Bernow	---	---	---	---	---	---
12---------- Bernow	---	---	---	---	---	---
13*:						
Bigfork----------	---	---	---	---	---	---
Yanush----------	---	---	---	---	---	---
14---------- Boggy	---	---	---	---	---	---
15---------- Bosville	25	55	30	1,450	---	---
16---------- Bosville	25	50	25	1,400	---	---
17---------- Bosville	---	---	---	---	---	---
18---------- Burleson	35	65	30	---	450	---
19---------- Burleson	30	60	25	---	400	---
20---------- Carnasaw	20	---	---	---	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Wheat	Grain sorghum	Soybeans	Peanuts	Cotton lint	Alfalfa hay
	Bu	Bu	Bu	Lb	Lb	Ton
21--Carnasaw	---	---	---	---	---	---
22*, 23*:						
Carnasaw	---	---	---	---	---	---
Clebit	---	---	---	---	---	---
24--Chigley	30	45	---	1,100	300	---
25--Chigley	---	---	---	---	---	---
26--Claremore	25	45	25	1,300	350	---
27--Counts	30	50	25	1,000	450	---
28--Dela	30	60	30	1,500	500	3.5
29--Dennis	40	70	35	1,400	450	---
30--Dennis	30	50	20	1,200	375	---
31--Dennis	---	---	---	---	---	---
32--Durant	40	60	30	1,200	400	---
33--Durant	30	40	20	1,100	375	---
34--Endsaw	20	---	---	---	---	---
35--Endsaw	---	---	---	---	---	---
36, 37--Endsaw	---	---	---	---	---	---
38--Eram	20	35	20	---	---	2.5
39--Eram	---	---	---	---	---	---
40--Eram	---	---	---	---	---	---
41--Gowton	35	65	30	1,650	500	4.0
42--Guyton	30	45	25	---	400	---
43--Hamden	30	50	20	1,000	425	---
44, 45, 46--Hartsells	20	35	20	1,000	---	---

See footnote at end of table.

TABLE 6.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Wheat	Grain sorghum	Soybeans	Peanuts	Cotton lint	Alfalfa hay
	Bu	Bu	Bu	Lb	Lb	Ton
47---------- Hartsells	---	---	---	---	---	---
48---------- Heiden	30	55	---	---	350	---
49---------- Heiden	---	---	---	---	---	---
50---------- Kaufman	35	70	35	---	500	2.5
51---------- Kaufman	---	---	---	---	---	---
52---------- Kiti	---	---	---	---	---	---
53---------- Kiti	---	---	---	---	---	---
54---------- Larue	20	35	20	1,200	---	---
55---------- Larue	20	30	15	1,000	---	---
56---------- Lightning	30	50	20	---	---	---
57---------- Parsons	30	50	30	---	---	---
58---------- Parsons	30	50	25	---	---	---
59---------- Parsons	25	40	20	---	---	---
60---------- Pickton	20	---	---	---	---	---
61---------- Rexor	35	70	35	1,500	500	4.0
62---------- Rexor	---	---	---	---	---	---
63---------- Saffell	30	---	---	---	---	---
64---------- Stigler	30	45	25	1,100	450	---
65---------- Tarrant	---	---	---	---	---	---
66---------- Trinity	35	70	40	---	450	---
67*. Udorthents						
68---------- Wrightsville	25	35	25	---	450	---
69*---------- Yanush	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1---------- Agan	Claypan Prairie----------	Favorable	4,000	Little bluestem----------	20
		Normal	2,800	Big bluestem----------	10
		Unfavorable	2,000	Indiangrass----------	10
				Switchgrass----------	5
				Sideoats grama----------	5
				Scribner panicum----------	5
				Meadow dropseed----------	5
				Fall witchgrass----------	5
				Catclaw sensitivebrier--------	5
2, 3, 4---------- Bates	Loamy Prairie----------	Favorable	7,000	Big bluestem----------	35
		Normal	5,500	Little bluestem----------	25
		Unfavorable	4,500	Indiangrass----------	12
				Switchgrass----------	5
				Leadplant----------	5
5*:					
Bates----------	Loamy Prairie----------	Favorable	7,000	Big bluestem----------	35
		Normal	5,500	Little bluestem----------	25
		Unfavorable	4,500	Indiangrass----------	12
				Switchgrass----------	5
				Leadplant----------	5
Coweta----------	Shallow Prairie----------	Favorable	3,500	Little bluestem----------	30
		Normal	2,300	Big bluestem----------	15
		Unfavorable	1,500	Indiangrass----------	10
				Switchgrass----------	10
				Tall dropseed----------	10
				Scribner panicum----------	5
				Sideoats grama----------	5
				Prairie-clover----------	5
				Dotted gayfeather----------	5
6, 7, 8, 9, 10----- Bernow	Sandy Savannah----------	Favorable	4,200	Little bluestem----------	25
		Normal	3,000	Big bluestem----------	15
		Unfavorable	2,200	Indiangrass----------	10
				Switchgrass----------	5
11*:					
Bernow----------	Sandy Savannah----------	Favorable	4,200	Little bluestem----------	25
		Normal	3,000	Big bluestem----------	15
		Unfavorable	2,200	Indiangrass----------	10
				Switchgrass----------	5
Romia----------	Sandy Savannah----------	Favorable	4,200	Little bluestem----------	25
		Normal	3,000	Big bluestem----------	20
		Unfavorable	2,200	Indiangrass----------	5
				Switchgrass----------	5
12*---------- Bernow	Eroded Sandy Savannah---------	Favorable	2,800	Little bluestem----------	30
		Normal	2,100	Indiangrass----------	20
		Unfavorable	1,600		
13*:					
Bigfork----------	Steep Chert Savannah----------	Favorable	3,500	Little bluestem----------	25
		Normal	2,600	Big bluestem----------	15
		Unfavorable	2,000	Beaked panicum----------	5
				Scribner panicum----------	5
Yanush----------	Steep Chert Savannah----------	Favorable	3,500	Little bluestem----------	25
		Normal	2,600	Big bluestem----------	15
		Unfavorable	2,000	Beaked panicum----------	5

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
15, 16, 17--------- Bosville	Sandy Savannah----------	Favorable Normal Unfavorable	4,200 3,000 2,200	Little bluestem---------- Big bluestem---------- Indiangrass---------- Switchgrass----------	25 15 10 5
18, 19---------- Burleson	Blackclay Prairie----------	Favorable Normal Unfavorable	7,000 5,500 4,000	Little bluestem---------- Indiangrass---------- Big bluestem---------- Sideoats grama---------- Silver bluestem---------- Tall dropseed----------	40 15 15 5 5 5
20*, 21*: Carnasaw----------	Sandy Savannah----------	Favorable Normal Unfavorable	4,500 3,200 2,500	Little bluestem---------- Big bluestem---------- Indiangrass---------- Switchgrass----------	25 15 10 5
Clebit----------	Shallow Savannah----------	Favorable Normal Unfavorable	3,500 2,200 1,900	Little bluestem---------- Big bluestem---------- Indiangrass---------- Switchgrass---------- Post oak---------- Scribner panicum----------	25 15 5 5 5 5
22*: Carnasaw----------	Sandy Savannah----------	Favorable Normal Unfavorable	4,200 3,000 2,200	Little bluestem---------- Big bluestem----------	25 15
Clebit----------	Shallow Savannah----------	Favorable Normal Unfavorable	3,200 2,400 1,800	Little bluestem---------- Big bluestem---------- Indiangrass----------	35 5 5
23*: Carnasaw----------	Savannah Breaks----------	Favorable Normal Unfavorable	2,800 2,100 1,600	Little bluestem---------- Big bluestem----------	40 5
Clebit----------	Savannah Breaks----------	Favorable Normal Unfavorable	2,200 1,600 1,200	Little bluestem---------- Big bluestem----------	40 5
24---------- Chigley	Sandy Savannah----------	Favorable Normal Unfavorable	5,000 3,500 2,500	Little bluestem---------- Big bluestem---------- Indiangrass---------- Switchgrass---------- Sand lovegrass---------- Scribner panicum---------- Purpletop---------- Tall dropseed---------- Sunflower---------- Goldenrod----------	25 20 5 5 5 5 5 5 5 5
25*: Chigley----------	Sandy Savannah----------	Favorable Normal Unfavorable	5,000 3,500 2,500	Little bluestem---------- Big bluestem---------- Indiangrass---------- Switchgrass---------- Sand lovegrass---------- Scribner panicum---------- Purpletop---------- Tall dropseed---------- Sunflower---------- Goldenrod----------	25 20 5 5 5 5 5 5 5 5
Rock outcrop.					

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
26*:					
Claremore	Loamy Prairie	Favorable	5,000	Big bluestem	30
		Normal	3,500	Little bluestem	15
		Unfavorable	2,500	Indiangrass	15
				Switchgrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5
Catoosa	Loamy Prairie	Favorable	6,500	Little bluestem	25
		Normal	5,000	Big bluestem	20
		Unfavorable	4,000	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
27---------- Counts	Loamy Savannah	Favorable	5,000	Little bluestem	20
		Normal	4,000	Big bluestem	15
		Unfavorable	2,500	Indiangrass	10
				Switchgrass	5
				Longspike tridens	5
				Panicum	5
				Sedge	5
29, 30---------- Dennis	Loamy Prairie	Favorable	7,000	Big bluestem	35
		Normal	5,500	Switchgrass	15
		Unfavorable	4,500	Little bluestem	10
				Indiangrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5
31*:					
Dennis	Eroded Prairie	Favorable	5,400	Big bluestem	25
		Normal	4,400	Little bluestem	20
		Unfavorable	3,600	Switchgrass	15
				Indiangrass	10
Eram	Eroded Prairie	Favorable	4,800	Little bluestem	20
		Normal	3,700	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Tall dropseed	5
32, 33---------- Durant	Loamy Prairie	Favorable	6,500	Little bluestem	25
		Normal	4,550	Big bluestem	20
		Unfavorable	3,250	Indiangrass	10
				Switchgrass	10
				Canada wildrye	5
				Sideoats grama	5
				Tall dropseed	5
				Lespedeza	5
				Dotted gayfeather	5
34*, 35*, 36*:					
Endsaw	Sandy Savannah	Favorable	4,400	Big bluestem	10
		Normal	3,300	Little bluestem	20
		Unfavorable	2,600	Indiangrass	10
Hector	Shallow Savannah	Favorable	4,800	Little bluestem	45
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	8

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
37*:					
Endsaw	Savannah Breaks	Favorable	2,800	Little bluestem	40
		Normal	2,100	Big bluestem	5
		Unfavorable	1,600		
Hector	Savannah Breaks	Favorable	2,200	Little bluestem	45
		Normal	1,600	Indiangrass	15
		Unfavorable	1,200	Big bluestem	8
38, 39	Loamy Prairie	Favorable	6,000	Big bluestem	30
Eram		Normal	4,200	Little bluestem	15
		Unfavorable	3,000	Switchgrass	15
				Indiangrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5
40*:					
Eram	Loamy Prairie	Favorable	6,000	Big bluestem	30
		Normal	4,200	Little bluestem	15
		Unfavorable	3,000	Switchgrass	15
				Indiangrass	10
				Scribner panicum	5
				Purpletop	5
				Tall dropseed	5
				Catclaw sensitivebrier	5
				Goldenrod	5
Talihina	Shallow Prairie	Favorable	4,500	Little bluestem	20
		Normal	3,200	Big bluestem	15
		Unfavorable	2,250	Indiangrass	10
				Switchgrass	10
				Tall dropseed	5
				Sideoats grama	5
43	Sandy Savannah	Favorable	4,200	Little bluestem	25
Hamden		Normal	3,000	Big bluestem	15
		Unfavorable	2,200	Indiangrass	10
				Switchgrass	5
44, 45, 46	Sandy Savannah	Favorable	4,800	Big bluestem	25
Hartsells		Normal	3,500	Little bluestem	25
		Unfavorable	2,500	Indiangrass	10
47*:					
Hartsells	Eroded Sandy Savannah	Favorable	2,800	Big bluestem	10
		Normal	1,800	Little bluestem	35
		Unfavorable	1,200	Indiangrass	10
Hector	Eroded Shallow Savannah	Favorable	1,800	Little bluestem	45
		Normal	1,200	Indiangrass	15
		Unfavorable	800	Big bluestem	8
48, 49*	Blackclay Prairie	Favorable	7,000	Little bluestem	50
Heiden		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
52*, 53*:					
Kiti	Edgerock	Favorable	2,800	Little bluestem	20
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,400	Big bluestem	10
				Indiangrass	10
				Tridens	10
				Hairy grama	5
Rock outcrop.					

See footnote at end of table.

TABLE 7.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
54, 55---------- Larue	Deep Sand Savannah----------	Favorable	4,500	Little bluestem----------	20
		Normal	3,000	Indiangrass----------	10
		Unfavorable	2,000	Longleaf uniola----------	10
				Switchgrass----------	10
				Purpletop----------	5
				Purple lovegrass----------	5
				Splitbeard bluestem----------	5
				Brownseed paspalum----------	5
57, 58, 59--------- Parsons	Claypan Prairie----------	Favorable	4,500	Little bluestem----------	25
		Normal	3,000	Big bluestem----------	20
		Unfavorable	2,000	Switchgrass----------	15
				Indiangrass----------	10
60---------- Pickton	Deep Sand Savannah----------	Favorable	4,500	Little bluestem----------	20
		Normal	3,000	Indiangrass----------	10
		Unfavorable	2,000	Switchgrass----------	10
63---------- Saffell	Sandy Savannah----------	Favorable	3,800	Bluestem----------	35
		Normal	3,000	Indiangrass----------	15
		Unfavorable	2,000	Virginia wildrye----------	5
				Panicum----------	5
				Sedge----------	5
64---------- Stigler	Loamy Savannah----------	Favorable	5,000	Big bluestem----------	25
		Normal	3,500	Indiangrass----------	15
		Unfavorable	2,500	Little bluestem----------	10
				Post oak----------	10
				Switchgrass----------	5
				Tickclover----------	5
				Purpletop----------	5
				Blackjack oak----------	5
65*---------- Tarrant	Very Shallow----------	Favorable	2,200	Little bluestem----------	15
		Normal	1,600	Sideoats grama----------	15
		Unfavorable	1,200	Hairy grama----------	5
				Buffalograss----------	5
				Texas grama----------	5
				Tridens----------	5
				Tall dropseed----------	5
				Silver bluestem----------	5
69*---------- Yanush	Smooth Chert Savannah---------	Favorable	3,800	Little bluestem----------	25
		Normal	2,800	Big bluestem----------	15
		Unfavorable	2,200	Beaked panicum----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available or that under present economic conditions it is not recommended that trees be planted. Site index is calculated at age 30 for eastern cottonwood and age 50 for all other species]

Soil name and map symbol	Ordination symbol	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Common trees	Site index	
6, 7, 8, 9, 10----- Bernow	4o	Slight	Slight	Slight	Southern red oak----	60	Shortleaf pine, loblolly pine.
11*:							
Bernow----------	4o	Slight	Slight	Slight	Southern red oak----	60	Shortleaf pine, loblolly pine.
Romia----------	4o	Slight	Slight	Slight	Southern red oak----	60	Shortleaf pine, loblolly pine.
12*---------- Bernow	4c	Severe	Moderate	Moderate	Southern red oak----	60	Shortleaf pine, loblolly pine.
13*:							
Bigfork----------	5f	Severe	Severe	Severe	Shortleaf pine------	55	Shortleaf pine.
Yanush----------	5f	Severe	Severe	Severe	Shortleaf pine------	60	Shortleaf pine, loblolly pine.
					Black walnut--------	---	
					Southern red oak----	---	
14---------- Boggy	2w	Slight	Moderate	Slight	Shortleaf pine------	80	Loblolly pine, sweetgum, shortleaf pine.
					Southern red oak----	80	
					Sweetgum----------	90	
					Red maple----------	---	
15, 16, 17--------- Bosville	4c	Slight	Moderate	Moderate	Southern red oak----	60	Shortleaf pine, loblolly pine.
					Black oak----------	60	
20*, 21*:							
Carnasaw----------	4o	Slight	Slight	Slight	Shortleaf pine------	60	Loblolly pine, shortleaf pine.
Clebit----------	5d	Moderate	Moderate	Moderate	Shortleaf pine------	40	Shortleaf pine, eastern redcedar.
					Eastern redcedar----	30	
22*:							
Carnasaw----------	4x	Moderate	Moderate	Severe	Shortleaf pine------	60	Loblolly pine, shortleaf pine.
Clebit----------	5x	Moderate	Moderate	Severe	Shortleaf pine------	40	Shortleaf pine, eastern redcedar.
					Eastern redcedar----	30	
23*:							
Carnasaw----------	5x	Severe	Severe	Severe	Shortleaf pine------	50	Loblolly pine, shortleaf pine.
Clebit----------	5x	Severe	Severe	Severe	Shortleaf pine------	40	Shortleaf pine, eastern redcedar.
					Eastern redcedar----	30	
27---------- Counts	4o	Slight	Slight	Slight	Shortleaf pine------	60	Shortleaf pine, eastern redcedar, loblolly pine.
					Southern red oak----	60	
					Eastern redcedar----	40	
28---------- Dela	2o	Slight	Slight	Slight	Southern red oak----	80	Loblolly pine, shortleaf pine, black walnut, southern red oak.
					Sweetgum----------	90	
					Eastern cottonwood--	100	
					Shortleaf pine------	80	
34*, 35*:							
Endsaw----------	5o	Slight	Slight	Slight	Post oak----------	50	
					Black oak----------	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Common trees	Site index	
34*, 35*:							
Hector	5d	Slight	Slight	Moderate	Shortleaf pine	50	
					Eastern redcedar	30	
36*:							
Endsaw	5o	Slight	Slight	Slight	Post oak	50	
					Black oak	---	
Hector	5d	Moderate	Moderate	Moderate	Shortleaf pine	50	
					Eastern redcedar	30	
37*:							
Endsaw	5r	Severe	Severe	Slight	Shortleaf pine	50	
Hector	5d	Severe	Severe	Severe	Shortleaf pine	50	
					Eastern redcedar	30	
41--- Gowton	2o	Slight	Slight	Slight	Southern red oak	76	Eastern cottonwood, pecan.
					Common hackberry	---	
					Pecan	---	
					Shagbark hickory	---	
42--- Guyton	2w	Slight	Severe	Moderate	Sweetgum	90	Loblolly pine, sweetgum.
					Green ash	---	
					Southern red oak	---	
					Water oak	---	
43--- Hamden	3w	Slight	Moderate	Slight	Southern red oak	70	Loblolly pine, sweetgum, cherrybark oak.
					Sweetgum	---	
					Shortleaf pine	70	
44, 45, 46--- Hartsells	5o	Slight	Slight	Slight	Black oak	55	Loblolly pine, shortleaf pine.
					Post oak	---	
					Shortleaf pine	60	
47*:							
Hartsells	5d	Severe	Severe	Severe	Black oak	50	
Hector	5d	Slight	Slight	Moderate	Post oak	50	
					Eastern redcedar	30	
50--- Kaufman	2w	Slight	Moderate	Moderate	Eastern cottonwood	100	Eastern cottonwood, green ash, pecan, sweetgum.
					Sweetgum	90	
					Water oak	---	
					Green ash	---	
					Bur oak	---	
51*:							
Kaufman	2w	Slight	Moderate	Moderate	Eastern cottonwood	100	Eastern cottonwood, green ash, pecan, sweetgum.
					Sweetgum	90	
					Water oak	---	
					Green ash	---	
					Bur oak	---	
Gowton	2o	Slight	Slight	Slight	Southern red oak	76	Eastern cottonwood, pecan.
					Common hackberry	---	
					Pecan	---	
					Shagbark hickory	---	
54, 55--- Larue	4s	Slight	Moderate	Moderate	Shortleaf pine	60	Loblolly pine, shortleaf pine.
					Southern red oak	---	
					Sweetgum	---	

See footnote at end of table.

TABLE 8.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns			Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Common trees	Site index	
56---------- Lightning	3w	Slight	Moderate	Moderate	Pin oak----------	---	Pecan, green ash, eastern cottonwood, bur oak.
					Pecan----------	---	
					Eastern cottonwood--	90	
					Green ash----------	---	
					Bur oak----------	---	
60---------- Pickton	4s	Slight	Slight	Moderate	Shortleaf pine------	60	Loblolly pine, southern red oak.
					Southern red oak----	60	
61---------- Rexor	2o	Slight	Slight	Slight	Southern red oak----	80	Loblolly pine.
62*:							
Rexor----------	2w	Slight	Moderate	Slight	Southern red oak----	80	Loblolly pine.
Dela----------	2o	Slight	Slight	Slight	Southern red oak----	80	Loblolly pine, shortleaf pine, black walnut, southern red oak.
					Sweetgum----------	90	
					Eastern cottonwood--	100	
					Shortleaf pine------	80	
63---------- Saffell	5f	Slight	Slight	Moderate	Shortleaf pine------	50	Loblolly pine, shortleaf pine, eastern redcedar.
					Eastern redcedar----	---	

64---------- Stigler	4o	Slight	Slight	Slight	Shortleaf pine------	60	Shortleaf pine, loblolly pine.
					Southern red oak----	---	
66---------- Trinity	3w	Slight	Moderate	Moderate	Eastern cottonwood--	90	Pecan, eastern cottonwood.
					Green ash----------	---	
					Pecan----------	50	
68---------- Wrightsville	3w	Slight	Severe	Moderate	Water oak----------	80	Loblolly pine, sweetgum.

69*---------- Yanush	5f	Moderate	Severe	Severe	Shortleaf pine------	55	
					Black walnut--------	---	
					Southern red oak----	---	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed]

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
6, 7, 8, 9, 10----- Bernow	Favorable	2,100	Little bluestem	15
	Normal	1,500	Big bluestem	10
	Unfavorable	1,100	Indiangrass	5
			Switchgrass	5
11*:				
Bernow----------	Favorable	2,100	Little bluestem	15
	Normal	1,500	Big bluestem	10
	Unfavorable	1,100	Indiangrass	5
			Switchgrass	5
Romia----------	Favorable	2,100	Little bluestem	15
	Normal	1,500	Big bluestem	10
	Unfavorable	1,100	Indiangrass	5
			Switchgrass	5
12*---------- Bernow	Favorable	2,100	Little bluestem	15
	Normal	1,500	Big bluestem	10
	Unfavorable	1,100	Indiangrass	5
			Switchgrass	5
13*:				
Bigfork----------	Favorable	2,000	Little bluestem	35
	Normal	1,400	Big bluestem	10
	Unfavorable	1,000	Beaked panicum	10
			Scribner panicum	10
Yanush----------	Favorable	3,000	Little bluestem	20
	Normal	2,100	Big bluestem	10
	Unfavorable	1,500	Beaked panicum	10
			Scribner panicum	10
14---------- Boggy	Favorable	3,000	Little bluestem	10
	Normal	2,100	Wildrye	10
	Unfavorable	1,600	Uniola	10
			Giant cane	10
			Switchgrass	5
			Big bluestem	5
			Beaked panicum	5
			Sedge	5
15, 16, 17--------- Bosville	Favorable	2,300	Little bluestem	15
	Normal	1,700	Big bluestem	10
	Unfavorable	1,300	Indiangrass	5
			Switchgrass	5
20*, 21*:				
Carnasaw----------	Favorable	2,300	Little bluestem	20
	Normal	1,700	Big bluestem	10
	Unfavorable	1,300	Indiangrass	5
Clebit----------	Favorable	1,600	Little bluestem	15
	Normal	1,106	Big bluestem	10
	Unfavorable	800	Post oak	5
			Scribner panicum	5
23*:				
Carnasaw----------	Favorable	1,800	Little bluestem	25
	Normal	1,300	Big bluestem	10
	Unfavorable	1,000	Muhly	10
Clebit----------	Favorable	1,200	Little bluestem	20
	Normal	800	Big bluestem	5
	Unfavorable	500	Muhly	5

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
27---------- Counts	Favorable	3,500	Big bluestem----------	20
	Normal	2,500	Little bluestem----------	10
	Unfavorable	1,800	Sedge----------	10
			Indiangrass----------	5
			Switchgrass----------	5
			Longspike tridens----------	5
			Panicum----------	5
28---------- Dela	Favorable	4,000	Little bluestem----------	15
	Normal	3,100	Sedge----------	10
	Unfavorable	2,500	Panicum----------	10
			Big bluestem----------	5
			Indiangrass----------	5
34*, 35*, 36*, 37*:				
Endsaw----------	Favorable	2,400	Little bluestem----------	20
	Normal	1,700	Canada wildrye----------	10
	Unfavorable	1,300	Post oak----------	10
			Water oak----------	10
			Panicum----------	10
			Sedge----------	10
			Big bluestem----------	5
			Indiangrass----------	5
			Lespedeza----------	5
Hector----------	Favorable	1,800	Little bluestem----------	20
	Normal	1,100	Indiangrass----------	5
	Unfavorable	600	Big bluestem----------	5
41---------- Gowton	Favorable	3,600	Little bluestem----------	10
	Normal	2,500	Big bluestem----------	10
	Unfavorable	1,800	Virginia wildrye----------	10
			Broadleaf uniola----------	10
			Beaked panicum----------	10
			Sedge----------	10
			Indiangrass----------	5
42---------- Guyton	Favorable	2,400	Little bluestem----------	20
	Normal	1,800	Virginia wildrye----------	10
	Unfavorable	1,400	Broadleaf uniola----------	10
43---------- Hamden	Favorable	2,100	Little bluestem----------	15
	Normal	1,500	Big bluestem----------	10
	Unfavorable	1,100	Indiangrass----------	5
			Switchgrass----------	5
47*:				
Hartsells---------	Favorable	2,100	Little bluestem----------	15
	Normal	1,500	Big bluestem----------	10
	Unfavorable	1,100	Indiangrass----------	5
Hector----------	Favorable	1,800	Little bluestem----------	45
	Normal	1,100	Indiangrass----------	15
	Unfavorable	600	Big bluestem----------	8
51*:				
Kaufman----------	Favorable	2,700	Virginia wildrye----------	15
	Normal	2,000	Sedge----------	15
	Unfavorable	1,500	Eastern gamagrass----------	10
Gowton----------	Favorable	3,600	Little bluestem----------	10
	Normal	2,500	Big bluestem----------	10
	Unfavorable	1,800	Virginia wildrye----------	10
			Broadleaf uniola----------	10
			Beaked panicum----------	10
			Sedge----------	10
			Indiangrass----------	5

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
54, 55----------	Favorable	3,000	Little bluestem----------	20
Larue	Normal	2,500	Indiangrass----------	10
	Unfavorable	2,000	Longleaf uniola----------	10
			Switchgrass----------	10
			Purpletop----------	5
			Purple lovegrass----------	5
			Splitbeard bluestem----------	5
			Brownseed paspalum----------	5
56----------	Favorable	2,500	Sedge----------	15
Lightning	Normal	1,600	Big bluestem----------	10
	Unfavorable	1,000	Switchgrass----------	10
60----------	Favorable	3,000	Little bluestem----------	20
Pickton	Normal	2,500	Panicum----------	15
	Unfavorable	2,000	Purpletop----------	10
			Big bluestem----------	10
			Indiangrass----------	5
			Longleaf uniola----------	5
			Beaked panicum----------	5
61----------	Favorable	5,000	Little bluestem----------	15
Rexor	Normal	3,500	Big bluestem----------	10
	Unfavorable	2,500	Switchgrass----------	10
			Panicum----------	5
			Eastern gamagrass----------	5
			Sedge----------	5
			Indiangrass----------	5
			Uniola----------	5
62*:				
Rexor----------	Favorable	5,000	Little bluestem----------	15
	Normal	3,500	Big bluestem----------	10
	Unfavorable	2,500	Switchgrass----------	10
			Panicum----------	5
			Eastern gamagrass----------	5
			Sedge----------	5
			Indiangrass----------	5
			Uniola----------	5
Dela----------	Favorable	4,000	Little bluestem----------	15
	Normal	3,100	Sedge----------	10
	Unfavorable	2,500	Panicum----------	10
			Big bluestem----------	5
			Indiangrass----------	5
63----------	Favorable	1,900	Bluestem----------	35
Saffell	Normal	1,400	Indiangrass----------	15
	Unfavorable	1,000	Virginia wildrye----------	5
			Panicum----------	5
			Sedge----------	5
64----------	Favorable	3,200	Big bluestem----------	15
Stigler	Normal	2,300	Post oak----------	15
	Unfavorable	1,700	Indiangrass----------	10
			Blackjack oak----------	10
			Switchgrass----------	5
			Little bluestem----------	5
66----------	Favorable	2,700	Virginia wildrye----------	15
Trinity	Normal	2,000	Sedge----------	15
	Unfavorable	2,500	Eastern gamagrass----------	10
			Switchgrass----------	10
			Indiangrass----------	10
			Giant cane----------	5
			Beaked panicum----------	5
			Panicum----------	5

See footnote at end of table.

TABLE 9.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
68---------- Wrightsville	Favorable	3,000	Plumegrass----------	15
	Normal	2,000	Switchgrass----------	10
	Unfavorable	1,250	Beaked panicum----------	10
			Uniola----------	10
			Paspalum----------	5
			Panicum----------	5
			Velvet panicum----------	5
			Sedge----------	5
			Blueberry----------	5
69*---------- Yanush	Favorable	3,000	Little bluestem----------	20
	Normal	2,100	Big bluestem----------	10
	Unfavorable	1,500	Beaked panicum----------	10
			Scribner panicum----------	10

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1 Agan	Severe: too clayey, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
2 Bates	Moderate: depth to rock.	Slight	Slight	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.
3 Bates	Moderate: depth to rock.	Slight	Slight	Moderate: shrink-swell, slope, low strength.	Moderate: low strength, shrink-swell.
4 Bates	Moderate: depth to rock.	Slight	Slight	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.
5*: Bates	Moderate: depth to rock.	Slight	Slight	Moderate: shrink-swell, slope, low strength.	Moderate: low strength, shrink-swell.
Coweta	Moderate: slope, depth to rock.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.	Moderate: depth to rock, slope.
6, 7 Bernow	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
8, 9 Bernow	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.
10 Bernow	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.
11*: Bernow	Moderate: slope.	Moderate: shrink-swell, slope.	Moderate: shrink-swell, slope.	Severe: slope.	Moderate: low strength, shrink-swell, slope.
Romia	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength, slope.
12* Bernow	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Moderate: low strength, shrink-swell.
13*: Bigfork	Severe: slope, large stones, depth to rock.	Severe: slope, large stones.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.
Yanush	Severe: small stones.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.

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
14---------- Boggy	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
15, 16---------- Bosville	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: low strength, wetness, shrink-swell.	Severe: low strength, shrink-swell.
17---------- Bosville	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, slope, wetness.	Severe: low strength, shrink-swell.
18, 19---------- Burleson	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell.
20*: Carnasaw----------	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Clebit----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
21*: Carnasaw----------	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength.
Clebit----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
22*, 23*: Carnasaw----------	Severe: too clayey, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.	Severe: shrink-swell, low strength, slope.
Clebit----------	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, large stones.
24---------- Chigley	Severe: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
25*: Chigley----------	Severe: too clayey.	Severe: low strength.	Severe: low strength.	Severe: low strength.	Severe: low strength.
Rock outcrop.					
26*: Claremore----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Catoosa----------	Severe: depth to rock.	Moderate: low strength, depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: slope, shrink-swell, depth to rock.	Severe: low strength.
27---------- Counts	Severe: too clayey, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: low strength, shrink-swell.

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
28---------- Dela	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
29, 30---------- Dennis	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
31*: Dennis----------	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Eram----------	Severe: too clayey, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
32, 33---------- Durant	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
34*: Endsaw----------	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Hector----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
35*: Endsaw----------	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, shrink-swell.
Hector----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
36*: Endsaw----------	Severe: 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.
Hector----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, depth to rock.
37*: Endsaw----------	Severe: 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.
Hector----------	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.
38, 39---------- Eram	Severe: too clayey, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.

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
40*:					
Eram	Severe: too clayey, wetness.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Talihina	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: shrink-swell, low strength, slope.	Severe: low strength, shrink-swell.
41--- Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
42--- Guyton	Severe: floods, wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
43--- Hamden	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Moderate: low strength, shrink-swell.
44, 45, 46--- Hartsells	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.
47*:					
Hartsells	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Moderate: slope, depth to rock.
Hector	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.
48, 49*--- Heiden	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
50--- Kaufman	Severe: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
51*:					
Kaufman	Severe: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
52*:					
Kiti	Severe: depth to rock, small stones.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Rock outcrop.					
53*:					
Kiti	Severe: depth to rock, slope, small stones.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.
Rock outcrop.					

See footnote at end of table.

TABLE 10.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
54---------- Larue	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
55---------- Larue	Slight----------	Slight----------	Slight----------	Moderate: slope.	Slight.
56---------- Lightning	Severe: wetness, floods, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: low strength, floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: low strength, floods, shrink-swell.
57, 58, 59-------- Parsons	Severe: wetness, too clayey.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: low strength, shrink-swell.
60---------- Pickton	Severe: cutbanks cave.	Slight----------	Moderate: wetness.	Slight----------	Slight.
61---------- Rexor	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength, shrink-swell.
62*:					
Rexor----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Dela----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
63---------- Saffell	Severe: small stones.	Slight----------	Slight----------	Moderate: slope.	Slight.
64---------- Stigler	Severe: wetness, too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
65*---------- Tarrant	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
66---------- Trinity	Severe: wetness, floods, too clayey.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: shrink-swell.
67*. Udorthents					
68---------- Wrightsville	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.
69*---------- Yanush	Severe: small stones.	Moderate: slope, shrink-swell.	Moderate: slope, shrink-swell.	Severe: slope.	Moderate: slope, shrink-swell.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the 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
1 Agan	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
2, 3, 4 Bates	Severe: depth to rock.	Moderate: depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: thin layer.
5*: Bates	Severe: depth to rock.	Moderate: depth to rock, slope.	Severe: depth to rock.	Moderate: depth to rock.	Fair: thin layer.
Coweta	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
6 Bernow	Slight	Moderate: seepage.	Slight	Slight	Good.
7, 8, 9, 10 Bernow	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
11*: Bernow	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Romia	Moderate: percs slowly, depth to rock, slope.	Severe: slope.	Moderate: depth to rock.	Moderate: slope.	Fair: too clayey, slope.
12* Bernow	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
13*: Bigfork	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, small stones.	Severe: large stones, slope, depth to rock.	Severe: slope.	Poor: small stones, slope, large stones.
Yanush	Moderate: slope.	Severe: small stones, slope.	Severe: small stones.	Moderate: slope.	Poor: small stones.
14 Boggy	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness.
15, 16 Bosville	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
17 Bosville	Severe: percs slowly, wetness.	Severe: wetness, slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
18 Burleson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
19 Burleson	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
20*:					
Carnasaw	Severe: percs slowly.	Moderate: depth to rock, slope, large stones.	Severe: too clayey.	Slight	Poor: too clayey.
Clebit	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, small stones, depth to rock.	Severe: seepage.	Poor: thin layer, small stones.
21*:					
Carnasaw	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Clebit	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: seepage, small stones, depth to rock.	Severe: seepage.	Poor: thin layer, small stones.
22*:					
Carnasaw	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: too clayey, slope.
Clebit	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: seepage, depth to rock, large stones.	Severe: seepage, slope.	Poor: thin layer, slope, large stones.
23*:					
Carnasaw	Severe: percs slowly, slope.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: too clayey, slope.
Clebit	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones, slope.	Severe: seepage, slope.	Poor: thin layer, slope, large stones.
24 Chigley	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Slight	Poor: thin layer.
25*:					
Chigley	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Slight	Poor: thin layer.
Rock outcrop.					
26*:					
Claremore	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim.
Catoosa	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.
27 Counts	Severe: wetness, percs slowly.	Severe: wetness.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
28 Dela	Severe: wetness, floods.	Severe: seepage, floods.	Severe: wetness, floods, seepage.	Severe: floods, seepage.	Good.

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
29, 30--Dennis	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
31*:					
Dennis	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
Eram	Severe: percs slowly, wetness, depth to rock.	Severe: depth to rock.	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
32, 33--Durant	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
34*:					
Endsaw	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Hector	Severe: depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
35*:					
Endsaw	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Hector	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
36*:					
Endsaw	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: slope, too clayey.
Hector	Severe: slope, depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: slope, seepage.	Poor: slope, thin layer.
37*:					
Endsaw	Severe: slope, percs slowly.	Severe: slope.	Severe: too clayey, slope.	Severe: slope.	Poor: slope, too clayey.
Hector	Severe: slope, depth to rock, large stones.	Severe: slope, depth to rock, seepage.	Severe: slope, depth to rock, large stones.	Severe: slope, seepage.	Poor: slope, thin layer, large stones.
38, 39--Eram	Severe: percs slowly, wetness, depth to rock.	Severe: depth to rock.	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
40*:					
Eram	Severe: percs slowly, wetness, depth to rock.	Severe: depth to rock.	Severe: too clayey.	Severe: wetness.	Poor: 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
40*: Talihina	Severe: percs slowly, wetness, depth to rock.	Severe: depth to rock, slope.	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
41 Gowton	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
42 Guyton	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
43 Hamden	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
44 Hartsells	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer, area reclaim.
45, 46 Hartsells	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Slight	Fair: thin layer, area reclaim.
47*: Hartsells	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Fair: thin layer, area reclaim.
Hector	Severe: depth to rock.	Severe: slope, depth to rock, seepage.	Severe: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
48 Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
49* Heiden	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
50 Kaufman	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey, wetness.	Severe: floods.	Poor: too clayey, wetness.
51*: Kaufman	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey, wetness.	Severe: floods.	Poor: too clayey, wetness.
Gowton	Severe: floods.	Moderate: seepage.	Severe: floods.	Severe: floods.	Fair: too clayey.
52*: Kiti	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, area reclaim, small stones.
Rock outcrop.					

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
53*:					
Kiti	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, small stones, slope.
Rock outcrop.					
54, 55--- Larue	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Fair: too sandy.
56--- Lightning	Severe: percs slowly, wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey.
57--- Parsons	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
58, 59--- Parsons	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
60--- Pickton	Moderate: wetness.	Severe: seepage.	Severe: wetness, too sandy, seepage.	Severe: seepage.	Fair: too sandy.
61--- Rexor	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
62*:					
Rexor	Severe: floods.	Severe: floods.	Severe: floods, wetness.	Severe: floods.	Fair: too clayey.
Dela	Severe: wetness, floods.	Severe: seepage, floods.	Severe: wetness, floods, seepage.	Severe: floods, seepage.	Good.
63--- Saffell	Slight	Moderate: slope, seepage.	Slight	Slight	Poor: small stones.
64--- Stigler	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Fair: thin layer.
65*--- Tarrant	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, large stones, too clayey.
66--- Trinity	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey.
67*. Udorthents					
68--- Wrightsville	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, too clayey.

See footnote at end of table.

TABLE 11.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
69*---------- Yanush	Moderate: slope.	Severe: small stones, slope.	Severe: small stones.	Moderate: slope.	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1---------- Agan	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
2, 3, 4---------- Bates	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
5*: Bates----------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: area reclaim.
Coweta----------	Fair: low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
6, 7, 8, 9, 10-------- Bernow	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
11*: Bernow----------	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Romia----------	Fair: low strength, thin layer, area reclaim.	Poor: excess fines.	Poor: excess fines.	Fair: slope.
12*---------- Bernow	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
13*: Bigfork----------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones, thin layer.
Yanush----------	Fair: shrink-swell.	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones.
14---------- Boggy	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
15, 16, 17---------- Bosville	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
18, 19---------- Burleson	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
20*, 21*: Carnasaw----------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Clebit----------	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones.
22*: Carnasaw----------	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
22*:				
Clebit	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, slope, large stones.
23*:				
Carnasaw	Poor: shrink-swell, low strength, slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
Clebit	Poor: slope, thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: small stones, slope, large stones.
24--- Chigley	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Poor: thin layer, too clayey.
25*:				
Chigley	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Poor: thin layer, too clayey.
Rock outcrop.				
26*:				
Claremore	Poor: thin layer.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer, area reclaim.
Catoosa	Poor: low strength.	Poor: excess fines.	Poor: excess fines.	Fair: thin layer.
27--- Counts	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
28--- Dela	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
29, 30--- Dennis	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
31*:				
Dennis	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Eram	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
32, 33--- Durant	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
34*, 35*:				
Endsaw	Poor: low strength, shrink-swell.	Poor: excess fines.	Poor: excess fines.	Poor: too clayey, thin layer, small stones.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
34*, 35*: Hector	Poor: thin layer.	Poor: excess fines.	Poor: excess fines.	Poor: thin layer, small stones, area reclaim.
36*: Endsaw	Poor: low strength, shrink-swell.	Poor: excess fines.	Poor: excess fines.	Poor: slope.
Hector	Poor: thin layer.	Poor: excess fines.	Poor: excess fines.	Poor: slope, thin layer, small stones.
37*: Endsaw	Poor: slope, low strength, shrink-swell.	Poor: excess fines.	Poor: excess fines.	Poor: slope.
Hector	Poor: slope, thin layer, large stones.	Poor: excess fines.	Poor: excess fines.	Poor: slope, thin layer, large stones.
38, 39--- Eram	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
40*: Eram	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Talihina	Poor: low strength, shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey, thin layer, area reclaim.
41--- Gowton	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
42--- Guyton	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
43--- Hamden	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
44, 45, 46--- Hartsells	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
47*: Hartsells	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope, too clayey.
Hector	Poor: thin layer.	Poor: excess fines.	Poor: excess fines.	Poor: thin layer, small stones, area reclaim.
48, 49*--- Heiden	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
50--Kaufman	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
51*: Kaufman	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Gowton	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
52*: Kiti	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Severe: small stones, area reclaim.
Rock outcrop.				
53*: Kiti	Poor: thin layer, area reclaim.	Unsuited: excess fines.	Unsuited: excess fines.	Severe: small stones, slope, area reclaim.
Rock outcrop.				
54, 55--Larue	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
56--Lightning	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
57, 58, 59--Parsons	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
60--Pickton	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: too sandy.
61--Rexor	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
62*: Rexor	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Dela	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
63--Saffell	Good	Poor: excess fines.	Fair: excess fines.	Poor: small stones.
64--Stigler	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
65*--Tarrant	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
66--Trinity	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
67*. Udorthents				

See footnote at end of table.

TABLE 12.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
68---------- Wrightsville	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
69*---------- Yanush	Fair: shrink-swell.	Unsuited: excess fines.	Poor: excess fines.	Poor: small stones.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
1---------- Agan	Slight---------	Moderate: unstable fill.	Severe: slow refill.	Percs slowly---	Percs slowly---	Percs slowly.
2, 3, 4---------- Bates	Moderate: depth to rock, seepage.	Severe: thin layer, piping.	Severe: no water.	Not needed-----	Depth to rock, soil blowing.	Depth to rock.
5*: Bates----------	Moderate: depth to rock, seepage.	Severe: thin layer, piping.	Severe: no water.	Not needed-----	Depth to rock, soil blowing.	Depth to rock.
Coweta----------	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed-----	Depth to rock, rooting depth, slope.	Droughty, rooting depth, slope.
6, 7, 8, 9, 10---- Bernow	Moderate: seepage.	Slight---------	Severe: deep to water.	Not needed-----	Favorable------	Favorable.
11*: Bernow----------	Moderate: seepage.	Slight---------	Severe: deep to water.	Not needed-----	Slope----------	Slope.
Romia----------	Moderate: seepage, depth to rock.	Moderate: thin layer.	Severe: no water.	Not needed-----	Favorable------	Slope.
12*---------- Bernow	Moderate: seepage.	Slight---------	Severe: deep to water.	Not needed-----	Favorable------	Favorable.
13*: Bigfork----------	Severe: depth to rock.	Severe: large stones.	Severe: no water.	Slope----------	Depth to rock, large stones, slope.	Depth to rock, large stones, slope.
Yanush----------	Moderate: seepage.	Moderate: seepage.	Severe: no water.	Slope----------	Favorable------	Favorable.
14---------- Boggy	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Floods---------	Not needed-----	Wetness.
15, 16, 17-------- Bosville	Slight---------	Moderate: unstable fill, compressible, shrink-swell.	Severe: deep to water, slow refill.	Percs slowly, slope, wetness.	Percs slowly, slope, wetness.	Percs slowly, slope, wetness.
18, 19---------- Burleson	Slight---------	Moderate: unstable fill, hard to pack.	Severe: deep to water.	Percs slowly---	Percs slowly---	Percs slowly.
20*: Carnasaw---------	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Severe: no water, slow refill.	Not needed-----	Percs slowly---	Percs slowly.
Clebit----------	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed-----	Slope, depth to rock, rooting depth.	Depth to rock, droughty, rooting depth.
21*: Carnasaw---------	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Severe: no water, slow refill.	Not needed-----	Percs slowly---	Slope, percs slowly.
Clebit----------	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed-----	Slope, depth to rock, rooting depth.	Depth to rock, droughty, 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	Terraces and diversions	Grassed waterways
22*, 23*:						
Carnasaw	Moderate: depth to rock.	Moderate: thin layer, hard to pack, large stones.	Severe: no water, slow refill.	Not needed	Slope, large stones, percs slowly.	Slope, percs slowly, large stones.
Clebit	Severe: depth to rock, seepage.	Severe: thin layer, large stones.	Severe: no water, large stones.	Not needed	Large stones, slope, depth to rock.	Large stones, depth to rock, droughty.
24--- Chigley	Slight	Moderate: hard to pack.	Severe: slow refill.	Slope	Erodes easily	Slope.
25*:						
Chigley	Slight	Moderate: hard to pack.	Severe: slow refill.	Slope	Erodes easily	Slope.
Rock outcrop.						
26*:						
Claremore	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Not needed	Depth to rock	Rooting depth.
Catoosa	Severe: depth to rock.	Moderate: unstable fill, piping, thin layer.	Severe: no water.	Not needed	Depth to rock, rooting depth, droughty.	Rooting depth, droughty.
27--- Counts	Slight	Moderate: unstable fill, compressible.	Severe: slow refill.	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
28--- Dela	Severe: seepage.	Moderate: unstable fill, seepage.	Moderate: deep to water.	Floods	Not needed	Not needed.
29, 30--- Dennis	Slight	Moderate: unstable fill, compressible, piping.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
31*:						
Dennis	Slight	Moderate: unstable fill, compressible, piping.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
Eram	Slight	Moderate: unstable fill, thin layer.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
32, 33--- Durant	Slight	Severe: piping, compressible.	Severe: no water.	Not needed	Percs slowly	Percs slowly.
34*:						
Endsaw	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Severe: deep to water.	Not needed	Percs slowly, erodes easily.	Erodes easily, percs slowly.
Hector	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed	Slope, depth to rock, rooting depth.	Droughty, rooting depth, slope.
35*:						
Endsaw	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Severe: deep to water.	Not needed	Percs slowly, erodes easily.	Slope, erodes easily, percs slowly.

See footnote at end of table.

TABLE 13.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Terraces and diversions	Grassed waterways
35*:						
Hector	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed	Slope, depth to rock, rooting depth.	Droughty, rooting depth, slope.
36*:						
Endsaw	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Severe: deep to water.	Not needed	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
Hector	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed	Slope, depth to rock, rooting depth.	Droughty, rooting depth, slope.
37*:						
Endsaw	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Severe: deep to water.	Not needed	Slope, percs slowly, erodes easily.	Slope, erodes easily, percs slowly.
Hector	Severe: depth to rock, seepage.	Severe: thin layer, large stones.	Severe: no water.	Not needed	Slope, depth to rock, large stones.	Droughty, large stones, slope.
38, 39 Eram	Slight	Moderate: unstable fill, thin layer.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
40*:						
Eram	Slight	Moderate: unstable fill, thin layer.	Severe: no water.	Percs slowly	Percs slowly	Percs slowly.
Talihina	Severe: depth to rock.	Severe: thin layer.	Severe: slow refill.	Not needed	Depth to rock, slope.	Rooting depth, percs slowly, slope.
41 Gowton	Moderate: seepage.	Moderate: unstable fill, piping.	Severe: deep to water.	Floods	Not needed	Not needed.
42 Guyton	Slight	Moderate: erodes easily, low strength, compressible.	Severe: no water.	Cutbanks cave, floods, percs slowly.	Not needed	Wetness.
43 Hamden	Moderate: seepage.	Slight	Severe: deep to water, slow refill.	Percs slowly	Percs slowly	Percs slowly.
44, 45, 46 Hartsells	Severe: depth to rock.	Moderate: low strength.	Severe: no water.	Not needed	Favorable	Favorable.
47*:						
Hartsells	Severe: depth to rock.	Moderate: low strength.	Severe: no water.	Not needed	Slope	Slope.
Hector	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: no water.	Not needed	Slope, depth to rock, rooting depth.	Droughty, rooting depth, slope.
48 Heiden	Slight	Moderate: unstable fill, shrink-swell.	Severe: no water.	Not needed	Percs slowly	Percs slowly.
49* Heiden	Slight	Moderate: unstable fill, shrink-swell.	Severe: no water.	Not needed	Slope	Percs slowly, slope.

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	Terraces and diversions	Grassed waterways
50---------- Kaufman	Slight---------	Moderate: low strength.	Severe: deep to water.	Floods, percs slowly, wetness.	Percs slowly---	Percs slowly.
51*: Kaufman----------	Slight---------	Moderate: low strength.	Severe: deep to water.	Floods, percs slowly, wetness.	Percs slowly---	Percs slowly.
Gowton----------	Moderate: seepage.	Moderate: unstable fill, piping.	Severe: deep to water.	Floods---------	Not needed-----	Not needed.
52*, 53*: Kiti----------	Severe: depth to rock.	Severe: thin layer.	Severe: deep to water.	Not needed-----	Not needed-----	Not needed.
Rock outcrop.						
54, 55---------- Larue	Moderate: seepage.	Slight---------	Severe: no water.	Not needed-----	Too sandy------	Slope, droughty.
56---------- Lightning	Slight---------	Moderate: unstable fill, compressible.	Severe: slow refill.	Floods, percs slowly.	Not needed-----	Wetness.
57, 58, 59-------- Parsons	Slight---------	Moderate: unstable fill, compressible.	Severe: no water.	Percs slowly, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
60---------- Pickton	Severe: seepage.	Severe: piping.	Severe: deep to water.	Not needed-----	Too sandy, slope.	Droughty, slope.
61---------- Rexor	Moderate: seepage.	Moderate: unstable fill, seepage.	Severe: deep to water.	Not needed-----	Not needed-----	Not needed.
62*: Rexor----------	Moderate: seepage.	Moderate: unstable fill, seepage.	Severe: deep to water.	Not needed-----	Not needed-----	Not needed.
Dela----------	Severe: seepage.	Moderate: unstable fill, seepage.	Moderate: deep to water.	Floods---------	Not needed-----	Not needed.
63---------- Saffell	Moderate: seepage.	Moderate: seepage, piping, thin layer.	Severe: no water.	Not needed-----	Erodes easily, slope, small stones.	Droughty, erodes easily, slope.
64---------- Stigler	Slight---------	Moderate: unstable fill, compressible, low strength.	Severe: deep to water.	Percs slowly---	Percs slowly---	Percs slowly.
65*---------- Tarrant	Severe: depth to rock.	Severe: thin layer, large stones.	Severe: no water.	Depth to rock	Depth to rock, large stones.	Rooting depth, large stones.
66---------- Trinity	Slight---------	Moderate: compressible, unstable fill.	Severe: deep to water.	Percs slowly, floods.	Floods, wetness, percs slowly.	Wetness, percs slowly.
67*. Udorthents						
68---------- Wrightsville	Slight---------	Severe: unstable fill, compressible.	Severe: no water.	Favorable, wetness, percs slowly.	Not needed-----	Not needed.

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	Terraces and diversions	Grassed waterways
69*---------- Yanush	Moderate: seepage.	Moderate: seepage.	Severe: no water.	Slope----------	Favorable------	Favorable.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Agan	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly.	Moderate: wetness.
2, 3, 4 Bates	Slight	Slight	Moderate: slope, depth to rock.	Slight.
5*: Bates	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Coweta	Slight	Slight	Severe: depth to rock, slope, large stones.	Slight.
6 Bernow	Slight	Slight	Slight	Slight.
7, 8 Bernow	Slight	Slight	Moderate: slope.	Slight.
9 Bernow	Slight	Slight	Moderate: slope.	Slight.
10 Bernow	Slight	Slight	Severe: slope.	Slight.
11*: Bernow	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Romia	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
12* Bernow	Slight	Slight	Moderate: slope.	Slight.
13*: Bigfork	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones, small stones.	Severe: large stones.
Yanush	Moderate: small stones, slope.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones.
14 Boggy	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.
15, 16 Bosville	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly.	Slight.
17 Bosville	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly, slope.	Slight.
18, 19 Burleson	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
20*:				
Carnasaw	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Clebit	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: depth to rock, small stones.	Moderate: small stones.
21*:				
Carnasaw	Moderate: percs slowly.	Moderate: slope.	Severe: slope.	Slight.
Clebit	Moderate: slope, small stones.	Moderate: slope, small stones.	Severe: slope, depth to rock, small stones.	Moderate: small stones.
22*:				
Carnasaw	Severe: slope, large stones.	Severe: slope.	Severe: slope.	Moderate: slope, large stones.
Clebit	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope, small stones, large stones.	Severe: large stones.
23*:				
Carnasaw	Severe: slope, large stones.	Severe: slope.	Severe: slope.	Severe: slope.
Clebit	Severe: large stones, slope.	Severe: large stones, slope.	Severe: slope, small stones, large stones.	Severe: large stones, slope.
24 Chigley	Moderate: percs slowly, small stones.	Moderate: small stones.	Moderate: slope, small stones.	Moderate.
25*:				
Chigley	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: slope.	Moderate.
Rock outcrop.				
26*:				
Claremore	Slight	Slight	Severe: depth to rock.	Slight.
Catoosa	Slight	Slight	Moderate: depth to rock, slope.	Slight.
27 Counts	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
28 Dela	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
29, 30 Dennis	Moderate: wetness, percs slowly.	Slight	Moderate: percs slowly, slope, wetness.	Slight.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
31*:				
Dennis	Moderate: wetness, percs slowly.	Slight	Moderate: percs slowly, slope, wetness.	Slight.
Eram	Moderate: percs slowly, too clayey, wetness.	Moderate: too clayey.	Moderate: slope, percs slowly, wetness.	Moderate: too clayey.
32, 33 Durant	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
34*:				
Endsaw	Moderate: percs slowly, small stones.	Moderate: small stones.	Moderate: small stones, large stones, percs slowly.	Moderate: small stones.
Hector	Slight	Slight	Severe: depth to rock.	Slight.
35*:				
Endsaw	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: small stones, large stones.	Moderate: small stones.
Hector	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock.	Slight.
36*:				
Endsaw	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.	Moderate: small stones, slope.
Hector	Severe: slope.	Severe: slope.	Severe: slope, depth to rock.	Moderate: slope.
37*:				
Endsaw	Severe: slope.	Severe: slope.	Severe: small stones, large stones, slope.	Severe: slope.
Hector	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones, depth to rock.	Severe: slope, large stones.
38 Eram	Moderate: percs slowly, too clayey, wetness.	Moderate: too clayey.	Moderate: slope, percs slowly, wetness.	Moderate: too clayey.
39 Eram	Moderate: percs slowly, too clayey, wetness.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
40*:				
Eram	Moderate: percs slowly, too clayey, wetness.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
40*:				
Talihina	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Severe: slope, depth to rock.	Moderate: too clayey.
41 Gowton	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods, too clayey.	Moderate: too clayey.
42 Guyton	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
43 Hamden	Moderate: percs slowly, wetness.	Slight	Moderate: percs slowly, wetness.	Slight.
44 Hartsells	Slight	Slight	Moderate: slope.	Slight.
45, 46 Hartsells	Slight	Slight	Severe: slope.	Slight.
47*:				
Hartsells	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Hector	Moderate: slope.	Moderate: slope.	Severe: slope, depth to rock.	Slight.
48, 49* Heiden	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
50 Kaufman	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
51*:				
Kaufman	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
Gowton	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
52*:				
Kiti	Moderate: small stones.	Moderate: small stones.	Severe: slope, large stones, small stones.	Severe: small stones, large stones.
Rock outcrop.				
53*:				
Kiti	Severe: slope, small stones.	Severe: slope, small stones.	Severe: slope, large stones, small stones.	Severe: small stones, large stones, slope.
Rock outcrop.				
54, 55 Larue	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
56---------- Lightning	Severe: floods, percs slowly, wetness.	Moderate: floods, wetness.	Severe: percs slowly, wetness, floods.	Moderate: floods, wetness.
57, 58, 59---------- Parsons	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly.	Moderate: wetness.
60---------- Pickton	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
61---------- Rexor	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
62*:				
Rexor----------	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Dela----------	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
63---------- Saffell	Severe: small stones.	Moderate: small stones.	Severe: small stones, slope.	Moderate: small stones.
64---------- Stigler	Severe: percs slowly.	Slight----------	Severe: percs slowly.	Slight.
65*---------- Tarrant	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, large stones.	Severe: large stones, too clayey.
66---------- Trinity	Severe: wetness, floods, percs slowly.	Severe: too clayey.	Severe: wetness, too clayey.	Severe: too clayey.
67*. Udorthents				
68---------- Wrightsville	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
69*---------- Yanush	Moderate: small stones, slope.	Moderate: slope, small stones.	Severe: slope, small stones.	Moderate: small stones, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements							Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
1---------- Agan	Fair	Fair	Fair	---	---	Poor	Poor	Fair	---	Poor.
2, 3, 4---------- Bates	Good	Good	Good	---	---	Poor	Very poor.	Good	---	Very poor.
5*: Bates----------	Good	Good	Good	---	---	Poor	Very poor.	Good	---	Very poor.
Coweta----------	Very poor.	Poor	Poor	---	---	Very poor.	Very poor.	Poor	---	Very poor.
6, 7, 8---------- Bernow	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
9---------- Bernow	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
10---------- Bernow	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
11*: Bernow----------	Fair	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Romia----------	Poor	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
12*---------- Bernow	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
13*: Bigfork----------	Very poor.	Poor	Fair	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Yanush----------	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Good	Very poor.
14---------- Boggy	Poor	Fair	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
15---------- Bosville	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
16---------- Bosville	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
17---------- Bosville	Fair	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
18, 19---------- Burleson	Good	Good	Poor	---	---	Very poor.	Very poor.	Fair	---	Very poor.
20*: Carnasaw----------	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Clebit----------	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	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	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
21*:										
Carnasaw	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Clebit	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
22*:										
Carnasaw	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Clebit	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
23*:										
Carnasaw	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Clebit	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.	Very poor.
24--Chigley	Good	Good	Good	---	---	Poor	Very poor.	Good	---	Very poor.
25*:										
Chigley	Fair	Good	Good	---	---	Poor	Very poor.	Good	---	Very poor.
Rock outcrop.										
26*:										
Claremore	Poor	Poor	Fair	---	---	Poor	Very poor.	Poor	---	Very poor.
Catoosa	Fair	Good	Good	---	---	Poor	Very poor.	Good	---	Very poor.
27--Counts	Fair	Good	Good	Good	Good	Fair	Fair	Good	Good	Fair.
28--Dela	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
29--Dennis	Good	Good	Good	---	---	Poor	Poor	Good	---	Poor.
30--Dennis	Good	Good	Good	---	---	Poor	Very poor.	Good	---	Very poor.
31*:										
Dennis	Good	Good	Good	---	---	Poor	Very poor.	Good	---	Very poor.
Eram	Fair	Good	Fair	---	---	Poor	Very poor.	Fair	---	Very poor.
32, 33--Durant	Good	Good	Good	---	---	Poor	Poor	Good	---	Poor.
34*:										
Endsaw	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Hector	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Poor	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	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
35*:										
Endsaw	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Hector	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.
36*:										
Endsaw	Poor	Fair	Good	Good	Good	Very poor.	Very poor.	Fair	Good	Very poor.
Hector	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.
37*:										
Endsaw	Very poor.	Poor	Good	Good	Good	Very poor.	Very poor.	Poor	Good	Very poor.
Hector	Very poor.	Very poor.	Poor	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Poor	Very poor.
38--- Eram	Good	Good	Fair	---	---	Poor	Very poor.	Good	---	Very poor.
39--- Eram	Fair	Good	Fair	---	---	Poor	Very poor.	Fair	---	Very poor.
40*:										
Eram	Fair	Good	Fair	---	---	Poor	Very poor.	Fair	---	Very poor.
Talihina	Poor	Poor	Fair	---	---	Very poor.	Very poor.	Poor	---	Very poor.
41--- Gowton	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
42--- Guyton	Fair	Fair	Fair	Fair	Good	Good	Good	Fair	Fair	Good.
43--- Hamden	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Poor.
44--- Hartsells	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
45, 46--- Hartsells	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
47*:										
Hartsells	Fair	Good	Good	Good	Good	Very poor.	Very poor.	Good	Good	Very poor.
Hector	Very poor.	Poor	Poor	Poor	Very poor.	Very poor.	Very poor.	Poor	Poor	Very poor.
48--- Heiden	Fair	Good	Fair	---	---	Poor	Very poor.	Fair	---	Very poor.
49*--- Heiden	Poor	Fair	Fair	---	---	Poor	Very poor.	Fair	---	Very poor.
50--- Kaufman	Fair	Fair	Poor	Good	Good	Poor	Good	Fair	Good	Fair.

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	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife
51*: Kaufman	Poor	Poor	Fair	Good	Good	Poor	Good	Poor	Good	Fair.
Gowton	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
52*, 53*: Kiti	Very poor.	Poor	Poor	---	---	Very poor.	Very poor.	Poor	---	Very poor.
Rock outcrop.										
54, 55--- Larue	Poor	Fair	Good	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
56--- Lightning	Fair	Good	Fair	Good	Good	Fair	Fair	Fair	Good	Fair.
57--- Parsons	Fair	Good	Good	---	---	Fair	Fair	Good	---	Fair.
58, 59--- Parsons	Fair	Good	Good	---	---	Fair	Poor	Good	---	Poor.
60--- Pickton	Poor	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
61--- Rexor	Good	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
62*: Rexor	Poor	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Dela	Poor	Fair	Fair	Good	Good	Poor	Poor	Fair	Good	Poor.
63--- Saffell	Fair	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
64--- Stigler	Good	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
65*--- Tarrant	Very poor.	Very poor.	Fair	---	---	Very poor.	Very poor.	Poor	---	Very poor.
66--- Trinity	Fair	Good	Fair	Good	Good	Poor	Fair	Fair	Good	Poor.
67*. Udorthents										
68--- Wrightsville	Fair	Fair	Fair	Fair	Fair	Good	Good	Fair	Fair	Good.
69*--- Yanush	Fair	Good	Good	Fair	Fair	Poor	Very poor.	Good	Good	Very poor.

*See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1---------- Agan	0-7	Loam----------	ML, CL, CL-ML	A-4, A-6	0	85-100	85-100	75-90	60-75	<33	NP-13
	7-50	Clay, silty clay, gravelly clay.	CH, CL	A-7-6	0	55-100	55-100	51-95	51-95	45-65	22-40
	50-65	Very gravelly clay loam, very gravelly sandy clay, very gravelly sandy clay loam.	GC	A-2-6, A-2-7	0-15	25-50	25-50	20-45	15-35	35-53	12-27
2, 3, 4---------- Bates	0-20	Fine sandy loam	ML, SM	A-4	0	100	100	90-100	40-55	<30	NP-5
	20-35	Loam, clay loam, sandy clay loam.	ML, CL	A-4, A-6	0	100	100	90-100	50-85	25-40	3-15
	35-38	Weathered bedrock.	---	---	---	---	---	---	---	---	---
5*:											
Bates----------	0-24	Fine sandy loam	ML, SM	A-4	0	100	100	90-100	40-55	<30	NP-5
	24-31	Loam, clay loam, sandy clay loam.	ML, CL	A-4, A-6	0	100	100	90-100	50-85	25-40	3-15
	31-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Coweta----------	0-11	Fine sandy loam	ML, CL, SM, SC	A-4	0-30	70-100	70-100	60-90	36-85	<31	NP-10
	11-16	Fine sandy loam, loam, clay loam.	ML, CL, SM, SC	A-2, A-4, A-6	0-25	55-75	55-75	45-70	30-65	<31	NP-12
	16-22	Weathered bedrock.	---	---	---	---	---	---	---	---	---
6, 7, 8, 9, 10----- Bernow	0-15	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	15-36	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	36-65	Clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
11*:											
Bernow----------	0-15	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	15-36	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	36-65	Clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
Romia----------	0-14	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	14-44	Sandy clay loam, clay loam, gravelly sandy clay loam.	SC, CL	A-2, A-4, A-6	0	50-100	50-100	50-95	20-90	25-40	7-18
	44-58	Weathered 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	
12*---------- Bernow	0-12	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-60	<26	NP-7
	12-52	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	52-65	Clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
13*:											
Bigfork----------	0-5	Cherty silt loam.	CL, GC, SC	A-4, A-6	40-75	55-80	55-80	45-80	36-80	22-32	5-15
	5-35	Cherty silty clay loam, stoney clay loam.	CL, GC, SC	A-6, A-7	40-75	55-80	55-80	50-80	44-80	33-43	12-20
	35-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Yanush----------	0-12	Cherty silt loam	ML, CL, GC, GM	A-2, A-4, A-6	0	50-70	50-70	45-65	30-65	22-35	2-14
	12-34	Cherty silty clay loam, cherty clay loam, very cherty clay loam.	GC	A-6, A-7, A-2	0-15	25-55	25-55	25-55	20-50	33-43	12-20
	34-66	Cherty silty clay loam, cherty clay loam, very cherty clay loam.	GC, GP-GC	A-2, A-6, A-7	15-30	10-55	10-55	10-50	8-50	33-43	12-20
14---------- Boggy	0-16	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-85	<29	NP-7
	16-72	Fine sandy loam, loam.	ML, SM, CL-ML, SM-SC	A-4	0	100	98-100	94-100	36-85	<29	NP-7
15, 16, 17--------- Bosville	0-6	Fine sandy loam	SM, ML, CL, SC	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	6-72	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-65	15-35
18, 19---------- Burleson	0-48	Clay----------	CH, MH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-95	51-80	27-55
	48-73	Clay, silty clay	CH, MH	A-7-6, A-7-5	0-1	95-100	80-100	75-95	70-95	51-80	30-55
20*, 21*:											
Carnasaw----------	0-7	Fine sandy loam	ML, CL, SM, SC	A-4	0-5	100	98-100	94-100	36-97	<30	NP-10
	7-42	Clay, silty clay	CL, CH	A-7	0	80-95	80-95	80-95	70-95	41-65	18-35
	42-52	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Clebit----------	0-3	Gravelly fine sandy loam.	GM, GC, GM-GC	A-4, A-2, A-1	0-10	45-60	45-60	30-55	15-45	<31	NP-10
	3-18	Gravelly very fine sandy loam, gravelly loam, gravelly fine sandy loam.	GM-GC, GM, GC	A-4, A-2, A-1	30-40	40-60	40-60	30-55	15-50	<31	NP-10
	18-30	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	
22*:											
Carnasaw	0-7	Gravelly loam	GM, GC, SM, CL	A-4, A-2	5-35	55-95	55-95	35-95	20-95	<30	NP-10
	7-42	Clay, silty clay	CL, CH	A-7	0	80-95	80-95	80-95	70-95	41-65	18-35
	42-52	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Clebit	0-5	Stony fine sandy loam.	GM, GC, GM-GC	A-4, A-2, A-1	10-30	45-60	45-60	30-55	15-45	<31	NP-10
	5-16	Gravelly very fine sandy loam, gravelly loam, gravelly fine sandy loam.	GM, GC, GM-GC	A-4, A-2, A-1	30-40	40-60	40-60	30-55	15-50	<31	NP-10
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
23*:											
Carnasaw	0-14	Stony fine sandy loam.	GM, GC, SM, CL	A-4, A-2	5-35	55-95	55-95	35-95	20-95	<30	NP-10
	14-42	Clay, silty clay	CL, CH	A-7	0	80-95	80-95	80-95	70-95	41-65	18-35
	42-52	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Clebit	0-5	Stony fine sandy loam.	GM, GC, GM-GC	A-4, A-2, A-1	10-30	45-60	45-60	30-55	15-45	<31	NP-10
	5-16	Gravelly very fine sandy loam, gravelly loam, gravelly fine sandy loam.	GM, GC, GM-GC	A-4, A-2, A-1	30-40	40-60	40-60	30-55	15-50	<31	NP-10
	16-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
24 Chigley	0-8	Fine sandy loam.	SM, SC, SM-SC	A-2, A-4	0	65-90	55-85	50-75	20-50	<30	NP-9
	8-50	Sandy clay, clay, gravelly clay.	CL, CH, SC	A-4, A-6, A-7	0	70-100	60-97	55-85	36-75	25-60	8-35
	50-72	Gravelly sandy clay, gravelly clay, gravelly clay loam.	SC, GC, CL, CH	A-2, A-4, A-6, A-7	0	50-100	40-99	35-70	20-55	25-60	8-35
25*:											
Chigley	0-8	Gravelly sandy loam.	SM, SC, SM-SC	A-2, A-4	0	65-90	55-85	50-75	20-50	<30	NP-9
	8-50	Sandy clay, clay, gravelly clay.	CL, CH, SC	A-4, A-6, A-7	0	70-100	60-97	55-85	36-75	25-60	8-35
	50-72	Gravelly sandy clay, gravelly clay, gravelly clay loam.	SC, GC, CL, CH	A-2, A-4, A-6, A-7	0	50-100	40-99	35-70	20-55	25-60	8-35
Rock outcrop.											

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	
26*:											
Claremore	0-8	Loam	ML, CL, CL-ML	A-4, A-6	0	98-100	95-100	90-100	65-85	20-35	2-14
	8-18	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	95-100	90-100	80-95	33-43	13-20
	18-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Catoosa	0-12	Loam	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	12-32	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	100	96-100	80-98	33-43	12-20
	32-40	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
27	0-15	Loam	CL, CL-ML	A-4	0	100	98-100	96-100	65-97	20-30	4-10
Counts	15-70	Clay, silty clay loam, clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	96-100	90-98	37-65	15-35
28	0-18	Fine sandy loam	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-60	<30	NP-10
Dela	18-72	Fine sandy loam, sandy loam, loam.	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-70	<30	NP-10
29, 30	0-16	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	65-97	20-37	1-15
Dennis	16-25	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-48	13-25
	25-72	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35
31*:											
Dennis	0-12	Loam	ML, CL, CL-ML	A-4, A-6	0	100	100	96-100	65-97	20-37	1-15
	12-18	Silty clay loam, clay loam.	CL	A-6, A-7	0	98-100	98-100	94-100	75-98	33-48	13-25
	18-72	Clay, silty clay, silty clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	94-100	75-98	37-65	15-35
Eram	0-10	Clay loam	CL	A-6, A-7	0	85-100	85-100	85-100	75-95	33-48	12-22
	10-32	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	95-100	95-100	90-100	85-98	37-65	13-34
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
32, 33	0-9	Loam	CL	A-4, A-6	0	100	100	96-100	65-97	28-40	8-17
Durant	9-70	Clay	CL, CH	A-7	0	100	100	96-100	90-95	45-70	21-39
34*, 35*, 36*:											
Endsaw	0-9	Fine sandy loam	CL-ML, ML, SM, SM-SC	A-2, A-4	0-15	65-95	60-90	50-80	20-55	<26	NP-7
	9-48	Gravelly clay, gravelly silty clay, silty clay.	CL, CH	A-7	0-15	75-100	70-98	68-96	65-95	41-60	18-32
	48-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
34*, 35*, 36*:											
Hector	0-6	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	80-100	80-100	80-100	30-65	<30	NP-6
	6-18	Fine sandy loam, gravelly fine sandy loam, gravelly loam.	SM, ML, GM, GM-GC	A-4, A-2	0-15	55-100	55-100	45-100	30-65	<30	NP-6
	18-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
37*:											
Endsaw	0-9	Stony fine sandy loam.	CL-ML, ML, GC, SC	A-4	0-15	65-95	60-90	50-85	40-75	24-31	3-9
	9-43	Gravelly clay, gravelly silty clay, silty clay.	CL, CH	A-7	0-15	75-100	70-98	68-96	65-95	41-60	18-32
	43-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Hector	0-7	Stony fine sandy loam.	GM, GM-GC	A-2	15-40	40-50	35-45	30-40	20-30	<30	NP-6
	7-18	Fine sandy loam, gravelly fine sandy loam, gravelly loam.	SM, ML, GM, GM-GC	A-4, A-2	0-20	55-100	55-100	45-100	30-65	<30	NP-6
	18-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
38, 39	0-11	Clay loam	CL	A-6, A-7	0	85-100	85-100	85-100	75-95	33-48	12-22
Eram	11-33	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	95-100	95-100	90-100	85-98	37-65	13-34
	33-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
40*:											
Eram	0-9	Clay loam	CL	A-6, A-7	0	85-100	85-100	85-100	75-95	33-48	12-22
	9-30	Clay, silty clay, clay loam.	CL, CH	A-7, A-6	0	95-100	95-100	90-100	85-98	37-65	13-34
	30-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Talihina	0-16	Clay loam	CL	A-6, A-7	0-15	87-100	87-100	85-100	70-98	37-50	15-26
	16-33	Weathered bedrock.	---	---	---	---	---	---	---	---	---
41	0-38	Clay loam	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
Gowton	38-68	Loam, clay loam	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
42	0-17	Silt loam	ML, CL-ML	A-4	0	100	100	95-100	65-90	<27	NP-7
Guyton	17-47	Silt loam, silty clay loam, clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	75-95	26-40	6-18
	47-80	Silt loam, silty clay loam, clay loam.	CL, CL-ML, ML	A-6, A-4	0	100	100	95-100	65-95	<40	NP-18
43	0-18	Fine sandy loam	SM, ML, SM-SC	A-4	0	100	95-100	95-100	36-60	<26	NP-7
Hamden	18-32	Sandy clay loam, clay loam, loam.	SC, CL	A-4, A-6	0	100	100	90-100	36-65	25-37	7-16
	32-86	Sandy clay, clay	CL, SC	A-6, A-7	0	100	100	90-100	40-90	35-50	14-25

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
44, 45, 46--------- Hartsells	0-14	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0-5	85-100	75-100	70-95	36-75	<30	NP-7
	14-38	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC, CL-ML, CL	A-4	0-5	85-100	75-100	60-100	40-75	<35	NP-15
	38-44	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
47*: Hartsells---------	0-5	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4	0-5	85-100	75-100	70-95	36-75	<30	NP-7
	5-35	Fine sandy loam, loam, sandy clay loam.	SM-SC, SC, CL-ML, CL	A-4	0-5	85-100	75-100	60-100	40-75	<35	NP-15
	35-50	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Hector------------	0-6	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-4, A-2	0	80-100	80-100	80-100	30-65	<30	NP-6
	6-15	Fine sandy loam, gravelly fine sandy loam, gravelly loam.	SM, ML, GM, GM-GC	A-4, A-2	0-15	55-100	55-100	45-100	30-65	<30	NP-6
	15-24	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
48, 49*------------ Heiden	0-65	Clay------------	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
50----------------- Kaufman	0-82	Clay------------	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
51*: Kaufman-----------	0-66	Clay------------	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
Gowton------------	0-28	Clay loam-------	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
	28-60	Loam, clay loam	CL	A-4, A-6	0	100	100	96-100	65-90	25-40	8-24
52*, 53*: Kiti--------------	0-14	Stony clay loam.	CL, ML	A-4, A-6	45-75	85-95	80-90	75-85	65-80	30-40	8-17
	14-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
54, 55------------ Larue	0-26	Loamy fine sand	SM	A-2-4	0	100	98-100	50-75	15-30	---	NP
	26-72	Sandy clay loam	SC, SM-SC	A-2-4, A-4, A-6	0	100	95-100	80-90	30-45	20-35	5-12
56----------------- Lightning	0-22	Silt loam-------	CL	A-4, A-6	0	100	100	95-100	85-98	30-40	8-19
	22-80	Silty clay loam, silty clay, clay.	CL, CH, MH	A-6, A-7	0	100	100	96-100	90-99	37-70	15-40
57, 58, 59--------- Parsons	0-14	Silt loam-------	ML, CL, CL-ML	A-4, A-6	0	100	96-100	96-100	80-97	20-37	1-12
	14-74	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	96-100	96-100	80-99	37-70	15-40

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	
60---------- Pickton	0-52	Loamy fine sand	SM, SM-SC	A-2-4	0	100	95-100	85-100	15-35	<25	NP-7
	52-82	Sandy clay loam, clay loam, fine sandy loam.	SM-SC, SC, CL, CL-ML	A-4, A-6	0	100	95-100	85-100	36-75	23-35	5-14
61---------- Rexor	0-10	Loam----------	ML, CL, CL-ML	A-4, A-6	0	98-100	98-100	96-100	65-97	22-37	3-14
	10-50	Clay loam, silt loam, silty clay loam.	ML, CL	A-4, A-6	0	98-100	98-100	96-100	80-98	30-40	8-17
	50-75	Loam, silt loam	ML, CL	A-4, A-6	0	98-100	98-100	96-100	70-97	30-37	8-14
62*:											
Rexor----------	0-12	Loam----------	ML, CL, CL-ML	A-4, A-6	0	98-100	98-100	96-100	65-97	22-37	3-14
	12-48	Clay loam, silt loam, silty clay loam.	ML, CL	A-4, A-6	0	98-100	98-100	96-100	80-98	30-40	8-17
	48-60	Loam, silt loam	ML, CL	A-4, A-6	0	98-100	98-100	96-100	70-97	30-37	8-14
Dela----------	0-12	Fine sandy loam	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-60	Fine sandy loam, sandy loam, loam.	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-70	<30	NP-10
63---------- Saffell	0-14	Gravelly fine sandy loam.	SM	A-1, A-2, A-4	0-5	70-80	50-75	40-65	20-40	<20	NP-3
	14-48	Gravelly fine sandy loam, gravelly sandy clay loam.	GC, SC, SM-SC, GM-GC	A-2, A-1	0-15	35-85	25-70	20-55	15-35	20-40	4-18
	48-60	Very gravelly sandy clay loam, very gravelly fine sandy loam, very gravelly loam.	GC, SC, SM-SC, GM-GC	A-2, A-1	0-15	35-85	25-70	20-55	15-35	20-40	4-18
64---------- Stigler	0-24	Very fine sandy loam.	CL, ML, CL-ML	A-4, A-6	0	100	100	94-100	60-97	20-37	2-14
	24-74	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
65*---------- Tarrant	0-14	Cobbly clay-----	CH, GC	A-7-6	33-77	55-100	51-100	51-95	45-95	55-76	31-49
	14-22	Indurated, unweathered bedrock.	---	---	---	---	---	---	---	---	---
66---------- Trinity	0-85	Clay----------	CH	A-7	0	100	98-100	85-100	80-99	55-90	30-60
67*. Udorthents											
68---------- Wrightsville	0-12	Silt loam-------	ML, CL, CL-ML	A-4	0	100	95-100	90-100	75-100	<31	NP-10
	12-44	Silty clay, clay, silty clay loam.	CH, CL, MH	A-7	0	100	100	95-100	90-100	41-65	22-40
	44-78	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

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
69*---------- Yanush	0-12	Cherty silt loam	ML, CL, GC, GM	A-2, A-4, A-6	0	50-70	50-70	45-65	30-65	22-35	2-14
	12-34	Cherty silty clay loam, cherty clay loam, very cherty clay loam.	GC	A-6, A-7, A-2	0-15	25-55	25-55	25-55	20-50	33-43	12-20
	34-66	Cherty silty clay loam, cherty clay loam, very cherty clay loam.	GC, GP-GC	A-2, A-6, A-7	15-30	10-55	10-55	10-50	8-50	33-43	12-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
1----------	0-7	0.2-0.6	0.15-0.20	5.6-7.3	Low----------	0.49	5
Agan	7-50	<0.06	0.12-0.16	6.1-7.8	High----------	0.37	
	50-65	0.2-0.6	0.03-0.07	7.4-8.4	Moderate-------	0.28	
2, 3, 4----------	0-20	0.6-2.0	0.15-0.17	5.1-6.5	Low----------	0.20	4
Bates	20-35	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.28	
	35-38	---	---	---	----------	---	
5*:							
Bates----------	0-24	0.6-2.0	0.15-0.17	5.1-6.5	Low----------	0.20	4
	24-31	0.6-2.0	0.15-0.19	5.1-6.5	Low----------	0.28	
	31-40	---	---	---	----------	---	
Coweta----------	0-11	2.0-6.0	0.09-0.16	5.1-6.5	Low----------	0.32	2
	11-16	0.6-2.0	0.09-0.18	5.1-6.5	Low----------	0.24	
	16-22	---	---	---	----------	---	
6, 7, 8, 9, 10---	0-15	2.0-6.0	0.11-0.15	5.1-7.3	Low----------	0.24	5
Bernow	15-36	0.6-2.0	0.12-0.20	4.5-6.5	Moderate-------	0.32	
	36-65	0.6-2.0	0.12-0.20	4.5-6.5	Low----------	0.32	
11*:							
Bernow----------	0-15	2.0-6.0	0.11-0.15	5.1-7.3	Low----------	0.24	5
	15-36	0.6-2.0	0.12-0.20	4.5-6.5	Moderate-------	0.32	
	36-65	0.6-2.0	0.12-0.20	4.5-6.5	Low----------	0.32	
Romia----------	0-14	2.0-6.0	0.11-0.15	5.1-6.5	Low----------	0.24	3
	14-44	0.6-2.0	0.08-0.18	4.5-6.0	Low----------	0.32	
	44-58	---	---	---	----------	---	
12*----------	0-12	2.0-6.0	0.11-0.15	5.1-7.3	Low----------	0.24	5
Bernow	12-52	0.6-2.0	0.12-0.20	4.5-6.5	Moderate-------	0.32	
	52-65	0.6-2.0	0.12-0.20	4.5-6.5	Low----------	0.32	
13*:							
Bigfork---------	0-5	0.6-2.0	0.05-0.15	5.1-6.5	Low----------	0.37	2
	5-35	0.6-2.0	0.05-0.15	4.5-6.0	Moderate-------	0.32	
	35-40	---	---	---	----------	---	
Yanush----------	0-12	0.6-2.0	0.08-0.17	5.6-6.5	Low----------	0.32	5
	12-34	0.6-2.0	0.08-0.11	4.5-6.0	Moderate-------	0.28	
	34-66	0.6-2.0	0.05-0.11	4.5-6.0	Moderate-------	0.28	
14----------	0-16	0.6-2.0	0.11-0.15	5.6-6.5	Low----------	0.24	5
Boggy	16-72	0.6-2.0	0.11-0.15	5.1-6.5	Low----------	0.24	
15, 16, 17-------	0-6	0.6-2.0	0.11-0.15	5.1-6.0	Low----------	0.37	5
Bosville	6-72	<0.06	0.15-0.20	4.5-6.0	High----------	0.43	
18, 19----------	0-48	<0.06	0.12-0.18	5.6-8.4	High----------	0.32	5
Burleson	48-73	<0.06	0.12-0.18	7.4-8.4	High----------	0.32	
20*, 21*:							
Carnasaw--------	0-7	0.6-2.0	0.11-0.20	4.5-6.0	Low----------	0.43	4
	7-42	0.06-0.2	0.02-0.13	4.5-5.5	High----------	0.32	
	42-52	---	---	---	----------	---	
Clebit----------	0-3	2.0-6.0	0.06-0.10	5.1-6.5	Low----------	0.20	1
	3-18	2.0-6.0	0.06-0.10	4.5-6.5	Low----------	0.20	
	18-30	---	---	---	----------	---	

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	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
22*:							
Carnasaw	0-7	0.6-2.0	0.11-0.20	4.5-6.0	Low	0.37	4
	7-42	0.06-0.2	0.12-0.18	4.5-5.5	High	0.32	
	42-52	---	---	---	---	---	
Clebit	0-5	2.0-6.0	0.06-0.10	5.1-6.5	Low	0.20	1
	5-16	2.0-6.0	0.06-0.10	4.5-6.5	Low	0.20	
	16-20	---	---	---	---	---	
23*:							
Carnasaw	0-14	0.6-2.0	0.11-0.20	4.5-6.0	Low	0.37	4
	14-37	0.06-0.2	0.12-0.18	4.5-5.5	High	0.32	
	37-42	0.06-0.2	0.08-0.13	4.5-5.5	High	0.32	
	42-52	---	---	---	---	---	
Clebit	0-5	2.0-6.0	0.06-0.10	5.1-6.5	Low	0.20	1
	5-16	2.0-6.0	0.06-0.10	4.5-6.5	Low	0.20	
	16-20	---	---	---	---	---	
24	0-8	2.0-6.0	0.09-0.13	5.1-7.3	Low	0.32	4
Chigley	8-50	0.2-0.6	0.14-0.18	5.1-7.8	Moderate	0.28	
	50-72	0.2-0.6	0.12-0.16	5.1-7.8	Moderate	0.28	
25*:							
Chigley	0-8	2.0-6.0	0.09-0.13	5.1-7.3	Low	0.32	4
	8-50	0.2-0.6	0.14-0.18	5.1-7.8	Moderate	0.28	
	50-72	0.2-0.6	0.12-0.16	5.1-7.8	Moderate	0.28	
Rock outcrop.							
26*:							
Claremore	0-8	0.6-2.0	0.16-0.24	5.6-6.5	Low	0.37	2
	8-18	0.6-2.0	0.16-0.20	5.6-7.3	Moderate	0.32	
	18-30	---	---	---	---	---	
Catoosa	0-12	0.6-2.0	0.15-0.24	5.6-6.5	Low	0.37	2
	12-32	0.6-2.0	0.15-0.22	5.1-7.3	Moderate	0.32	
	32-40	---	---	---	---	---	
27	0-15	0.6-2.0	0.15-0.24	4.5-6.0	Low	0.49	5
Counts	15-70	<0.06	0.12-0.22	4.5-8.4	High	0.43	
28	0-18	2.0-6.0	0.10-0.15	5.1-6.5	Low	0.20	5
Dela	18-72	2.0-6.0	0.10-0.20	5.1-6.5	Low	0.32	
29, 30	0-16	0.6-2.0	0.15-0.20	5.1-6.0	Low	0.43	5
Dennis	16-25	0.2-0.6	0.15-0.20	4.5-6.0	Moderate	0.37	
	25-72	0.06-0.2	0.15-0.20	5.1-8.4	High	0.37	
31*:							
Dennis	0-12	0.6-2.0	0.15-0.20	5.1-6.0	Low	0.43	5
	12-18	0.2-0.6	0.15-0.20	4.5-6.0	Moderate	0.37	
	18-72	0.06-0.2	0.15-0.20	5.1-8.4	High	0.37	
Eram	0-10	0.2-0.6	0.15-0.19	5.6-6.5	Moderate	0.37	3
	10-32	0.06-0.2	0.14-0.18	5.1-7.3	High	0.37	
	32-40	---	---	---	---	---	
32, 33	0-9	0.6-2.0	0.15-0.24	5.6-6.5	Low	0.49	5
Durant	9-70	<0.06	0.12-0.18	5.6-8.4	High	0.37	
34*, 35*, 36*:							
Endsaw	0-9	0.6-2.0	0.06-0.14	5.1-6.0	Low	0.32	4
	9-48	0.06-0.2	0.08-0.18	4.5-5.5	High	0.32	
	48-60	---	---	---	---	---	

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	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
34*, 35*, 36*:							
Hector	0-6	2.0-6.0	0.10-0.14	5.1-6.5	Low	0.17	1
	6-18	2.0-6.0	0.08-0.15	4.5-5.5	Low	0.17	
	18-22	---	---	---	---	---	
37*:							
Endsaw	0-9	0.6-2.0	0.08-0.18	5.1-6.0	Low	0.43	4
	9-43	0.06-0.2	0.08-0.18	4.5-5.5	High	0.32	
	43-60	---	---	---	---	---	
Hector	0-7	2.0-6.0	0.05-0.10	5.1-6.5	Low	0.17	1
	7-18	2.0-6.0	0.08-0.15	4.5-5.5	Low	0.17	
	18-22	---	---	---	---	---	
38, 39	0-11	0.2-0.6	0.15-0.19	5.6-6.5	Moderate	0.37	3
Eram	11-33	0.06-0.2	0.14-0.18	5.1-7.3	High	0.37	
	33-40	---	---	---	---	---	
40*:							
Eram	0-9	0.2-0.6	0.15-0.19	5.6-6.5	Moderate	0.37	3
	9-30	0.06-0.2	0.14-0.18	5.1-7.3	High	0.37	
	30-40	---	---	---	---	---	
Talihina	0-16	0.06-0.2	0.15-0.19	5.1-7.8	High	0.37	2
	16-33	---	---	---	---	---	
41	0-38	0.6-2.0	0.15-0.20	5.6-7.8	Low	0.24	5
Gowton	38-68	0.6-2.0	0.15-0.20	5.6-8.4	Low	0.32	
42	0-17	0.6-2.0	0.20-0.23	4.5-6.0	Low	0.49	3
Guyton	17-47	0.06-0.2	0.15-0.22	4.5-5.5	Low	0.37	
	47-80	0.06-2.0	0.15-0.22	5.1-8.4	Low	0.37	
43	0-18	2.0-6.0	0.11-0.15	4.5-6.0	Low	0.24	5
Hamden	18-32	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.32	
	32-86	0.2-0.6	0.12-0.18	4.5-6.0	Moderate	0.28	
44, 45, 46	0-14	2.0-6.0	0.12-0.18	3.6-5.5	Low	0.28	2
Hartsells	14-38	0.6-2.0	0.13-0.18	3.6-5.5	Low	0.32	
	38-44	---	---	---	---	---	
47*:							
Hartsells	0-5	2.0-6.0	0.12-0.18	3.6-5.5	Low	0.28	2
	5-35	0.6-2.0	0.13-0.18	3.6-5.5	Low	0.32	
	35-50	---	---	---	---	---	
Hector	0-6	2.0-6.0	0.10-0.14	5.1-6.5	Low	0.17	1
	6-15	2.0-6.0	0.08-0.15	4.5-5.5	Low	0.17	
	15-24	---	---	---	---	---	
48, 49*	0-65	<0.06	0.15-0.20	7.9-8.4	Very high	0.32	5
Heiden							
50	0-82	0.06-0.2	0.15-0.20	5.6-7.8	High	0.32	5
Kaufman							
51*:							
Kaufman	0-66	0.06-0.2	0.15-0.20	5.6-7.8	High	0.32	5
Gowton	0-28	0.6-2.0	0.15-0.20	5.6-7.8	Low	0.24	5
	28-60	0.6-2.0	0.15-0.20	5.6-8.4	Low	0.32	
52*, 53*:							
Kiti	0-14	0.6-2.0	0.07-0.11	6.6-8.4	Moderate	0.28	1
	14-22	---	---	---	---	---	
Rock outcrop.							

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	Shrink-swell potential	Erosion factors	
						K	T
	In	In/hr	In/in	pH			
54, 55----------	0-26	6.0-20	0.05-0.10	5.6-6.5	Low----------	0.17	5
Larue	26-72	0.6-2.0	0.10-0.15	5.1-6.5	Low----------	0.24	
56----------	0-22	0.06-0.6	0.16-0.20	5.1-7.3	Moderate-------	0.49	5
Lightning	22-80	<0.06	0.12-0.20	4.5-8.4	High----------	0.37	
57, 58, 59-------	0-14	0.6-2.0	0.16-0.24	5.1-6.5	Low----------	0.49	4
Parsons	14-74	<0.6	0.14-0.22	5.1-7.8	High----------	0.43	
60----------	0-52	6.0-20	0.07-0.11	5.6-7.3	Low----------	0.17	5
Pickton	52-82	0.6-2.0	0.12-0.17	4.5-6.5	Low----------	0.24	
61----------	0-10	0.6-2.0	0.15-0.24	4.5-6.0	Low----------	0.37	5
Rexor	10-50	0.6-2.0	0.15-0.24	4.5-6.0	Moderate-------	0.37	
	50-75	0.6-2.0	0.15-0.24	4.5-6.0	Low----------	0.37	
62*:							
Rexor----------	0-12	0.6-2.0	0.15-0.24	4.5-6.0	Low----------	0.37	5
	12-48	0.6-2.0	0.15-0.24	4.5-6.0	Moderate-------	0.37	
	48-60	0.6-2.0	0.15-0.24	4.5-6.0	Low----------	0.37	
Dela----------	0-12	2.0-6.0	0.10-0.15	5.1-6.5	Low----------	0.20	5
	12-60	2.0-6.0	0.10-0.20	5.1-6.5	Low----------	0.32	
63----------	0-14	2.0-6.0	0.05-0.10	5.1-6.5	Low----------	0.20	4
Saffell	14-48	0.6-2.0	0.06-0.10	5.1-6.5	Low----------	0.28	
	48-60	0.6-2.0	0.06-0.12	5.1-6.5	Low----------	0.28	
64----------	0-24	0.6-2.0	0.13-0.24	4.5-5.5	Low----------	0.49	5
Stigler	24-74	<0.06	0.14-0.22	4.5-7.8	High----------	0.43	
65*----------	0-14	0.2-0.6	0.10-0.17	7.9-8.4	Low----------	0.20	1
Tarrant	14-22	---	---	---	----------	---	
66----------	0-85	<0.06	0.15-0.20	7.4-8.4	Very high------	0.32	5
Trinity							
67*.							
Udorthents							
68----------	0-12	0.2-0.6	0.16-0.24	4.5-7.3	Low----------	0.49	5
Wrightsville	12-44	<0.06	0.14-0.22	4.5-6.0	High----------	0.37	
	44-78	<0.06	0.14-0.22	4.5-6.0	High----------	0.43	
69*----------	0-12	0.6-2.0	0.08-0.17	5.6-6.5	Low----------	0.32	5
Yanush	12-34	0.6-2.0	0.08-0.11	4.5-6.0	Moderate-------	0.28	
	34-66	0.6-2.0	0.05-0.11	4.5-6.0	Moderate-------	0.28	

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--SOIL AND WATER FEATURES

[The definitions of "flooding" and "water table" in the Glossary explain terms such as "rare," "brief," "apparent," and "perched." The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1---------- Agan	D	None--------	---	---	0-2.0	Perched	Dec-May	>60	---	High-----	Moderate.
2, 3, 4---------- Bates	B	None--------	---	---	>6.0	---	---	20-40	Ripable	Low------	Moderate.
5*: Bates----------	B	None--------	---	---	>6.0	---	---	20-40	Ripable	Low------	Moderate.
Coweta----------	C	None--------	---	---	>6.0	---	---	10-20	Ripable	Low------	Moderate.
6, 7, 8, 9, 10---- Bernow	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
11*: Bernow----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
Romia----------	B	None--------	---	---	>6.0	---	---	40-60	Ripable	High-----	High.
12*---------- Bernow	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
13*: Bigfork----------	C	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	High.
Yanush----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
14---------- Boggy	C	Frequent----	Very brief	Jan-May	0.0-2.0	Apparent	Nov-Apr	>60	---	Moderate	Moderate.
15, 16, 17-------- Bosville	D	None--------	---	---	1.0-2.0	Perched	Feb-Jul	>60	---	High-----	High.
18, 19---------- Burleson	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
20*, 21*, 22*, 23*: Carnasaw--------	C	None--------	---	---	>6.0	---	---	30-60	Ripable	High-----	High.
Clebit----------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Low------	Moderate.
24---------- Chigley	C	None--------	---	---	3.0-4.0	Perched	Feb-May	>60	---	High-----	Moderate.
25*: Chigley----------	C	None--------	---	---	3.0-4.0	Perched	Feb-May	>60	---	High-----	Moderate.
Rock outcrop.											
26*: Claremore--------	D	None--------	---	---	>6.0	---	---	10-20	Hard	Moderate	Moderate.
Catoosa----------	B	None--------	---	---	>6.0	---	---	20-40	Hard	Moderate	Moderate.
27---------- Counts	C	None--------	---	---	1.0-2.0	Perched	Nov-Apr	>60	---	High-----	Moderate.
28---------- Dela	B	Occasional	Very brief	Nov-May	3.0-5.0	Apparent	Nov-May	>60	---	Moderate	Moderate.

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		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
29, 30--Dennis	C	None	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High	Moderate.
31*:											
Dennis	C	None	---	---	2.0-3.0	Perched	Dec-Apr	>60	---	High	Moderate.
Eram	C	None	---	---	2.0-3.0	Perched	Dec-Apr	20-40	Rippable	High	Moderate.
32, 33--Durant	D	None	---	---	>6.0	---	---	>60	---	High	Moderate.
34*, 35*, 36*, 37*:											
Endsaw	C	None	---	---	>6.0	---	---	40-60	Rippable	High	High.
Hector	D	None	---	---	>6.0	---	---	10-20	Hard	Low	Moderate.
38, 39--Eram	C	None	---	---	2.0-3.0	Perched	Dec-Apr	20-40	Rippable	High	Moderate.
40*:											
Eram	C	None	---	---	2.0-3.0	Perched	Dec-Apr	20-40	Rippable	High	Moderate.
Talihina	D	None	---	---	0.5-2.0	Perched	Nov-Apr	10-20	Rippable	High	Moderate.
41--Gowton	B	Occasional	Very brief	Feb-Jul	>6.0	---	---	>60	---	Moderate	Moderate.
42--Guyton	D	Occasional	Very brief	Jan-Dec	0-1.5	Apparent	Dec-May	>60	---	High	Moderate.
43--Hamden	B	None	---	---	0.5-1.5	Perched	Nov-Apr	>60	---	High	High.
44, 45, 46--Hartsells	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High.
47*:											
Hartsells	B	None	---	---	>6.0	---	---	20-40	Hard	Moderate	High.
Hector	D	None	---	---	>6.0	---	---	10-20	Hard	Low	Moderate.
48, 49*--Heiden	D	None	---	---	>6.0	---	---	>60	---	High	Low.
50--Kaufman	D	Occasional	Very brief	Nov-May	0-3.5	Apparent	Nov-Apr	>60	---	High	Low.
51*:											
Kaufman	D	Frequent	Very brief	Nov-May	0-3.5	Apparent	Nov-Apr	>60	---	High	Low.
Gowton	B	Frequent	Very brief	Nov-May	>6.0	---	---	>60	---	Moderate	Moderate.
52*, 53*:											
Kiti	C	None	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Rock outcrop.											
54, 55--Larue	A	None	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
56--Lightning	D	Occasional	Very brief	Jan-Jul	0-2.0	Perched	Nov-Apr	>60	---	High	Moderate.
57, 58, 59--Parsons	D	None	---	---	0.5-1.5	Perched	Dec-Apr	>60	---	High	Moderate.

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		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
60---------- Pickton	A	None--------	---	---	4.0-6.0	Apparent	Jan-Mar	>60	---	Moderate	High.
61---------- Rexor	A	Occasional	Very brief	Nov-May	3.0-4.0	Apparent	Nov-May	>60	---	Moderate	Moderate.
62*:											
Rexor----------	A	Frequent	Very brief	Nov-May	3.0-4.0	Apparent	Nov-May	>60	---	Moderate	Moderate.
Dela----------	B	Frequent	Very brief	Nov-May	3.0-5.0	Apparent	Nov-May	>60	---	Moderate	Moderate.
63---------- Saffell	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
64---------- Stigler	C	None--------	---	---	2.0-3.0	Perched	Nov-Jun	>60	---	High-----	High.
65*---------- Tarrant	D	None--------	---	---	>6.0	---	---	6-20	Hard	High-----	Low.
66---------- Trinity	D	Occasional	Very brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---	High-----	Low.
67*. Udorthents											
68---------- Wrightsville	D	None--------	---	---	0.6-1.5	Perched	Dec-Apr	>60	---	High-----	High.
69*---------- Yanush	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates that the soils are a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series]

Soil name	Family or higher taxonomic class
Agan	Fine, mixed, thermic Udertic Paleustalfs
Bates	Fine-loamy, siliceous, thermic Typic Argiudolls
Bernow	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Bigfork	Loamy-skeletal, siliceous, thermic Typic Hapludults
Boggy	Coarse-loamy, siliceous, nonacid, thermic Acric Fluvaquents
Bosville	Fine, mixed, thermic Albaquic Paleudalfs
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Carnasaw	Clayey, mixed, thermic Typic Hapludults
Catoosa	Fine-silty, mixed, thermic Typic Argiudolls
Chigley	Fine, mixed, thermic Udic Paleustalfs
Claremore	Loamy, mixed, thermic Lithic Argiudolls
Clebit	Loamy-skeletal, siliceous, thermic Lithic Dystrochrepts
Counts	Fine, mixed, thermic Albaquic Paleudalfs
Coweta	Loamy, siliceous, thermic, shallow Typic Hapludolls
Dela	Coarse-loamy, siliceous, nonacid, thermic Typic Udifluvents
Dennis	Fine, mixed, thermic Aquic Paleudolls
Durant	Fine, montmorillonitic, thermic Vertic Argiustolls
Endsaw	Clayey, mixed, thermic Typic Hapludults
Eram	Fine, mixed, thermic Aquic Argiudolls
Gowton	Fine-loamy, mixed, thermic Cumulic Hapludolls
Guyton	Fine-silty, siliceous, thermic Typic Glossaqualfs
Hamden	Fine-loamy, siliceous, thermic Aquic Paleudalfs
Hartsells	Fine-loamy, siliceous, thermic Typic Hapludults
Hector	Loamy, siliceous, thermic Lithic Dystrochrepts
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
Kaufman	Very-fine, montmorillonitic, thermic Typic Pelluderts
Kiti	Loamy-skeletal, mixed, thermic Lithic Haplustolls
Larue	Loamy, siliceous, thermic Arenic Paleudalfs
Lightning	Fine, mixed, thermic Typic Ochraqualfs
Parsons	Fine, mixed, thermic Mollic Albaqualfs
Pickton	Loamy, siliceous, thermic Grossarenic Paleudalfs
Rexor	Fine-silty, siliceous, thermic Ultic Hapludalfs
Romia	Fine-loamy, siliceous, thermic Ultic Hapludalfs
*Saffell	Loamy-skeletal, siliceous, thermic Typic Hapludults
Stigler	Fine, mixed, thermic Aquic Paleudalfs
Talihina	Clayey, mixed, thermic, shallow Aquic Hapludolls
*Tarrant	Clayey-skeletal, montmorillonitic, thermic Lithic Calciustolls
Trinity	Very-fine, montmorillonitic, thermic Typic Pelluderts
Wrightsville	Fine, mixed, thermic Typic Glossaqualfs
Yanush	Loamy-skeletal, siliceous, thermic Typic Paleudalfs

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