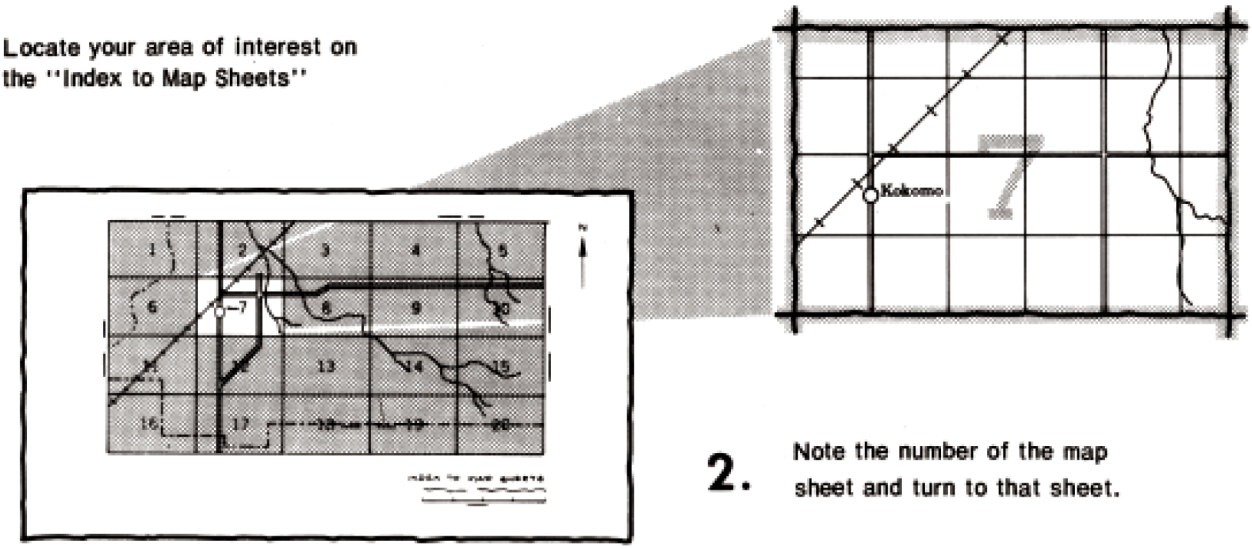
SOIL SURVEY OF
Montague County, Texas

United States Department of Agriculture
Soil Conservation Service

In cooperation with
Texas Agricultural Experiment Station

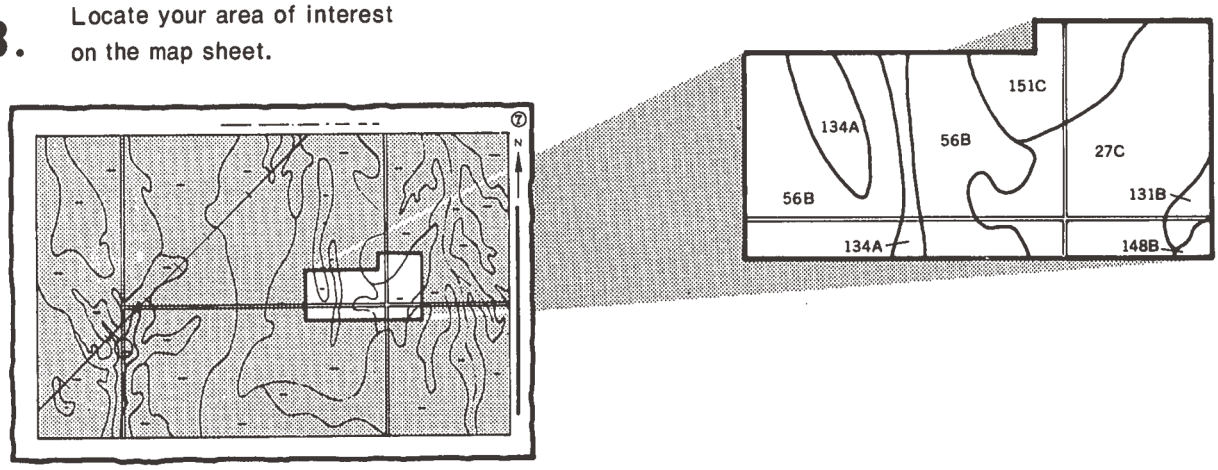
HOW TO USE

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

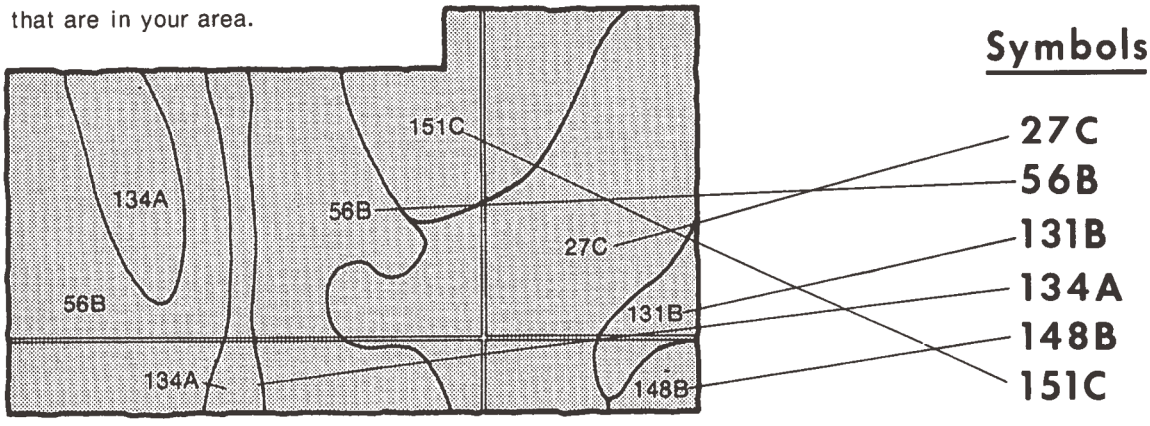


2. Note the number of the map sheet and turn to that sheet.

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

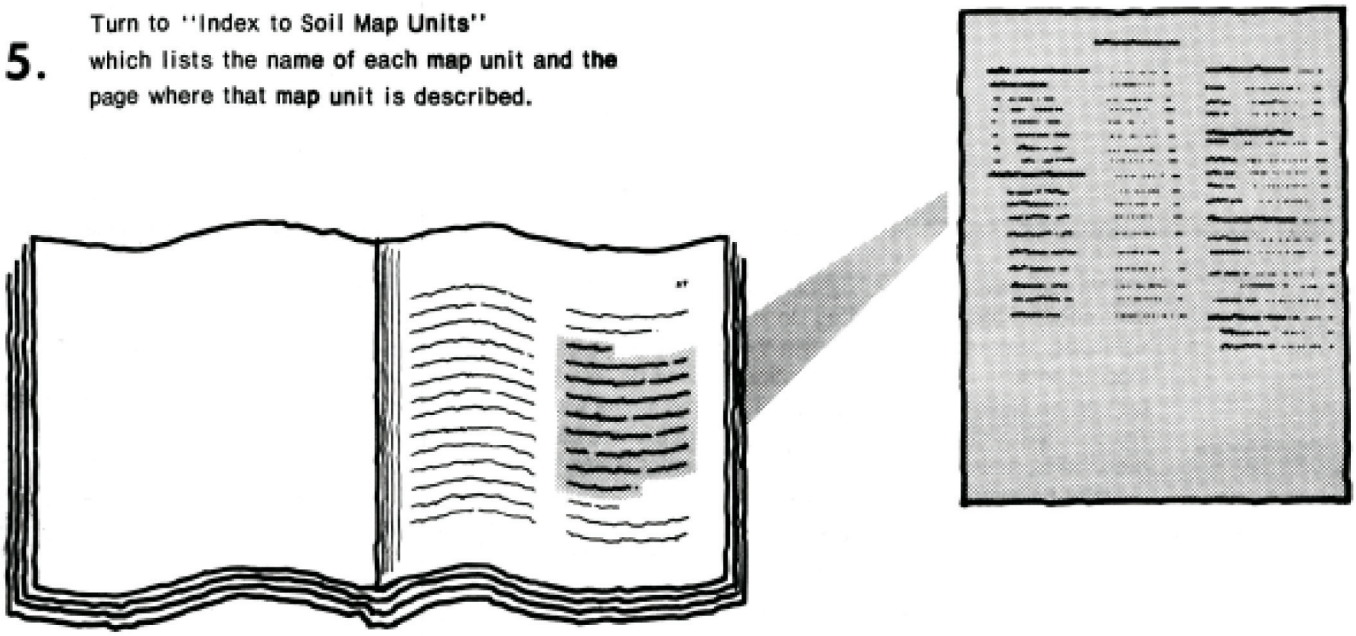


4. List the map unit symbols that are in your area.

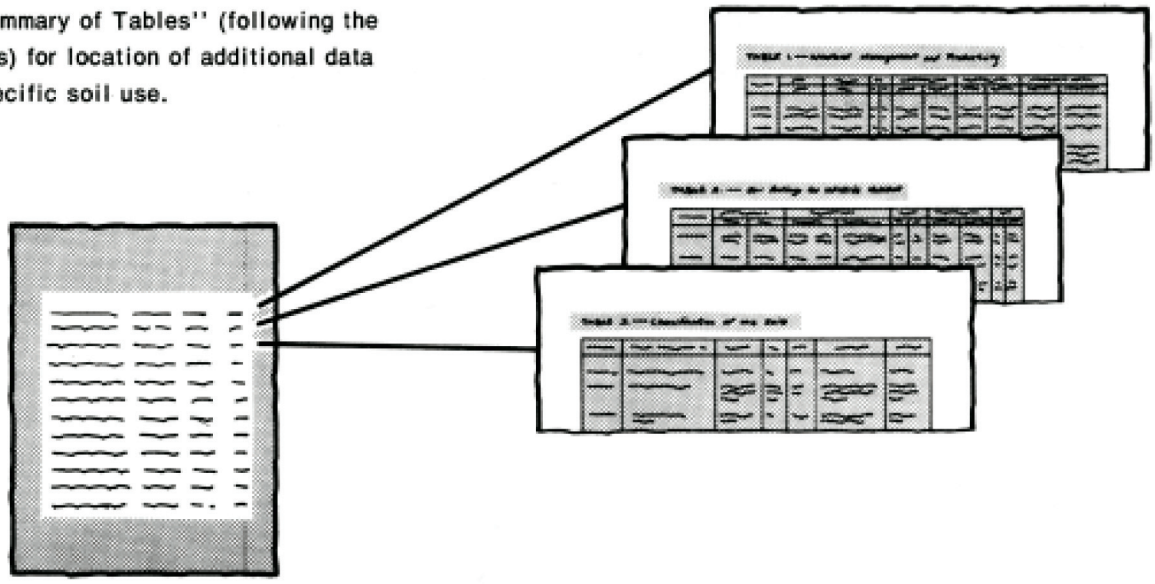


THIS SOIL SURVEY

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 1958-73. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Upper Elm-Red Soil and Water Conservation District.

Cover picture: Peanuts on a terraced field that is farmed on the contour. The soil is a Windthorst fine sandy loam.

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Issued June 1978

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Foreword

The Soil Survey of Montague County, Texas 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.

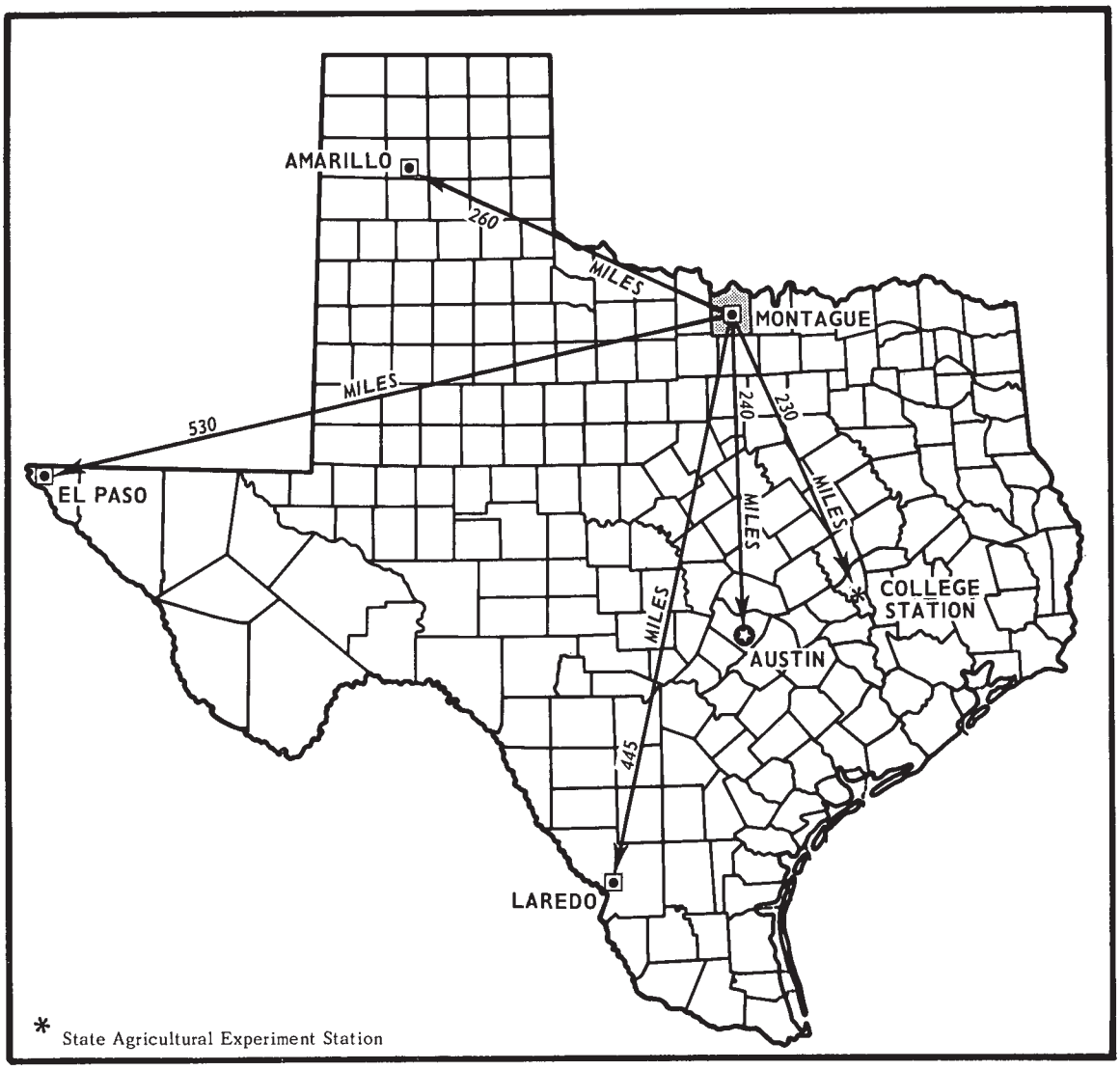
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers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

Many people assume that soils are all more or less alike. They are unaware that 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.

We believe that this soil survey can help bring us a better environment and a better life. Its widespread use can greatly assist us in the conservation, development, and productive use of our soil, water, and other resources.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Montague County in Texas.

SOIL SURVEY OF MONTAGUE COUNTY, TEXAS

By Dennis F. Clower, Soil Conservation Service

William J. Guckian, Billy J. Wagner, Rex A. Cockran, Charles R. Cail, Lee A. Putnam, and Lyle C. Lovelace, Soil Scientists, Soil Conservation Service, assisted in the field mapping

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

MONTAGUE COUNTY is in the northern part of north-central Texas (see map on facing page). It is bordered on the north by the Red River and by the State of Oklahoma. Its total area is 599,680 acres, or 937 square miles.

Montague County is in the North Central Prairie, the West Cross Timbers, and the Grand Prairie Land Resource Areas. The soils of the North Central Prairie in the northwestern part of the county formed mainly under grass and are dominantly dark colored and loamy. The soils of the West Cross Timbers formed under post oak savannah and are dominantly light colored and sandy and loamy. The soils of the Grand Prairie in the eastern part of the county formed under grass and are dominantly dark colored and loamy and clayey. Management problems are generally related to slope. All but the nearly level soils are susceptible to sheet and gully erosion unless they are protected. Seasonal soil blowing is a concern on the sandy soils unless they are protected by vegetative cover.

General nature of the county

This section was prepared for those who want general information about Montague County. It discusses briefly the history of the county, natural resources, agriculture, and climate.

History

Montague County was organized in 1858 and formally created from Cooke County in 1859 by act of the State Legislature. It was named for Col. Daniel Montague, a civil engineer who surveyed much of north-central Texas.

Old Spanish Fort, of which few traces remain, was established in 1719 by the French as a post for the protection of French traders in the Red River Valley. The early towns of the county were Spanish Fort, Red River Station, Head-of-Elm or Saint Jo, Queens Peak, and Forestburg.

Red River Station, settled about 1870, was the best crossing on the Red River for a hundred miles in either direction. The Chisholm Trail crossed here, and thousands of longhorn cattle went north from Texas over it. The old Butterfield Stage Coach Trail crossed Montague County from east to west. The Chihuahua Trail and the old California Trail also crossed the county.

Montague, in the geographical center of the county, is the county seat. The town of Bowie grew rapidly when the Fort Worth and Denver Railroad was built to the town in 1882. About the same time, the Gainesville, Henrietta and Western Railroad, which later became part of the M.K.T. system, was built across the northern side of the county. Nocona, Saint Jo, and Stoneburg were served by the "Katy" for many years. The Chicago, Rock Island and Gulf Railroad was built through Bowie about 9 or 10 years later.

The county had a population of 849 in 1860. The population grew rapidly until about 1910, but decreased from 25,123 in 1910 to 20,442 in 1940 and to 14,893 in 1960. In 1970, the population was 15,326.

Climate

ROBERT B. ORTON, climatologist for Texas, National Weather Service, helped plan and write this section.

The climate of Montague County is subtropical; winters are dry and summers are hot and humid. The continental climate is characterized by a wide range in annual extremes of temperature. About 32 inches of rain falls annually; about 69 percent of this amount falls during thundershowers from April through October. Prevailing winds are southerly to southeasterly except in January and February when northerly winds are predominant. The relative humidity is slightly lower in summer than in other seasons. The average annual relative humidity is 79 percent at 6 a.m., 52 percent at noon, and 49 percent at 6 p.m. The area receives approximately 68 percent of the total possible sunshine annually. Temperature and precipitation data, as recorded at Bowie, are shown in table 1.

Winter temperatures are relatively mild; freezing temperatures occur only about 58 percent of winter nights. Rapid drops in temperature occur when polar Canadian air masses plunge southward across Texas, but periods of very cold weather rarely last longer than 48 to 72 hours. Short periods of warm, sunny weather often occur. Precipitation in winter falls as rain, freezing rain, sleet, or snow.

Spring is a very changeable season in Montague County. During March, warm and cool spells of short duration follow each other in rapid succession. March and April are the windiest months. Thunderstorms are most frequent in April, May, and June.

In summer the daytime temperatures are hot. Thundershowers occur on an average of 6 days per month. They offer some relief from summer heat, otherwise there is little variety in the day-to-day weather pattern during July and August.

Fall is the most pleasant season. It is characterized by mild, sunny days and crisp, cool nights. Windspeeds are lowest during this season. Rainfall increases during September and October.

The average length of the freeze-free season in Montague County is 229 days. The mean date of the last occurrence of temperatures of 32 degrees F or below in the spring is March 27, and that of the first occurrence of temperatures of 32 degrees F or below in the fall is November 11.

Farming

Cattle ranching was the first agricultural enterprise in the county. The availability of cheap land and good grass made the county especially suitable for livestock raising. Today cattle ranching is still the main enterprise. In 1969, there were approximately 56,000 cattle in the county. Horses, swine, goats, and sheep also are raised in the county.

Livestock operations are primarily cow-calf. Supplemental feeding is generally heavy, and stock are fed from December to late February or March.

Crop production was once a major enterprise in the county, but much of the land that was formerly cultivated is now in pasture. In 1926, the many gins in the county produced 19,946 bales of cotton. The major crop is now wheat, which is normally grazed in the winter. Peanuts, oats, grain sorghum, cotton, and corn are also grown. Peach, apple, and pecan orchards do well on some soils in the county.

Natural resources

Soil is the most important natural resource in the county. Most people in the county earn their living from the land by producing forage for livestock or food and fiber for market and home.

Oil and gas are produced from numerous wells in the county. They provide a major source of income to some landowners and have served as a solid tax base from which public facilities can be operated.

Water is another natural resource. Lake Amon G. Carter, Lake Nocona, and Bowie Lake furnish municipal water for Bowie and Nocona and support good recreational facilities. Many floodwater-retarding structures have been built in the county to help prevent flood damage. Most of these lakes are used for recreation and for watering of livestock (fig. 1).

Wildlife produced on the farms and ranches provides recreation and income for many residents.

Other natural resources are limestone, which is crushed for road construction, and sand and gravel.

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 section "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 their interpretations 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 useful 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, the map units described in this survey. Each map unit is a unique natural landscape unit that has a distinct pattern of soils and of relief and drainage features. A unit typically consists of one or more soils of major extent and some soils of minor extent. It is named for the major soils. The kinds of soil in one unit can occur in other map units, but in a different pattern.

The 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 generally suitable for certain kinds of farming or 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 soils in any one map unit ordinarily differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. Table 2 shows the extent of each map unit and gives general ratings of the potential of each, in relation to the other map units, for each major land use. Adverse soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the county are used to overcome soil limitations. These ratings reflect the ease of overcoming such soil limitations and the probability of soil problems persisting after such practices are used. The location of existing transportation systems or other kinds of facilities is not considered.

Each unit is rated for *cultivated farm crops*, *rangeland*, *pastureland*, *urban uses*, *wildlife habitat*, and *recreation*.

Descriptions of units

1. Windthorst-Duffau

Deep, loamy and sandy, gently sloping to sloping soils on uplands

This unit is made up of gently sloping to sloping soils that have slopes of 1 to 8 percent. Most areas are dissected by numerous drainageways.

This unit makes up about 37 percent of the county. Windthorst soils make up about 44 percent of the unit; Duffau soils, about 38 percent; and less extensive areas of Chaney, Selden, Pulexas, Eufaula, and Patilo soils, the remaining 18 percent.

Windthorst soils are gently sloping; they are on convex ridgetops and in more sloping areas adjacent to streams. They have a surface layer of very friable, grayish brown, neutral fine sandy loam about 5 inches thick. The subsurface layer is very friable, very pale brown, neutral fine sandy loam that extends to a depth of 10 inches. The subsoil is firm, yellowish red, slightly acid sandy clay to a depth of 21 inches; firm, mottled red and reddish yellow, medium acid sandy clay to a depth of 36 inches; and firm, reddish yellow, slightly acid sandy clay loam to a depth of 55 inches. The underlying material is firm, light gray, moderately alkaline clay loam that extends to a depth of 60 inches or more.

Duffau soils are well drained; they are in slightly concave areas on broad ridgetops and on more sloping foot slopes adjacent to streams. These soils have a surface layer of friable, brown, mildly alkaline fine sandy loam about 5 inches thick. The subsurface layer is very friable, light brown, neutral fine sandy loam that extends to a depth of 12 inches. The subsoil is friable, yellowish red, slightly acid sandy clay loam to a depth of 26 inches; friable, reddish yellow, medium acid sandy clay loam to a depth of 45 inches; and friable, red, slightly acid sandy clay loam to a depth of 70 inches or more.

Chaney and Selden soils are gently sloping, moderately well drained, sandy soils in broad areas on uplands. Pulexas soils are frequently flooded soils in narrow areas on bottom lands. The Eufaula and Patilo soils are in deep, sandy areas on uplands.

The soils in this unit are used mainly as range and improved pasture. A few fields are cultivated to peanuts, small grains, and sorghums, and a few areas are in orchards. The soils in this unit are subject to severe gully erosion.

This unit has high potential as rangeland and pastureland and medium potential as cropland. Potential for most urban uses is medium. The clayey lower layers shrink and swell with changes in moisture, which creates foundation problems for dwellings and low-cost streets and roads. The slow permeability of the subsoil often causes septic tank systems to fail during rainy seasons. Potential for recreational development is medium because of slow permeability and slope. These soils have high potential for rangeland wildlife habitat.

2. Renfrow-Stoneburg-Anocon

Deep and moderately deep, loamy, gently sloping to sloping soils on uplands

This unit is made up of dominantly gently sloping to undulating soils that have slopes of 1 to 8 percent.

This unit makes up about 24 percent of the county. Renfrow soils make up about 30 percent of the unit; Stoneburg soils, about 18 percent; Anocon soils, about 17 percent; and less extensive areas of Waurika, Vernon, Knoco, and Gowen soils, the remaining 35 percent.

Renfrow soils are on less sloping side slopes and foot slopes adjacent to drainageways. They have a surface layer of friable, dark brown, slightly acid loam about 11 inches thick. The subsoil extends to a depth of 65 inches or more. It is very firm, reddish brown clay that is mildly alkaline to a depth of 31 inches and calcareous below.

Stoneburg soils are on narrow to broad, convex ridgetops and are underlain by sandstone. They have a surface layer of friable, brown, slightly acid fine sandy loam about 11 inches thick. The subsoil is friable, reddish brown, slightly acid loam to a depth of 16 inches; firm, reddish brown, slightly acid clay loam to a depth of 26 inches; and firm, yellowish red, slightly acid clay loam to a depth of 35 inches. It has an abrupt boundary and rests on strongly cemented, brownish yellow sandstone.

Anocon soils are on side slopes and in slightly convex, broad areas on uplands. They have a surface layer of friable, brown, slightly acid fine sandy loam about 16 inches thick. The subsoil is very firm, reddish brown, neutral sandy clay to a depth of 26 inches; very firm, brown, moderately alkaline sandy clay to a depth of 39 inches; and firm, yellowish red, moderately alkaline sandy clay loam to a depth of 65 inches or more.

Waurika soils are in plane to concave areas on the lower parts of slopes adjacent to drainageways. Vernon and Knoco soils are clayey and are on convex, erosional side slopes. Gowen soils are in narrow areas on bottom lands and are subject to frequent flooding.

The soils in this unit are used mainly as rangeland. A few cultivated fields are used for wheat and forage sorghum.

This unit has high potential as rangeland and pastureland, and medium potential as cropland. Potential for most urban uses is medium. The soils have low potential for septic tank absorption fields because effluent percolates slowly through the clayey lower layers and the sandstone. The clayey lower layers also shrink and swell with changes in moisture, which creates foundation problems for dwellings and low-cost streets and roads. Potential for recreational development is medium because of slow permeability and slope. These soils have high potential for rangeland wildlife habitat.

3. Bonti-Cona-Truce

Moderately deep and deep, loamy and stony, gently sloping to hilly soils on uplands

This map unit is made up of dominantly gently sloping to steep soils that have slopes of 2 to 25 percent.

This unit makes up about 17 percent of the county. Bonti soils make up about 29 percent of the unit; Cona soils, about 26 percent; Truce soils, about 19 percent; and less extensive areas of Exray, Owens, Vashti, and Gowen soils, the remaining 26 percent.

Bonti soils are on narrow to broad, convex ridgetops and are underlain by sandstone. They have a surface layer of very friable, brown, slightly acid fine sandy loam about 5 inches thick. The subsurface layer is very friable, pale brown, slightly acid fine sandy loam that extends to a depth of 8 inches. The subsoil is firm, yellowish red, strongly acid sandy clay that extends to a depth of 19 inches. It has an abrupt boundary and rests on strongly cemented sandstone.

Cona soils are on hillsides that are dissected by numerous drainageways. They have a surface layer of very friable, brown, neutral stony fine sandy loam about 4 inches thick. The subsurface layer is very friable, neutral, very pale brown stony fine sandy loam that extends to a depth of 8 inches. Conglomerate sandstone fragments, 3 to 20 inches across, cover about 15 percent of the surface. The subsoil is very firm, red, strongly acid sandy clay to a depth of 17 inches; very firm, mottled red and reddish yellow, strongly acid clay to a depth of 27 inches; and very firm, pale yellow, strongly acid clay that has mottles of red, reddish yellow, and gray and that extends to a depth of 33 inches. The underlying material is very firm, gray, strongly acid shaly clay that has red and strong brown mottles and that extends to a depth of 45 inches.

Truce soils are on convex side slopes and moderately steep hillsides. They have a surface layer of friable, yellowish brown, neutral fine sandy loam about 3 inches thick. The subsurface layer is friable, light yellowish brown, neutral fine sandy loam that extends to a depth of 6 inches. The subsoil is very firm, yellowish red, neutral clay to a depth of 16 inches; very firm, brown, neutral clay to a depth of 25 inches; and very firm, brownish yellow, moderately alkaline clay to a depth of 45 inches. The underlying material is massive, moderately alkaline, light gray and brownish yellow shaly clay that extends to a depth of 55 inches or more.

Exray soils are on narrow ridgetops and are underlain by sandstone. Owens soils are mainly moderately steep, shaly, eroded soils on south-facing slopes. Vashti soils are gently sloping and are in broad areas on uplands. Gowen soils are frequently flooded and are in narrow bottom lands.

Most of the soils in this unit are too steep and stony for cultivation and are better suited as rangeland. Much of the area is in native post oak trees. A few fields are cultivated to wheat, oats, and forage sorghum.

This unit has high potential as rangeland and medium potential as pastureland and cropland. Potential for most urban uses is medium. These soils have low potential for septic tank absorption fields because effluent percolates slowly through the clayey lower layers and the sandstone.

The clayey lower layers also shrink and swell with changes in moisture, which causes foundation problems for dwellings and low-cost streets and roads. Potential for recreational development is medium because of slow permeability, stones, and slope. Potential for rangeland wildlife habitat is high.

4. Aledo-Venus-Bolar

Shallow to deep, loamy and gravelly, gently sloping to moderately steep soils on uplands

This unit is made up of dominantly gently sloping to moderately steep soils that have slopes of 2 to 20 percent.

This unit makes up about 8 percent of the county. Aledo soils make up about 32 percent of the unit; Venus soils, about 17 percent; Bolar soils, about 15 percent; and less extensive areas of Bosque, Sanger, Branyon, Hensley, and Lindy soils, the remaining 36 percent.

Aledo soils are on ridgetops, knolls, and gravelly hills. They have a surface layer of calcareous, grayish brown gravelly clay loam to a depth of 5 inches and calcareous, dark grayish brown very gravelly clay loam to a depth of 14 inches. It has an abrupt boundary and rests on a thick layer of strongly cemented fractured limestone bedrock.

Venus soils are on more sloping side slopes and foot slopes below limestone escarpments. These soils have a surface layer of friable, calcareous, dark grayish brown loam about 12 inches thick. The subsoil is friable, calcareous, pale brown loam to a depth of 48 inches and friable, calcareous, light yellowish brown clay loam to a depth of 60 inches or more.

Bolar soils are on convex ridgetops and on benches of hillsides. They have a surface layer of friable, calcareous, dark grayish brown clay loam about 9 inches thick. The subsoil is grayish brown silty clay loam to a depth of 15 inches; dark brown clay loam to a depth of 23 inches; and pale brown very gravelly clay loam to a depth of 27 inches. It has an abrupt boundary and rests on a thick layer of strongly cemented, fractured limestone.

Bosque soils are frequently or occasionally flooded soils in narrow areas on bottom lands. Sanger and Branyon soils are deep, gently sloping, clayey soils on side slopes and foot slopes. Hensley and Lindy soils are gently sloping and are in broad areas on uplands; they are underlain by limestone.

The soils in this unit are used mainly as rangeland. A few fields are cultivated to wheat, oats, and grain sorghum.

This unit has medium potential as rangeland. It has medium to low potential as pastureland and cropland because of the restricted root zone, stones, and moderately steep slopes. Potential for most urban uses is medium. The soils have low potential for septic tank absorption fields and community development mainly because of depth to rock or shrinking and swelling with changes in moisture. Potential for recreational development is medium. These soils have medium potential for rangeland wildlife habitat. In some places limestone is mined for road material.

5. Pulexas-Gowen

Deep, loamy, nearly level soils on flood plains

This unit is made up of nearly level soils that have slopes of 0 to 1 percent.

This unit makes up about 8 percent of the county. Pulexas soils make up about 62 percent of the unit; Gowen soils, about 31 percent; and less extensive areas of Bosque soils, the remaining 7 percent.

Pulexas soils are in narrow areas on bottom lands of streams that drain areas of loamy and sandy, timbered soils on uplands. These soils have a surface layer of friable, brown, neutral fine sandy loam about 5 inches thick. The underlying material is very friable, light yellowish brown, mildly alkaline, stratified fine sandy loam to a depth of 30 inches; friable, brown, moderately alkaline fine sandy loam to a depth of 42 inches; and friable, brown, moderately alkaline, loam to a depth of 60 inches or more.

Gowen soils are along larger streams that drain areas of dark, loamy soils on uplands. They have a surface layer of friable, dark grayish brown, neutral loam about 28 inches thick. The underlying material, which extends to a depth of 52 inches or more, is friable, brown, neutral clay loam.

Bosque soils are calcareous, loamy soils on bottom lands.

The soils in this unit are used mainly as rangeland and for improved pasture. A few fields are cultivated to small grains and forage sorghums.

This unit has high potential as rangeland and pastureland. Areas that are flooded only occasionally have high potential as cropland. The soils have low potential for community development and sanitary facilities because of the hazard of flooding. Potential for most recreation uses is medium. These soils have high potential for rangeland wildlife habitat.

6. Bastrop-Teller

Deep, loamy, nearly level to sloping soils on terraces

This unit is made up of nearly level to undulating soils that have slopes of 0 to 8 percent.

This unit makes up about 4 percent of the county. Bastrop soils make up about 65 percent of the unit; Teller soils about, 34 percent; and Pulexas soils the remaining 1 percent.

Bastrop soils are on broad, slightly convex ridgetops and side slopes. These soils have a surface layer of very friable, brown, slightly acid loam about 7 inches thick. The subsoil is friable, red, slightly acid to neutral loam to a depth of 61 inches and friable, light red, calcareous loam to a depth of 70 inches or more.

Teller soils are nearly level; they are on broad terraces. These soils have a surface layer of very friable, brown, slightly acid loam about 14 inches thick. The subsoil is friable, reddish brown, slightly acid clay loam to a depth of 28 inches; friable, reddish brown, slightly acid loam to a

depth of 45 inches; and friable, brown, slightly acid loam to a depth of 62 inches. The underlying material, to a depth of 70 inches or more, is friable, neutral, light yellowish brown loam.

Pulexas soils are frequently flooded soils in narrow areas on bottom lands.

The soils in this unit are used as rangeland and cropland. The main cultivated crops include wheat, grain sorghum, and cotton.

This unit has high potential as rangeland, pastureland and cropland. The potential for urban and recreational uses is high. These soils also have high potential for wildlife habitat.

7. Gaddy-Miller-Yahola

Deep, sandy to clayey, nearly level soils on flood plains

This unit is made up of nearly level soils that have slopes of 0 to 1 percent.

This unit makes up about 2 percent of the county. Gaddy soils make up about 55 percent of the unit; Miller soils, about 30 percent; and Yahola soils, the remaining 15 percent.

Gaddy soils are mainly in low areas on bottom lands and are flooded frequently. They have a surface layer of very friable, calcareous, light reddish brown loamy fine sand about 4 inches thick. The underlying material is very friable, calcareous, pink loamy fine sand that contains thin strata of fine sandy loam and that extends to a depth of 16 inches over loose, calcareous, pink fine sand that contains thin strata of fine sandy loam and that extends to a depth of 45 inches or more.

Miller soils are mainly in slightly depressional areas on bottom lands. They have a surface layer of firm, calcareous, reddish brown clay about 17 inches thick. The subsoil is very firm, calcareous, reddish brown clay to a depth of 39 inches and firm, calcareous, red silty clay loam to a depth of 50 inches. The substratum, to a depth of 60 inches or more, is very friable, calcareous, reddish yellow fine sandy loam.

Yahola soils, intermixed with Gaddy soils, are nearly level and are on bottom lands. They have a surface layer of very friable, reddish brown fine sandy loam about 8 inches thick. The underlying material, to a depth of 50 inches or more, is very friable, calcareous fine sandy loam that has thin strata of silt loam and loamy fine sand throughout. It is reddish yellow to a depth of 44 inches and pink below.

The soils in this unit are used mainly as rangeland and for improved pastures. A few fields are cultivated to wheat and forage sorghum.

This unit has high potential as rangeland and pastureland. Areas that are flooded only occasionally have high potential as cropland. These soils have low potential for community development and sanitary facilities because of the hazard of flooding. Potential for most recreational uses is medium. These soils have medium potential for rangeland wildlife habitat.

Broad land-use considerations

The soils in the county vary widely in their potential for major land uses, as indicated in table 2. For each land use, general ratings of the potential of each unit in relation to the other units are indicated. Kinds of soil limitations are also indicated in general terms. The ratings of soil potential reflect the relative cost of such practices and also the hazard of continued soil related problems after such practices are installed. The ratings do not consider location in relation to existing transportation systems or other kinds of facilities.

Kinds of land uses considered in table 2 are cultivated farm crops, rangeland, pastureland, urban uses, wildlife habitat, and recreation. Cultivated farm crops grown extensively include grain sorghum, wheat, oats, and peanuts. Rangeland refers to land on which native plants grow. Pastureland refers to land growing improved grasses such as Coastal bermudagrass. Urban includes residential, commercial, and industrial land uses. Wildlife habitat refers to land used to provide food and cover for wildlife. Recreation includes nature study area trails, camping and picnic areas, and the like.

Each year considerable land is being developed for urban uses in Bowie, Nocona, and other towns in the county. About 15,953 acres were in urban or built-up areas in 1967, according to the Conservation Needs Inventory (4). Much of this acreage was suited as cropland. In general, in the survey area the soils that are well suited as cropland are also well suited to urban development. The data about specific soils in this soil survey can be used in planning future land use.

Most soils in the county are favorable for urban development. The Pulexas-Gowen and Gaddy-Miller-Yahola units, however, are on flood plains, and flooding is a severe limitation. Also, urban development is costly on the soils that have hard bedrock just below the surface in the Aledo-Venus-Bolar unit.

Most of the soils of the county have high potential as pastureland and rangeland. The hilly soils in the Bonti-Cona-Truce and Aledo-Venus-Bolar units have large stones and are shallow and limit the development and management of improved pastures.

The Bastrop-Teller unit has high potential for recreational development. The hardwood trees on the Bonti-Cona-Truce, Aledo-Venus-Bolar, and Windthorst-Duffau units enhance the beauty in much of the area. These three units also provide habitat for many important wildlife species. Potentials for wildlife are also discussed in the section "Use and management of the soils."

Soils information can be used as a guide in planning the orderly growth and development of the county. It is especially helpful in determining which lands to allocate to each use.

Soil maps for detailed planning

The kinds of soil (map units) shown on the detailed soil maps at the back of this publication 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 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 unit on the detailed soil map. Each map unit 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.

A soil map unit represents an area on the landscape and consists mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map at the back of this publication are phases of soil series.

Soils that have profiles that are 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. All the soils in the United States having the same series name have essentially the same properties that affect their use and their response to management practices.

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 characteristic that affects the use of the soils. 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, Windthorst fine sandy loam, 2 to 5 percent slopes, is one of several phases within the Windthorst series.

Some map units are made up of two or more dominant kinds of soil. Three such kinds of map units are shown on the soil map of this survey area: 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 of a complex contains some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Bolar-Aledo complex, 3 to 20 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. A soil association has considerable regularity in geographic pattern and in the kinds of soil that make up the associaton. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for the expected uses of the soils. Anocon-Stoneburg association, undulating, 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. Duffau and Windthorst 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. The soils that are included in mapping are recognized 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.

Some mapped areas include places that have little or no soil material. Such places are delineated on the soil map and given descriptive names. Ustolls-Rock outcrop association, steep 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 acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses are 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.

Soil descriptions

1—Aledo gravelly clay loam, 1 to 8 percent slopes. This shallow, gently sloping to sloping soil is on uplands, mainly on limestone ridges. Slopes are slightly convex and average about 3 percent. Areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of calcareous, dark grayish brown gravelly clay loam to a depth of 5 inches and calcareous, dark grayish brown very gravelly clay loam to a depth of 14 inches. The surface layer has an abrupt boundary and rests on a thick layer of strongly cemented, fractured limestone bedrock.

This soil is well drained. Runoff is medium, and permeability is moderate. Available water capacity is very low, and the root zone is shallow.

Included with this soil in mapping are small areas of Bolar soils that have concave slopes. Also included are small areas of similar soils that are less than 10 inches thick over fractured limestone bedrock; these soils are on gravelly knolls and make up about 17 percent of the mapped area.

This soil is not suitable for cultivated crops. It is used almost entirely as rangeland. Potential for native range plants is low mainly because of limestone gravel and the

restricted root zone. The climax plant community is a mixture of tall, mid, and short grasses, a few motts of live oak, and a few shrubs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is low.

Potential for urban uses is low. Shallow depth to rock is difficult to overcome. Potential for most recreational uses is medium, but depth to rock and gravel on the surface restrict some playground uses. Capability subclass VIs; Shallow range site.

2—Anocon-Stoneburg association, undulating. This is an association of undulating soils in smooth areas on uplands. Slopes range from 1 to 8 percent, but average about 3 percent. Areas are irregular to oblong and range from 15 to several hundred acres.

Anocon soils make up about 64 percent of the association; Stoneburg soils, about 18 percent; and other soils, about 18 percent. The composition of this association is more variable than that of other map units in the survey area. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

Anocon soils are in broad areas on uplands and foot slopes. They have a surface layer of friable, brown, slightly acid fine sandy loam about 16 inches thick. The subsoil is very firm, reddish brown, neutral sandy clay to a depth of 26 inches; very firm, brown, moderately alkaline sandy clay to a depth of 39 inches; and firm, yellowish red, moderately alkaline sandy clay loam to a depth of 65 inches.

Anocon soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of water erosion is moderate. Natural fertility and organic matter content are moderate.

Stoneburg soils are on ridgetops underlain by sandstone. They have a surface layer of friable, dark grayish brown, neutral fine sandy loam about 10 inches thick. The subsoil is friable, reddish brown, slightly acid sandy clay loam to a depth of 26 inches and firm, reddish yellow, neutral clay loam to a depth of 39 inches. The subsoil has an abrupt boundary and rests on brown, neutral, strongly cemented sandstone.

Stoneburg soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is medium. Natural fertility and organic matter content are moderately high. The hazard of water erosion is moderate.

Included with these soils in mapping are small areas of Renfrow soils. Also included on side slopes are a few areas of soils that are similar to Stoneburg soils except that sandstone is not within 60 inches of the surface. The included soils make up less than 30 percent of any one mapped area.

The soils in this association can be cultivated, but are used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses and forbs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for wheat and grain sorghum is medium. Terraces and contour farming help control water erosion. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is high. Improved grasses such as weeping lovegrass, Coastal bermudagrass, and Kleingrass are well suited to the soils in this association.

This association has medium potential for most urban uses. Shrinking and swelling with changes in moisture and low strength are the main limitations, but they can be overcome by good design and careful installation procedures. The sandy clay subsoil restricts permeability; this is a limitation for septic tank absorption fields, but can be overcome by increasing the size of the absorption areas or by modifying the filter field in some other manner. Potential for most recreational uses is high. Slope restricts some playground uses. Capability subclass IIIe; Loamy Prairie range site.

3—Bastrop loam, 2 to 5 percent slopes. This deep, gently sloping soil is in smooth areas on uplands. Slopes are slightly convex and average about 3 percent. Soil areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of very friable, brown, slightly acid loam about 7 inches thick. The subsoil is friable, red, slightly acid to neutral loam to a depth of 61 inches and friable, light red, calcareous loam to a depth of 70 inches or more.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are moderate. The soil has good tilth and can be worked throughout a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Teller soils on foot slopes. Also included are a few areas of soils that are similar to Bastrop soils except that they have a more clayey subsoil and a few areas of soils that have slopes of about 1 percent. These included soils make up less than 15 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses and forbs and post oak trees along some of the larger streams. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for wheat and grain sorghum is medium. Terraces and contour farming help control water erosion. Crop residue left on or near the surface help conserve moisture and maintain tilth and productivity.

Potential for pasture production is high. Improved grasses such as weeping lovegrass, Coastal bermudagrass, and Kleingrass are well suited to this soil.

This soil has high potential for most urban or recreational uses. Slope restricts some playground uses. Capability subclass IIIe; Sandy Loam range site.

4—Bastrop loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands. Slopes are slightly convex and average about 7 percent. Areas are irregularly shaped to enlongated and range from 10 to several hundred acres.

This soil has a surface layer of very friable, brown, neutral loam about 7 inches thick. The subsoil is friable, yellowish red, neutral sandy clay loam to a depth of 26 inches; friable, red, neutral sandy clay loam to a depth of 67 inches; and friable, reddish yellow, mildly alkaline loam to a depth of 80 inches or more.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are moderate. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of soils that are similar to Bastrop soils, but have a subsoil of fine sandy loam. Also included are a few areas of gullied soils and a few areas of soils that have slopes of as much as 12 percent. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses and forbs. A few post oak trees grow along some of the drainageways. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for wheat and grain sorghum is medium. Terraces and contour farming help control water erosion. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is high. Improved grasses such as weeping lovegrass, Coastal bermudagrass, and Kleingrass are well suited to this soil.

This soil has high potential for most urban or recreational uses, although in places slope restricts some building and playground uses. Capability subclass IVe; Sandy Loam range site.

5—Bolar clay loam, 2 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands, mainly along limestone ridges. Slopes are slightly convex and average about 3 percent. Areas are irregularly shaped and range from 10 to 200 acres.

This soil has a surface layer of friable, calcareous, dark grayish brown clay loam about 9 inches thick. The subsoil is friable, calcareous, grayish brown silty clay loam to a depth of 15 inches; friable, calcareous brown clay loam to a depth of 23 inches; and friable, calcareous, pale brown very gravelly clay loam to a depth of 27 inches. The subsoil has an abrupt boundary and rests on a thick layer of strongly cemented, fractured limestone.

This soil is well drained. Runoff is medium, and permeability is moderate. Available water capacity is low. Natural fertility and organic matter content are moderate.

Included with this soil in mapping are small areas of Venus soils on foot slopes. Also included are a few areas of soils that are similar to Bolar soils except that they are more clayey. Aledo soils are on knolls in areas of 0.5 acre to 3 acres; they make up about 4 percent of some mapped areas. Included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and a few motts of live oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for wheat, oats, and grain sorghum is medium. Crop residue left on or near the surface helps to prevent water erosion, conserve moisture, and improve soil tilth and water intake. Contour farming and terracing are needed in most areas to prevent water erosion. When cuts or excavations exceed about 20 inches, there is a hazard of cutting into a bed of strongly cemented, fractured limestone.

Potential for pasture production is medium. Improved grasses such as Kleingrass, weeping lovegrass, and Coastal bermudagrass are suited.

Potential for most urban uses is medium. Depth to rock and low strength restrict some uses. Potential for most recreation uses is medium because of the clayey surface layer. Capability subclass IIIe; Clay Loam range site.

6—Bolar-Aledo complex, 3 to 20 percent slopes. This is a complex of gently sloping to moderately steep soils on uplands, mainly in narrow bands along hillsides. Slopes are slightly convex and average about 12 percent. Areas are long and narrow and range from 50 to 300 feet wide; they range from 15 to several hundred acres.

Bolar soils make up about 45 percent of the complex; Aledo soils, about 45 percent; and other closely associated soils, about 10 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Bolar soils are on slightly convex benches and in the less sloping areas in the complex. They have a surface layer of friable, moderately alkaline, grayish brown stony clay loam about 13 inches thick. Limestone fragments, 3 to 15 inches across, cover from 1 to 15 percent of the surface. The subsoil is firm, moderately alkaline, pale brown clay loam to a depth of 22 inches and firm, moderately alkaline, yellow clay loam to a depth of 28 inches. Limestone fragments make up about 30 percent, by volume, of the lower part of the subsoil. The subsoil has an abrupt boundary and rests on a layer of hard, fractured limestone that is interbedded with clayey marl.

Bolar soils are well drained. Runoff is rapid. Permeability is moderate, and available water capacity is low. The root zone is moderately deep. Natural fertility and organic matter content are moderate.

Aledo soils are on convex knolls and ridges and in the more sloping areas in the complex. They have a surface layer of friable, moderately alkaline, dark grayish brown gravelly clay loam to a depth of 3 inches and friable,

moderately alkaline, grayish brown very gravelly clay loam to a depth of 10 inches. Limestone fragments, 3 to 15 inches across, cover from 1 to 50 percent of the surface; limestone fragments make up about 65 percent of the volume of the surface layer. The surface layer has an abrupt boundary and rests on a bed of hard, coarsely fractured limestone.

Aledo soils are well drained. Runoff is rapid. Permeability is moderate, and available water capacity is very low. The root zone is shallow. Natural fertility and organic matter content are moderately low.

Included with these soils in mapping are small areas of Venus soils on foot slopes. Also included on foot slopes are a few areas of soils that are similar to the Venus soils except that they are more clayey. These included soils make up less than 20 percent of any one mapped area.

The soils in this complex are not suitable for cultivated crops. They are used mainly as rangeland (fig. 2).

Potential for native range plants is medium. Rapid runoff, medium to very low available water capacity, and restricted rooting depth limits forage production to moderate yields during favorable years. The climax plant community is a mixture of tall and mid grasses, forbs, live oak, and Texas oak. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is low.

Potential for most urban or recreational uses is low. Slope, corrosivity to uncoated steel, low strength, depth to bedrock, and the stony or gravelly surface layer are difficult to overcome. Capability subclass VIs; Bolar soil in Clay Loam range site; Aledo soil in Shallow range site.

7—Bonti fine sandy loam, 2 to 5 percent slopes. This moderately deep, gently sloping soil is on erosional uplands, mainly along slightly convex ridges. Slopes are smooth and average less than 3 percent. Areas are irregularly shaped and range from 10 to 350 acres in size.

This soil has a surface layer of very friable, brown, slightly acid fine sandy loam about 5 inches thick. The subsurface layer is very friable, pale brown, slightly acid fine sandy loam that extends to a depth of 8 inches. The subsoil is firm, yellowish red, strongly acid sandy clay that extends to a depth of 29 inches. It has an abrupt boundary and rests on strongly cemented sandstone.

This soil is well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is low. Natural fertility and organic matter content are moderately low.

Included with this soil in mapping are small areas of Exray soils, which are near the edges of ridgetops. Also included are small areas of Truce soils, which have a substratum of shaly clay. Also included on foot slopes are a few areas of soils that are similar to Bonti soils except that they have a less clayey subsoil. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and post oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for wheat, oats, and grain sorghum is medium. Crop residue left on or near the soil surface helps prevent water erosion and conserve moisture. Contour farming and terraces are needed in most areas to prevent water erosion. When cuts or excavations exceed about 20 inches, there is a hazard of cutting into a bed of strongly cemented sandstone.

Potential for pasture production is medium. Improved grasses such as Kleingrass, weeping lovegrass, King Ranch bluestem, and Coastal bermudagrass are suited.

Potential for most urban or recreational uses is medium. Depth to rock and low strength restrict some uses. Capability subclass IIIe; Sandy Loam range site.

8—Bonti-Exray complex, 5 to 25 percent slopes. This is a complex of sloping to steep soils on uplands, mainly in a mass of low hills with narrow tops or in narrow bands along hillsides. Slopes are convex and average about 8 percent. Areas are irregularly shaped to elongated and range from 15 to several hundred acres.

Bonti soils make up about 29 percent of the complex; Exray soils, about 27 percent; and other closely associated soils, about 44 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Bonti soils are on ridgetops and in the less sloping areas in the complex. They have a surface layer of very friable, brown, neutral stony fine sandy loam about 4 inches thick. The subsurface layer is very friable, light yellowish brown, neutral stony fine sandy loam that extends to a depth of 10 inches. Sandstone fragments, 5 to 20 inches across, cover about 5 percent of the surface. The subsoil is firm, medium acid sandy clay; it is red to a depth of 17 inches and reddish yellow to a depth of 24 inches. The subsoil has an abrupt boundary and rests on a layer of strongly cemented sandstone.

Bonti soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is low. The root zone is moderately deep.

The Exray soils are on narrow ridgetops and in steeper areas that are closely associated with sandstone outcrops in the complex. They have a surface layer of friable, brown, slightly acid stony fine sandy loam about 3 inches thick. Sandstone fragments, 3 to 15 inches across, cover about 2 percent of the surface. The subsurface layer is friable, light yellowish brown, medium acid fine sandy loam that extends to a depth of 6 inches. The subsoil is firm, red, medium acid sandy clay that extends to a depth of 13 inches. The subsoil has an abrupt boundary and rests on a layer of strongly cemented, coarsely fractured sandstone.

Exray soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow. Natural fertility and organic matter content are low.

Included with these soils in mapping are areas of moderately steep Truce soils, which are on side slopes

that have a substratum of shale. These soils make up about 17 percent of the mapped acreage. Also included are small areas of soils that are similar to Exray soils except that they have a loamy subsoil. These soils make up about 24 percent of the mapped acreage. Also included are very small areas of soils that are similar to Bonti soils except that they have a loamy subsoil.

The soils in this complex are not suitable for cultivated crops. They are used mainly as rangeland (fig. 3).

Potential for native plants is medium. Rapid runoff, medium to very low available water capacity, and restricted rooting depth limit forage production to moderate yields during favorable years. The climax plant community is a mixture of tall and mid grasses, forbs, and post oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for most urban or recreational uses is low. Slope, depth to bedrock, low strength, and the stony surface layer are difficult to overcome. Capability subclass VIIs; Sandstone Hills range site.

9—Bosque loam, occasionally flooded. This deep, nearly level soil is on flood plains along major streams. Slopes are smooth and range from 0 to 1 percent. Most areas of this soil are subject to flooding about once every 3 to 10 years, but some areas are rarely flooded because they are protected by flood-prevention structures. Areas are long and narrow and range from 10 to several hundred acres.

This soil has a surface layer of friable, calcareous, dark brown loam about 22 inches thick. The subsoil is friable, calcareous, brown loam to a depth of 44 inches and friable, calcareous, pale brown loam to a depth of 65 inches or more.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Gowen soils. Also included are a few areas of soils that are similar to Bosque soils except that they are more clayey; these included clayey soils are next to clayey soils on uplands and make up less than 15 percent of any one mapped area. Areas of light colored, loamy soils are next to stream channels in some places. Included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops but is mainly used as rangeland and pastureland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for wheat, oats, forage sorghum, and grain sorghum is high. Crop residues left on or near the surface help conserve moisture and maintain tilth and productivity. Pecans are well suited to this soil.

Potential for pasture production is high. Pasture grasses such as johnsongrass, Coastal bermudagrass, and Kleingrass are well suited.

This soil has low potential for most urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some camping uses. Capability subclass IIw; Loamy Bottomland range site.

10—Bosque soils, frequently flooded. These deep, nearly level soils are on flood plains along small streams. Areas are long and narrow and are parallel to the stream channels. Slopes range from 0 to 1 percent. Most areas are subject to flooding once or twice a year. The surface layer is mainly loam, but is sandy loam or clay loam in some areas. Individual areas range from 10 to several hundred acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, to be interpreted for the expected use of the soils involved.

Bosque soils in this map unit typically have a surface layer of friable, calcareous, grayish brown loam about 19 inches thick. The subsoil is friable, calcareous, dark grayish brown loam to a depth of 33 inches and friable, calcareous, grayish brown loam to a depth of 48 inches or more.

These soils are well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.

Included with these soils in mapping are small areas of Gowen and Pulexas soils and areas of light colored, stratified, loamy soils next to stream channels in some places. Also included are a few areas of soils that are similar to Bosque soils except that they are more clayey throughout. Included soils make up less than 25 percent of any one mapped area.

The soils in this map unit generally are not suitable for cultivated crops because of the hazard of flooding. These soils are subject to washing or scouring and to deposition of fresh alluvial sediments. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for pasture production is high. Pasture grasses such as johnsongrass, Coastal bermudagrass, and Kleingrass are well suited.

These soils have low potential for most urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some playground and camping uses. Capability subclass Vw; Loamy Bottomland range site.

11—Branyon silty clay, 1 to 3 percent slopes. This deep, gently sloping soil is on uplands and terraces mainly

in valleys. Slopes are smooth, slightly concave to plane, and average less than 2 percent. Soil areas are broad to irregularly shaped and range from 10 to 750 acres. In undisturbed areas, the surface is characterized by weak gilgai microrelief, which consists of microknolls and microdepressions. The microknolls are 2 to 10 inches higher than the microdepressions. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

This soil has a surface layer of very firm, calcareous, very dark gray silty clay to a depth of 33 inches and very firm, calcareous, dark gray silty clay to a depth of 65 inches or more.

This soil is moderately well drained. Runoff is slow to medium. When dry, this soil has wide, deep cracks that extend to the surface. Water enters dry, cracked soil rapidly, but it enters wet soil very slowly and seals the cracks. Permeability is very slow. Available water capacity is high. Natural fertility and organic matter content are high.

Included with this soil in mapping are small areas of Sanger soils and a few very small areas of dark gray clayey soils that are about 40 inches thick over limestone. Also included are a few areas of soils that have slopes of less than 1 percent. These included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as cropland. Small grain and grain sorghum are the main cultivated crops.

Potential for native range plants is high. The climax plant community is mainly a mixture of tall and mid grasses and forbs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for wheat, oats, grain sorghum, and cotton is high. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Contour farming and terracing are needed in most areas to prevent water erosion. Grassed waterways provide good outlets for terrace systems when excess water is a concern.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, Kleingrass, and weeping lovegrass are well suited.

This soil has low potential for most urban or recreational uses. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and the clayey surface layer are the main limiting features. Capability subclass IIe; Blackland range site.

12—Chaney loamy fine sand, 2 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are slightly convex to slightly concave and average less than 3 percent. Areas are irregularly shaped to broad and range from 10 to 900 acres.

This soil has a surface layer of loose, pale brown, slightly acid loamy fine sand about 6 inches thick. The subsurface layer is loose, very pale brown, slightly acid loamy fine sand that extends to a depth of 10 inches. The subsoil is firm, medium acid, sandy clay; it is reddish yellow to a depth of 23 inches and mottled reddish yellow and light gray to a depth of 47 inches. The underlying material is very firm, reddish yellow and light gray, massive clay.

This soil is moderately well drained. Runoff is slow to medium. Permeability is slow. Available water capacity is medium.

Included with this soil in mapping are small areas of Selden and Windthorst soils. Also included are a few areas of gullied soils and a few areas of soils that have slopes of less than 2 percent. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops but is used mainly as pastureland. Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, weeping lovegrass, and Kleingrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for peanuts is high, and potential for grain sorghum is medium. Crop residue left on or near the surface helps conserve moisture, control soil blowing, and maintain tilth. Contour farming and terracing are needed in most areas to prevent water erosion. Peaches, apples, and melons are also well suited (fig. 4).

Potential for most urban or recreational uses is medium. Shrinking and swelling with changes in moisture, low strength, slow permeability, and the sandy surface layer are the main limitations, but they can be overcome by good design and careful installation procedures. Capability subclass IIIe; Loamy Sand range site.

13—Cona association, hilly. This is an association of sloping to moderately steep soils on uplands. The soils are on a mass of low hills with narrow tops or in narrow bands along hillsides. Slopes range from 5 to 25 percent, but average about 8 percent. Areas are irregularly shaped to elongated and range from 20 to several hundred acres in size.

Cona soils make up about 72 percent of the association, shallow soils make up about 16 percent, and closely associated soils that have a subsoil of loam make up the remaining 12 percent. The composition of this association is more variable than that of other map units in the survey area. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

Cona soils in this association have a surface layer of very friable, brown, neutral stony fine sandy loam about 4 inches thick. The subsurface layer is very friable, very pale brown, neutral stony fine sandy loam that extends to a depth of 8 inches. Conglomerate sandstone fragments, 3 to 20 inches across, cover about 15 percent of the surface. The subsoil is very firm, strongly acid, red sandy clay to a depth of 17 inches; is very firm, strongly acid, mottled red and reddish yellow clay to a depth of 27 inches; and very firm, strongly acid, pale yellow clay that has mottles of red, reddish yellow, and gray and that extends to a

depth of 33 inches. The underlying material is very firm, strongly acid, gray shaly clay that has red and strong brown mottles and that extends to a depth of 45 inches or more.

Cona soils are well drained. Runoff is rapid. Permeability is slow, and available water capacity is medium. The hazard of water erosion is moderate.

Included with these soils in mapping are small areas of Truce, Windthorst, and Bonti soils on the lower parts of slopes. A soil that is similar to Exray soils is on ridgetops in some places and makes up as much as 10 percent of some mapped areas. Also included in some places are small areas of soils that have steep slopes and boulder sized fragments of sandstone. Also included on foot slopes are a few areas of soils that are similar to Duffau soils. These included soils make up about 20 to 40 percent of most mapped areas.

The soils in this association are not suitable for cultivated crops mainly because of the stony surface, slope, and susceptibility to water erosion. They are used mainly as rangeland.

Potential for native plants is medium. The climax plant community is a mixture of tall and mid grasses and few to many post oak, blackjack oak, and elm trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for most urban or recreational uses is low. Slope, shrinking and swelling with changes in moisture, low strength, and the stony surface layer are the most limiting features. Capability subclass VIs; Sandstone Hills range site.

14—Duffau loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are smooth and average about 2 percent. Areas are broad to irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of very friable, brown, slightly acid, loamy fine sand about 8 inches thick. The subsurface layer is very friable, pale brown, slightly acid loamy fine sand that extends to a depth of 11 inches. The **subsoil is friable, yellowish red, slightly acid sandy clay** loam to a depth of 48 inches and friable, reddish yellow, slightly acid sandy clay loam to a depth of 70 inches or more.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is medium. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Selden and Windthorst soils. Also included are duned or mounded areas of soils that have a sandy surface layer thicker than 20 inches. In a few areas soils have slopes of as much as 6 percent. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential is high for peanuts and medium for grain sorghum. Crop residue left on or near the surface helps conserve moisture, control soil blowing, and maintain tilth. Contour farming and terracing are needed in most areas to prevent water erosion. Peaches, apples, and melons are also well suited.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, weeping lovegrass, and Kleingrass are well suited to this soil.

Potential for most urban or recreational uses is medium. Low strength and the sandy surface are the main limitations. Capability subclass IIIe; Loamy Sand range site.

15—Duffau fine sandy loam, 2 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are smooth and average about 3 percent. Areas are broad to irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of friable, brown, mildly alkaline fine sandy loam about 5 inches thick. The subsurface layer is very friable, light brown, neutral fine sandy loam that extends to a depth of 12 inches. The subsoil is friable, yellowish red, slightly acid sandy clay loam to a depth of 26 inches; friable, reddish yellow, medium acid sandy clay loam to a depth of 45 inches; and friable, slightly acid, red sandy clay loam to a depth of 70 inches or more.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are moderately low. The soil has good tilth and can be worked throughout a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Windthorst and Selden soils. Also included are a few areas of gullied soils, a few areas of soils that have slopes of less than 2 percent, and a few small areas of soils that have a surface layer of loamy fine sand. These included soils make up less than 15 percent of any one mapped area.

This soil is suitable for cultivated crops but is used mainly as rangeland and pastureland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, Kleingrass, and weeping lovegrass are well suited (fig. 5).

Potential is high for peanuts and medium for grain sorghum and small grains. Crop residue left on or near the surface helps conserve moisture, control soil blowing, and maintain tilth. Terracing and contour farming help control water erosion. Peaches, apples, and melons are well suited.

Potential for most urban uses is medium. Low strength is the main limitation, but this can be overcome by good design and careful installation procedures. Potential for most recreational uses is high, but slope restricts some playground uses. Capability subclass IIIe; Sandy Loam range site.

16—Duffau fine sandy loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands. Slopes are smooth and average about 6 percent. Areas are irregularly shaped to long and narrow and range from 10 to several hundred acres.

This soil has a surface layer of friable, brown, slightly acid fine sandy loam about 10 inches thick. The subsoil is friable, yellowish red, medium acid sandy clay loam to a depth of 38 inches; friable, reddish yellow, medium acid sandy clay loam to a depth of 48 inches; and friable, reddish yellow, medium acid loam to a depth of 70 inches or more.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are moderately low. The root zone is deep and easily penetrated by plant roots. The hazard of water erosion is high.

Included with this soil in mapping are small areas of Windthorst soils on the upper parts of slopes. Also included are small areas of soils that are similar to Duffau soils, but are underlain by very soft sandstone at a depth of about 40 inches; these soils are on convex ridgetops. Also included are a few areas of gullied soils and small areas of soils that have a surface layer of loamy fine sand. These included soils make up less than 20 percent of any one mapped area.

These soils can be cultivated, but are used mainly as rangeland. Potential for native plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for peanuts, grain sorghum, and small grain is medium. Terracing and contour farming help control water erosion. Crop residue left on or near the surface help conserve moisture and maintain tilth and productivity.

Potential for pasture production is high. Improved grasses such as weeping lovegrass, Coastal bermudagrass, and Kleingrass are well suited to this soil.

This soil has medium potential for most urban uses. Low strength is the main limitation. Potential for most recreational uses is high. Slope restricts some playground uses. Capability subclass IVe; Sandy Loam range site.

17—Duffau and Windthorst soils, gullied. This is an undifferentiated group of gently sloping to sloping, very severely eroded soils on uplands. Slopes are slightly concave and range from 2 to 8 percent. These areas consist of a system of interconnecting gullies flanking narrow ridges of Duffau and Windthorst soils. Gullies 2 to 30 feet deep and 4 to 200 feet wide commonly dissect these areas at intervals of 10 to 100 feet. Soil areas are irregularly shaped and range from 8 to 70 acres (fig. 6).

Duffau soils make up about 35 percent of this map unit; Windthorst soils, about 22 percent; and gullied areas, about 43 percent. The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Duffau soils are on the lower parts of slopes between gullies. They have a surface layer of friable, brown, slightly acid fine sandy loam about 3 inches thick. The subsurface layer is friable, pink, slightly acid fine sandy loam that extends to a depth of 6 inches. The subsoil is friable, slightly acid, yellowish red sandy clay loam to a depth of 22 inches and friable, reddish yellow over light red and very pale brown, slightly acid loam to a depth of 62 inches. The underlying material is friable, light brown soft sandstone or pack sand.

Duffau soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. The hazard of erosion is high.

Windthorst soils in this map unit are on the upper parts of slopes on ridges between the gullies. They have a surface layer of friable, brown, slightly acid fine sandy loam about 4 inches thick. The subsoil, to a depth of 48 inches, is firm, red, medium acid sandy clay that has light brown mottles in the lower part. The underlying material is massive, reddish yellow fine sandy loam.

Windthorst soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is medium. The hazard of water erosion is high.

The soils in this map unit are not suitable for cultivated crops. They are used mainly for wildlife habitat or as rangeland. Shaping, sodding, or seeding is expensive and requires good management and careful maintenance to be successful. Capability subclass VIIe; Sandy Loam range site.

18—Eufaula-Patilo complex, 1 to 8 percent slopes. This is a complex of gently sloping to undulating soils on uplands. Slopes are mainly convex and average about 4 percent. Areas are smooth to dunelike and range from 10 to about 420 acres.

Eufaula soils make up about 55 percent of the complex; Patilo soils, about 31 percent; and other closely associated soils, about 14 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Eufaula soils are in convex areas. They have a surface layer of loose, pale brown, slightly acid fine sand about 4 inches thick. The subsurface layer is loose, pink, neutral fine sand that extends to a depth of 60 inches. Below that is a transitional layer of loose, pink, neutral fine sand that has thin layers of yellowish red fine sandy loam and that extends to a depth of 80 inches or more.

Eufaula soils are somewhat excessively drained. Runoff is very slow. Permeability is rapid, and available water capacity is low. The root zone is deep and easily penetrated by plant roots.

Patilo soils are in slightly concave areas and on foot slopes. They have a surface layer of loose, grayish brown, slightly acid fine sand about 4 inches thick. The subsurface layer is loose, pink, slightly acid fine sand that extends to a depth of 45 inches. The subsoil is firm, strongly acid sandy clay loam that is mottled in shades of light gray, reddish yellow, and red and that extends to a depth of 65 inches or more.

Patilo soils are moderately well drained. Runoff is slow. Permeability is moderately slow, and available water capacity is low. The root zone is deep and easily penetrated by plant roots. The hazard of soil blowing is high.

Included with these soils in mapping are small areas of soils that are similar to Eufaula soils except that they do not have yellowish red lamellae. Also included are soils that are similar to Patilo soils except that they are better drained and do not have gray mottles in the subsoil. Also included on foot slopes are a few areas of soils that have a sandy surface layer less than 40 inches thick. These included soils make up from 7 to 28 percent of any one mapped area.

The soils in this complex can be cultivated, but are used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for peanuts is medium. Crop residue left on or near the surface helps conserve moisture, control soil blowing, and maintain tilth.

Potential for pasture production is medium. Improved grasses such as weeping lovegrass and Coastal bermudagrass are suited to the soils in this complex.

This complex has medium potential for most urban uses. Slope, wetness, and the loose, sandy surface layer are the main limitations, but they can be overcome by good design and careful installation procedures. Potential for most recreational uses is low because of the sandy surface layer and slopes. Capability subclass IVs; Deep Sand range site.

19—Gaddy soils, frequently flooded. This is an undifferentiated group of deep, nearly level soils on low flood plains along the Red River. Areas are long and narrow and are parallel to and 2 to 10 feet above the river channel. Slopes range from 0 to 1 percent. Most areas are flooded about once or twice a year to once every 2 years. The surface layer is mainly loamy fine sand, but is fine sandy loam or clay loam in some areas. Individual areas range from 15 to 400 acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Gaddy soils in this map unit typically have a surface layer of very friable, calcareous, light reddish brown loamy fine sand about 4 inches thick. The underlying material is very friable, calcareous, pink loamy fine sand that contains thin strata of fine sandy loam to a depth of 16 inches and loose, calcareous, pink fine sand that contains thin strata of fine sandy loam to a depth of 45 inches or more.

These soils are somewhat excessively drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is low. The root zone is deep and easily penetrated by plant roots.

Included with these soils in mapping are small areas of Yahola soils. Also included are small areas of Miller soils in old sloughs or low areas where water stands for longer periods. A few small, oval sand dunes that average about 4 feet high and about 200 feet long are in some areas. Narrow areas between different levels of the flood plains have slopes of more than 1 percent. These included soils make up less than 20 percent of any one mapped area.

The soils in this map unit generally are unsuitable for cultivated crops because of the hazard of flooding. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildife habitat is medium.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

These soils have low potential for most urban or recreational uses. Flooding is a severe limitation and is very difficult to overcome. Capability subclass Vw; Sandy Bottomland range site.

20—Gowen loam, occasionally flooded. This deep, nearly level soil is on flood plains along major streams. Slopes are smooth and range from 0 to 1 percent. Most areas of this soil are subject to flooding about once every 3 to 10 years, but some areas are rarely flooded because they are protected by flood-prevention structures. Areas are long and narrow and range from 10 to several hundred acres.

This soil has a surface layer of friable, dark grayish brown, neutral loam about 28 inches thick. The underlying material, extending to a depth of 52 inches or more, is friable, brown, neutral clay loam.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are a few areas of soils that are similar to Gowen soils except that they have a surface layer of light colored sandy loam and stratified lower layers. In the bottoms of the drainageways, some profiles have higher clay content than described as typical of the Gowen series. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is mainly used as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and

mid grasses, forbs, and scattered shrubs and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for oats, wheat, forage sorghum, and grain sorghum is high. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Pecans are well suited to the soil.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

This soil has low potential for most urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some camping uses. Capability subclass IIw; Loamy Bottomland range site.

21—Gowen soils, frequently flooded. These deep, nearly level soils are on flood plains along small streams where channels have become filled with sand and debris. Areas are long and narrow. Slopes range from 0 to 1 percent. Most areas are subject to flooding once or twice a year. The surface layer is mainly loam, but is sandy loam or clay loam in some areas. Individual areas range from 10 to several hundred acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Gowen soils in this map unit typically have a surface layer of friable, brown, neutral, weakly stratified loam about 13 inches thick. The underlying material is friable, brown, mildly alkaline clay loam to a depth of 41 inches and friable, brown, moderately alkaline clay loam to a depth of 60 inches or more.

These soils are well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. **Natural fertility and organic matter content are high. The root zone is deep and easily penetrated by plant roots.**

Included with these soils in mapping are a few areas of Pulexas and Bosque soils. Also included near stream channels are a few areas of soils that are similar to Gowen soils except that they have a surface layer of light colored sandy loam and lower layers of stratified material. In the bottoms of drainageways, some included soils have higher clay content than that described as typical of the series. These included soils make up less than 30 percent of any one mapped area.

The soils in this map unit generally are not suitable for cultivated crops because of the hazard of flooding. These soils are subject to washing or scouring and to deposition of fresh alluvial sediments. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, scattered shrubs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

These soils have low potential for urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some playground and camping uses. Capability subclass Vw; Loamy Bottomland range site.

22—Hensley loam, 1 to 5 percent slopes. This shallow, gently sloping soil is on uplands, mainly along slightly convex limestone ridges. Slopes are smooth and average about 2 percent. Areas are irregularly shaped and range from 10 to 150 acres.

This soil has a surface layer of friable, brown, mildly alkaline loam about 4 inches thick. The subsoil is very firm, dark reddish brown, mildly alkaline clay that extends to a depth of 16 inches. It has an abrupt boundary and rests on a thick layer of strongly cemented, fractured limestone.

This soil is well drained. Runoff is medium. Permeability is slow, and available water capacity is very low. The root zone is shallow.

Included with this soil in mapping are small areas of Lindy soils and very small areas of Aledo soils. These included soils make up less than 15 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is medium mainly because of the restricted root zone. The climax plant community is a mixture of tall, mid, and short grasses, a few shrubs, and a few motts of live oak trees. Management needs include proper stocking and controlled grazing. Potential for wildlife habitat is medium.

Potential for small grains and grain sorghum is low. Crop residue left on the surface helps prevent water erosion, conserve moisture, and improve soil tilth and water intake.

Potential for pasture production is medium. Improved grasses such as Kleingrass, Coastal bermudagrass, weeping lovegrass, and King Ranch bluestem are suited.

Potential for most urban uses is low. Depth to bedrock is difficult to overcome. Capability subclass IVe; Redland range site.

23—Lindy clay loam, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on uplands, mainly along slightly convex ridges. Areas are irregularly shaped and range from 10 to 180 acres.

This soil has a surface layer of friable, dark grayish brown, slightly alkaline clay loam about 6 inches thick. The subsoil is very firm, reddish brown, moderately alkaline clay that extends to a depth of 31 inches. It has an abrupt boundary and rests on a thick layer of strongly cemented, coarsely fractured limestone.

This soil is well drained. Runoff is medium. Permeability is slow, and available water capacity is low. The root zone is moderately deep.

Included with this soil in mapping are small areas of Hensley soils. Also included are a few areas of soils that

are similar to Lindy soils except that they have a dark brown subsoil; this soil is in concave areas. These included soils make up less than 25 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and a few shrubs and live oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for oats and grain sorghum is high. Crop residue left on or near the surface helps prevent water erosion, conserve moisture, and improve soil tilth and water intake. Contour farming and terraces are needed in most areas to prevent water erosion. When cuts or excavations exceed 20 inches, there is a hazard of cutting into a bed of strongly cemented limestone.

Potential for pasture production is medium. Improved grasses such as Kleingrass, Coastal bermudagrass, weeping lovegrass, and King Ranch bluestem are well suited.

Potential for most urban or recreational uses is medium. Depth to rock, low strength, and shrinking and swelling with changes in moisture restrict some uses. Capability subclass IIIe; Deep Redland range site.

24—Miller clay, occasionally flooded. This deep, nearly level soil is on flood plains, mainly along the Red River. Slopes are smooth to weakly concave and range from 0 to 1 percent. Most areas are subject to flooding about once every 2 to 5 years. Areas are long and narrow and range from 10 to 230 acres.

This soil has a surface layer of firm, calcareous, reddish brown clay about 17 inches thick. The subsoil is very firm, calcareous, reddish brown clay to a depth of 39 inches and firm, calcareous, red silty clay loam to a depth of 50 inches. The substratum, extending to a depth of 60 inches or more, is very friable, calcareous, reddish yellow fine sandy loam.

This soil is moderately well drained. Runoff is slow. Permeability is very slow, and available water capacity is high. Natural fertility and organic matter content are medium.

Included with this soil in mapping are a few areas of soils that are similar to Miller soils except that they have a light colored, clayey surface layer. Also included are similar soils that have a clayey solum 20 to 35 inches thick over a fine sandy loam substratum. These included soils are in slightly convex areas and make up less than 30 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for wheat, oats, grain sorghum, and alfalfa is high. This soil is difficult to till; tillage needs to be timely and kept to a minimum. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Native pecans grow in most areas; pecan orchards have been developed in some places.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

This soil has low potential for most urban or recreational uses. Flooding is a severe limitation and is very difficult to overcome. Capability subclass IIIw; Clayey Bottomland range site.

25—Miller soils, frequently flooded. These deep, nearly level soils are on flood plains, mainly along the Red River. Slopes are weakly concave to smooth and range from 0 to 1 percent. Most areas are subject to flooding once or twice a year. The surface layer is mainly clay, but is clay loam or silty clay in some areas. Individual areas range from 10 to several hundred acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Miller soils in this map unit have a surface layer of very firm, calcareous, reddish brown clay to a depth of 5 inches; firm, calcareous, reddish brown silty clay loam to a depth of 9 inches; and very firm, calcareous, reddish brown clay to a depth of 18 inches. The subsoil is very firm, calcareous, reddish brown clay to a depth of 35 inches and firm, calcareous, yellowish red silty clay to a depth of 47 inches. The substratum, extending to a depth of 55 inches or more, is very friable, calcareous, reddish yellow fine sandy loam.

This unit is moderately well drained. Runoff is slow. Permeability is very slow, and available water capacity is high. Natural fertility and organic matter content are medium.

Included with this unit in mapping are a few areas of soils that are similar to Miller soils except that they have a light colored, clayey surface layer. Also included are similar soils that have a clayey surface layer 20 to 35 inches thick over a substratum of fine sandy loam. These included soils are in slightly convex areas and make up about 30 percent of any one mapped area.

The soils in this map unit generally are not suitable for cultivated crops because of the hazard of flooding. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is medium. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is low.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited. Native pecans grow in most areas; pecan orchards have been developed in some places.

These soils have low potential for most urban or recreational uses. Flooding is a severe limitation and is very difficult to overcome. Capability subclass Vw; Clayey Bottomland range site.

26—Pulexas fine sandy loam, occasionally flooded. This deep, nearly level soil is on flood plains along small streams. Slopes are smooth and range from 0 to 1 percent. Most areas of this soil are subject to flooding about once every 3 to 10 years, but some areas are rarely flooded because they are protected by flood-prevention structures. Areas are long and narrow and range from 10 to several hundred acres in size.

This soil has a surface layer of very friable, pale brown, neutral fine sandy loam about 7 inches thick. The underlying material is very friable, brown, neutral fine sandy loam to a depth of 18 inches; friable, yellowish brown, neutral fine sandy loam to a depth of 42 inches; and friable, brown, mildly alkaline fine sandy loam below that.

This soil is well drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is medium. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are a few areas of Gowen soils. Also included are a few areas of soils that are similar to Pulexas soils except that they are more clayey. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for small grains and sorghum is high. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Pecans are well suited to this soil.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited.

This soil has low potential for most urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some camping uses. Capability subclass IIw; Loamy Bottomland range site.

27—Pulexas soils, frequently flooded. These deep, nearly level soils are on flood plains along small streams where channels have become filled with sand and debris. Areas are long and narrow. Slopes range from 0 to 1 percent. Most areas are subject to flooding once or twice a year. The surface layer is mainly fine sandy loam, but is sandy loam, loam, or clay loam in some areas. Individual areas range from 10 to several hundred acres.

The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Pulexas soils in this map unit typically have a surface layer of friable, brown, neutral fine sandy loam about 5 inches thick. The underlying material is very friable, light yellowish brown, mildly alkaline, stratified fine sandy loam to a depth of 30 inches; friable, brown, moderately alkaline fine sandy loam to a depth of 42 inches; and friable, brown, moderately alkaline loam to a depth of 60 inches.

This unit is well drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is medium. The root zone is deep and easily penetrated by plant roots.

Included with this unit in mapping are a few areas of Gowen soils. Also included are a few areas of soils that are similar to Pulexas soils except that they are more clayey. These included soils make up less than 20 percent of any one mapped area.

The soils in this map unit generally are not suitable for cultivated crops because of the hazard of flooding. These soils are subject to washing or scouring and to deposition of fresh alluvial sediments. They are used mainly as rangeland, but a few areas have been planted to improved pasture grasses.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass and Kleingrass are well suited. Pecans are also well suited.

These soils have low potential for urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Flooding restricts some playground and camping uses. Capability subclass Vw; Loamy Bottomland range site.

28—Renfrow loam, 1 to 4 percent slopes. This deep, gently sloping soil is on uplands. Slopes are smooth and average about 2 percent. Areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of friable, slightly acid, dark brown loam about 11 inches thick. The subsoil to a depth of 65 inches is very firm, reddish brown clay that is mildly alkaline in the upper 20 inches and calcareous below.

This soil is well drained. Runoff is medium. Permeability is very slow, and available water capacity is high. Natural fertility and organic matter content are moderate.

Included with this soil in mapping are small areas of Waurika and Anocon soils. Also included are a few very small areas of Vernon soils on clayey ridges. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of mid grasses such as sideoats grama, blue grama, meadow dropseed, and silver bluestem, and there are also small areas of short and tall grasses. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for wheat and grain sorghum is medium. Terracing and contour farming help control water erosion. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is medium. Improved grasses such as King Ranch bluestem, Coastal bermudagrass, weeping lovegrass, and Kleingrass are suited to this soil.

This soil has low potential for most urban or recreational uses. Shrinking and swelling with changes in moisture, low strength, and very slow permeability are the main limitations. Capability subclass IIIe; Claypan Prairie range site.

29—Sanger silty clay, 3 to 5 percent slopes. This deep, gently sloping soil is on uplands, mainly in bands along hillsides. Slopes are slightly convex and average about 4 percent. Areas are elongated to oblong and range from 10 to 320 acres. In undisturbed areas, the surface is characterized by weak gilgai microrelief, which consists of microknolls and microdepressions. The microknolls are 3 to 10 inches higher than the microdepressions. Evidence of gilgai microrelief is destroyed after a few years of cultivation.

The soil has a surface layer of very firm, calcareous, dark gray silty clay about 8 inches thick. Between depths of 8 and 60 inches, the soil is very firm, calcareous, silty clay; it is dark grayish brown to a depth of 46 inches and grayish brown to a depth of 60 inches or more.

This soil is well drained. Runoff is medium. When dry, this soil has wide, deep cracks that extend to the surface. Water enters dry, cracked soil rapidly, but it enters wet soil very slowly and seals the cracks. Permeability is very slow. Available water capacity is high. Natural fertility and organic matter content are moderately high.

Included with this soil in mapping are areas of Branyon soils and very small areas of Bolar soils. Also included are a few areas of soils that have slopes of less than 3 percent or more than 5 percent. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland and native meadows (fig. 7). The climax plant community is a mixture of tall and mid grasses and forbs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for grain sorghum and oats is high. Terracing and contour farming help control water erosion. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is high. Improved grasses such as Kleingrass, Coastal bermudagrass, and weeping lovegrass are well suited to this soil.

This soil has low potential for most urban or recreational uses. Shrinking and swelling with changes in moisture, low strength, corrosivity to uncoated steel, and the clayey surface are the main limiting features. Capability subclass IIIe; Blackland range site.

30—Sanger stony clay, 5 to 12 percent slopes. This deep, sloping to strongly sloping soil is on uplands in bands along hillsides. Slopes are slightly convex and average about 6 percent. Areas are long and narrow to oblong and range from 10 to 300 acres. In undisturbed areas the surface is characterized by weak gilgai microrelief, which consists of microknolls and microdepressions. The microknolls are 3 to 10 inches higher than the microdepressions and extend up and down the slope.

This soil has a surface layer of very firm, calcareous, dark gray stony clay about 9 inches thick. Limestone fragments, 20 to 40 inches across, cover about 1 percent of the surface; most of these fragments are partially buried and standing on edge. The next layer is very firm, calcareous, dark grayish brown silty clay to a depth of 14 inches and very firm, calcareous, grayish brown silty clay that contains a few slickensides and that extends to a depth of 43 inches. The underlying material is massive, gray and light yellowish brown shaly clay.

This soil is well drained. Runoff is medium. Water enters the dry, cracked soil rapidly, but it enters wet soil very slowly and seals the cracks. Permeability is very slow. Available water capacity is high.

Included with this soil in mapping are small areas of Bolar soils on ridgetops and very small areas of Aledo soils on ridgetops. Also included are a few areas of soils that have slopes of less than 5 percent and a few small areas of soils that do not have stones. These included soils make up less than 20 percent of any one mapped area.

This soil is not suitable for cultivated crops. It is used mainly as rangeland.

Potential for native range plants is high. The climax community is a mixture of tall and mid grasses and forbs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

This soil has low potential for most urban or recreational uses. Shrinking and swelling upon wetting and drying, low strength, large stones, and very slow permeability are the main limitations. Capability subclass VIs; Blackland range site.

31—Selden fine sand, 1 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are slightly concave and average about 2 percent. Areas are irregularly shaped to broad and range from 10 to several hundred acres.

The soil has a surface layer of very friable, brown, neutral fine sand about 7 inches thick. The subsurface layer is very friable, very pale brown, neutral fine sand that extends to a depth of 15 inches. The subsoil is friable, reddish yellow, medium acid sandy clay loam to a depth of 25 inches; firm, reddish yellow, medium acid sandy clay loam that is finely mottled with gray and red to a depth of 34 inches; and firm, mottled red, light gray, and reddish yellow, neutral sandy clay loam and clay loam below.

This soil is moderately well drained. Runoff is slow. Permeability is moderately slow, and available water

capacity is medium. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chaney and Duffau soils. Also included are soils that are similar to Selden soils except that they do not have gray mottles within 30 inches of the surface. Also included are a few areas of gullied soils. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as pastureland and rangeland. Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, weeping lovegrass, and Kleingrass are well suited to this soil.

Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential is high for peanuts and medium for grain sorghum. Crop residue left on or near the surface helps conserve moisture, control soil blowing, and maintain tilth. Contour farming and terracing are needed in most areas to prevent water erosion. Apples, peaches, and melons are well suited to the soil.

Potential for most urban uses is high. Corrosivity to uncoated steel, drainage, and slow permeability are the main limiting features, but they can be overcome by good design and careful installation procedures. Potential for recreational uses is medium because of the sandy surface layer. Capability subclass IIIe; Loamy Sand range site.

32—Stoneburg-Anocon association, gently undulating. This is an association of gently undulating soils in smooth areas on uplands. Slopes range from 1 to 5 percent, but average about 3 percent. Areas are irregularly shaped to oblong and range from 15 to several hundred acres.

Stoneburg soils make up about 61 percent of the association; Anocon soils, about 15 percent; and other soils, about 24 percent. The composition of this association is more variable than that of other map units in the survey area. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

Stoneburg soils are on ridgetops and in broad areas that are underlain by sandstone. They have a surface layer of friable, slightly acid, brown fine sandy loam about 11 inches thick. The subsoil is friable, slightly acid, reddish brown loam to a depth of 16 inches and firm, slightly acid clay loam that is reddish brown to a depth of 26 inches and yellowish red to a depth of 35 inches. It has an abrupt boundary and rests on strongly cemented, brownish yellow sandstone.

Stoneburg soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is medium. Natural fertility and organic matter content are moderately high. The hazard of water erosion is moderate.

Anocon soils are on foot slopes. They have a surface layer of friable, dark grayish brown, neutral fine sandy loam about 10 inches thick. The subsoil is firm, yellowish brown, neutral sandy clay to a depth of 27 inches; firm, strong brown, neutral sandy clay that contains a few fragments of sandstone to a depth of 41 inches; and firm, yellowish red and brown, neutral clay loam to a depth of 62 inches or more.

Anocon soils are well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is high. The hazard of water erosion is moderate. Natural fertility and organic matter content are moderate.

Included with these soils in mapping are soils that are similar to Stoneburg soils except that they have a more clayey subsoil. Also included are other soils that are similar to Stoneburg soils except that the combined surface layer and subsoil ranges from 40 to 60 inches in thickness. A loamy soil underlain at a shallow depth by sandstone is in some areas. Also included are a few areas of stony soils on the edges of ridgetops; these stony areas are indicated by appropriate symbols on the soil maps. Any one of these included soils makes up about 5 to 15 percent of most mapped areas; together, included soils make up about 15 to 25 percent of a few mapped areas.

The soils in this association can be cultivated, but are used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses and forbs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife is high.

Potential for wheat and grain sorghum is medium. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Contour farming and terracing are needed in most areas to prevent water erosion. When cuts or excavations exceed 20 inches, there is a hazard of cutting into a bed of hard sandstone.

Potential for pasture production is medium. Improved grasses such as Kleingrass, Coastal bermudagrass, and weeping lovegrass are suited to the soils in this association.

The soils in this association have medium potential for most urban uses and high potential for most recreational uses. Depth to rock and low strength restrict some uses. Capability subclass IIIe; Loamy Prairie range site.

33—Teller loam, 0 to 1 percent slopes. This deep, nearly level soil is on geologic terraces, mainly along the Red River. Areas are broad and range from 10 to about 3,800 acres; the largest area is northwest of Spanish Fort.

This soil has a surface layer of very friable, brown, slightly acid loam about 14 inches thick. The subsoil is friable, reddish brown, slightly acid clay loam to a depth of 28 inches; friable, reddish brown, slightly acid loam to a depth of 45 inches; and friable, brown, slightly acid loam to a depth of 62 inches. The underlying material to a depth of 70 inches is friable, light yellowish brown, neutral loam.

This soil is well drained. Runoff is slow. Permeability is moderate, and available water capacity is high. Natural

fertility and organic matter content are moderately high. The soil has good tilth and can be worked throughout a wide range of moisture conditions. The root zone is deep and easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bastrop soils and small areas of Teller soils that have slopes of 1 to 2 percent. Also included are areas of soils that are similar to Teller soils except that they have a subsoil of very fine sandy loam in which clay content is less than 18 percent. A few small areas of depressional soils that have a more clayey subsoil are included along drainageways. These included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as cropland, and it has high potential for this use. It is among the most productive of the county and is well suited to grain sorghum, cotton, wheat, oats, alfalfa, and corn. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, Kleingrass, and weeping lovegrass are well suited to this soil.

This soil has high potential for most urban or recreational uses. Seepage restricts use of the soil for sanitary landfills. Capability class I; Loamy Prairie range site.

34—Truce fine sandy loam, 2 to 5 percent slopes. This deep, gently sloping soil is on uplands. Slopes are smooth and average about 3 percent. Areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of friable, yellowish brown, neutral fine sandy loam about 3 inches thick. The subsurface layer is friable, light yellowish brown, neutral fine sandy loam that extends to a depth of 6 inches. The subsoil is very firm, yellowish red, neutral clay to a depth of 16 inches; very firm, brown, neutral clay to a depth of 25 inches; and very firm, brownish yellow, moderately alkaline clay to a depth of 45 inches. The underlying material is massive, light gray and brownish yellow, clayey shale.

This soil is well drained. Runoff is rapid. Permeability is slow, and available water capacity is medium. Natural fertility and organic matter content are moderately low.

Included with this soil in mapping are small areas of Bonti and Vashti soils and very small areas of Owens soils on ridges or in eroded areas. Also included are a few gullied areas and a few areas of soils that have a stony surface layer. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for range plants is medium. The climax plant community is a mixture of mid grasses such as sideoats grama, vine-mesquite, silver bluestem, Texas wintergrass, and various dropseeds. There are also small areas of short grasses, tall grasses, and post oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for pasture production is medium. Improved grasses such as King Ranch bluestem, Kleingrass, weeping lovegrass, and Coastal bermudagrass are suited to this soil.

Potential for wheat, oats, and grain sorghum is medium. Crop residue left on or near the surface helps prevent water erosion and conserve moisture. Contour farming and terracing are needed in most areas to prevent water erosion.

Potential for most urban or recreational uses is medium. Low strength, shrinking and swelling with changes in moisture, slow permeability, and the clay subsoil are the main limitations. Capability subclass IIIe; Light Sandy Loam range site.

35—Truce-Owens complex, 5 to 20 percent slopes. This is a complex of sloping to moderately steep soils on uplands, mainly on a mass of low hills or in narrow bands along hillsides. Slopes are convex and average about 12 percent. Areas are irregularly shaped to elongated and range from 15 to several hundred acres.

Truce soils make up about 49 percent of the complex; Owens soils, about 22 percent; and other associated soils, about 29 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Truce soils, which are sloping and strongly sloping, are on side slopes. They have a surface layer of very friable, pale brown, neutral stony fine sandy loam about 3 inches thick. The subsurface layer is very friable, light yellowish brown, neutral stony fine sandy loam that extends to a depth of 7 inches. Sandstone fragments, 1 to 15 inches across, cover about 15 percent of the surface. The subsoil is very firm, yellowish red, slightly acid clay to a depth of 14 inches; very firm, strong brown, slightly acid clay to a depth of 26 inches; and very firm, mottled strong brown and brownish yellow, neutral clay to a depth of 41 inches. The underlying material to a depth of 48 inches is pale yellow, moderately alkaline clayey shale.

Truce soils are well drained. Runoff is rapid. Permeability is slow, and available water capacity is low. The hazard of water erosion is moderate.

Owens soils, which are moderately steep to steep, are on side slopes (fig. 8). Many areas are eroded. The surface layer is very firm, calcareous, brown clay about 4 inches thick. The subsoil is firm, calcareous, grayish brown clay that extends to a depth of 18 inches. The underlying material is light gray shaly clay.

Owens soils are well drained. Runoff is rapid. Permeability is very slow, and available water capacity is low. The root zone is shallow.

Included with these soils in mapping are small areas of Bonti soils on ridgetops. Also included are soils that are similar to Exray soils on ridgetops and in steeper areas of sandstone outcrops; these shallow soils make up about 17 percent of the complex. Soils that have short, steep slopes of as much as 40 percent are common in some mapped areas.

The soils in this complex are not suitable for cultivated crops. They are used mainly as rangeland.

Potential for native range plants is medium. Rapid runoff, medium to low available water capacity, and restricted rooting depth limit forage production to moderate yields during favorable years. The climax plant community is a mixture of mid grasses, forbs, and post oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium to low.

Potential for most urban or recreational uses is low. Slope, corrosivity to uncoated steel, low strength, and the stony surface layer are difficult to overcome. Capability subclass VIIs; Truce soil in Sandstone Hills range site; Owens soil in Rocky Hills range site.

36—Ustolls-Rock outcrop association, steep. This is an association of steep soils and Rock outcrop on hillsides. Slopes range from 20 to 45 percent. Areas are mainly irregular bands 100 to 600 feet wide; they range from 25 to 250 acres (fig. 9).

Ustolls make up about 60 percent of the map unit, Rock outcrop makes up about 12 percent, and closely associated soils make up the remaining 28 percent. Some areas of Ustolls and Rock outcrop are large enough to map separately at the scale used, but since use and management are similar, separate mapping was not justified.

About two-thirds of the Ustolls part of this association is Haplustolls, and about one-third is Calciustolls. These soils are on the mid and lower parts of slopes. They formed in moderately deep, loamy colluvium over shale and soft sandstone. Loose fragments of limestone cover 3 to 50 percent of the surface; these fragments range in size from gravel to boulders 12 feet in diameter.

These soils are well drained to excessively drained. Runoff is rapid. Permeability is moderate to slow. The soils are moderately alkaline and calcareous throughout. The hazard of water erosion is high. These soils are moderate to high in natural fertility and organic matter content.

Rock outcrop is in the higher, steeper parts of the association. It consists of outcrops of fractured limestone. Boulders that have broken off the limestone caps are on the upper parts of slopes. Runoff is rapid.

Included in this association in mapping are areas of Aledo soils on ridgetops. Also included are a few areas of shallow soils that have a light colored surface layer. Erosion has cut large, deep gullies in a few places.

This association is used as rangeland and for wildlife habitat. It has medium potential for climax rangeland vegetation because of stones, steep slopes, and the restricted root zone. The climax plant community is a mixture of tall and mid grasses and few to many elm, hackberry, Texas oak, and live oak trees. Trees and shrubs commonly dominate the loamy soils, and grasses dominate the clayey soils. Management needs include proper stocking and controlled grazing.

This association has low potential for crops, pasture, or urban use. Steep slopes, stones, and shallow depth to rock are very difficult to overcome. Capability subclass VIIs; Ustolls in Steep Rocky range site; Rock outcrop not assigned to a range site.

37—Vashti fine sandy loam, 2 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Slopes are smooth and average less than 3 percent. Areas are irregularly shaped and range from 10 to 400 acres.

This soil has a surface layer of very friable, pale brown, neutral fine sandy loam about 5 inches thick. The subsurface layer is very friable, light yellowish brown, neutral fine sandy loam that extends to a depth of 10 inches. The subsoil is friable, light yellowish brown, slightly acid sandy clay loam to a depth of 19 inches; friable, yellow, neutral sandy clay loam to a depth of 27 inches; and friable, mottled light gray and yellow, neutral sandy clay loam to a depth of 31 inches. It has an abrupt boundary and rests on strongly cemented sandstone.

This soil is moderately well drained. Runoff is medium. Permeability is moderate, and available water capacity is low.

Included with this soil in mapping are small areas of Bonti and Truce soils. Also included, on foot slopes, are a few areas of soils that are similar to Vashti soils except that they have a combined surface layer and subsoil thicker than 50 inches. These included soils make up less than 25 percent of any one mapped area.

This soil can be cultivated but is used mainly as rangeland. Potential for native range plants is high The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for small grain and grain sorghum is medium. Crop residue left on or near the surface helps prevent water erosion and conserve moisture. Contour farming and terracing are needed in most areas to prevent water erosion. When cuts or excavations exceed 20 inches, there is a hazard of cutting into a bed of strongly cemented sandstone.

Potential for pasture production is medium. Improved grasses such as weeping lovegrass, Coastal bermudagrass, and Kleingrass are well suited to this soil.

Potential for most urban uses is medium. Depth to rock and shrinking and swelling with changes in moisture restrict some uses. Potential for most recreational uses is high. Slope restricts some playground uses. Capability subclass IIIe; Sandy Loam range site.

38—Venus loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands, mainly in bands along foot slopes. Slopes are slightly convex and average about 6 percent. Areas are long and narrow and range from 300 to 600 feet in width. They range from 10 to several hundred acres.

This soil has a surface layer of friable, calcareous, dark grayish brown loam about 12 inches thick. The subsoil is friable, calcareous, pale brown loam to a depth of 48 inches and friable, calcareous, light yellowish brown clay loam to a depth of 60 inches or more.

This soil is well drained. Runoff is medium. Permeability is moderate, and available water capacity is high. Natural fertility and organic matter content are moderately high. The hazard of water erosion is high.

Included with this soil in mapping are areas of Duffau soils and small areas of Sanger soils. Also included, on foot slopes, are a few areas of soils that are similar to Venus soils except that they have a dark surface layer more than 20 inches thick. Also included are a few areas of gullied soils and a few areas of soils that have slopes of 3 to 5 percent. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and a few motts of live oak trees and shrubs. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for oats and wheat is medium. Crop residue left on or near the surface helps prevent water erosion, conserve moisture, and improve soil tilth and water intake. Contour farming and terraces are needed in most areas to prevent erosion.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, weeping lovegrass, King Ranch bluestem, and Kleingrass are well suited to this soil.

Potential for most urban or recreational uses is high. Slope and low strength are the main limitations. Capability subclass IVe; Clay Loam range site.

39—Vernon clay, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands, mainly along clayey ridges. Slopes are slightly convex and average about 3 percent. Areas are irregularly shaped and range from 10 to 500 acres.

This soil has a surface layer of very firm, calcareous, reddish brown clay about 4 inches thick. The subsoil is very firm, calcareous, reddish brown clay that extends to a depth of 29 inches; concretions of calcium carbonate and pebbles of quartz are common. The underlying material is massive, mottled weak red and gray shaly clay that extends to a depth of 35 inches or more.

This soil is well drained. Runoff is rapid. Permeability is very slow, and available water capacity is low. Natural fertility and organic matter content are low.

Included with this soil in mapping are very small areas of Renfrow soils and Stoneburg soils on foot slopes. Also included are a few areas of Owens soils on the upper parts of slopes where sheet erosion has occurred. These included soils make up less than 20 percent of any one mapped area.

This soil can be cultivated, but is used mainly as rangeland. Potential for native range plants is low. The climax plant community is a mixture of mid and short grasses such as sideoats grama, meadow dropseed, and buffalograss. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is low.

Potential for wheat and oats is low. Crop residue left on or near the surface helps prevent water erosion, conserve moisture, and improve soil tilth and water intake.

Potential for pasture production is low. Improved grasses such as King Ranch bluestem are suited.

Potential for most urban or recreational uses is low. Low strength, shrinking and swelling upon wetting and drying, and the clayey surface layer are difficult to overcome. Capability subclass IVe; Shallow Clay range site.

40—Vernon-Knoco complex, 5 to 25 percent slopes, severely eroded. This is a complex of sloping to steep soils on uplands, mainly in narrow bands along hillsides. Slopes are convex and average about 12 percent. Shallow gullies, 1 to 10 feet wide and 1 to 5 feet deep, commonly dissect these areas at intervals of 10 to 100 feet. These shallow gullies have sloping sides. Areas are irregularly shaped to elongated and range from 10 to several hundred acres.

Vernon soils make up about 46 percent of the complex; Knoco soils, about 38 percent; and other associated soils, about 16 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Vernon soils, which are less sloping, are on the lower parts of slopes. They have a surface layer of very firm, calcareous, reddish brown stony clay about 5 inches thick. Sandstone fragments, 1 to 12 inches across, and rounded pebbles of quartz cover from 1 to 25 percent of the surface. The subsoil is very firm, calcareous, reddish brown clay that extends to a depth of 28 inches. The underlying material to a depth of 36 inches is very firm, calcareous, reddish brown shaly clay.

Vernon soils are well drained. Runoff is rapid. Permeability is very slow, and available water capacity is low. The root zone is moderately deep.

Knoco soils are on the middle and upper parts of slopes and in eroded areas. They have a surface layer of very firm, calcareous, reddish brown stony clay about 7 inches thick. Sandstone fragments, 3 to 24 inches across, cover 5 percent of the surface; calcareous pebbles of sandstone, siltstone, and quartz, 0.5 inch to 3 inches across, cover 70 percent of the surface. The underlying material is extremely firm, calcareous, reddish brown shaly clay to a depth of 22 inches and extremely firm, calcareous, reddish gray and light gray shale to a depth of 28 inches or more.

Knoco soils are excessively drained. Runoff is rapid. Permeability is very slow, and available water capacity is very low. The root zone is very shallow.

Included with these soils in mapping are small areas of Owens soils. Outcrops of sandstone on ridgetops make up about 5 percent of the complex.

The soils in this complex are used as rangeland and for wildlife habitat. They have low potential for rangeland vegetation because of steep slopes, the restricted root zone, and stones. The climax plant community is a mixture of short and mid grasses. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is low.

Potential for most urban or recreational uses is low. Slope, shrinking and swelling with changes in moisture, very slow permeability, low strength, and the stony or gravelly surface layer are difficult to overcome. Capability subclass VIIs; Shallow Clay range site.

41—Waurika-Renfrow complex, 0 to 1 percent slopes. This is a complex of nearly level soils on uplands, mainly along small drainageways and in depressional areas. Slopes are smooth and concave. Areas are irregularly shaped to elongated and range from 10 to 300 acres.

Waurika soils make up about 64 percent of the complex; Renfrow soils, about 25 percent; and other closely associated soils, about 11 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Waurika soils are in slightly concave areas. They have a surface layer of friable, grayish brown, slightly acid silt loam about 11 inches thick. The subsurface layer is friable, light brownish gray, slightly acid silt loam that extends to a depth of 14 inches. The subsoil is very firm, very dark grayish brown, neutral clay to a depth of 24 inches and very firm, moderately alkaline, brown clay and silty clay to a depth of 54 inches. It is calcareous in the lower 21 inches. The underlying material is firm, calcareous, reddish brown silty clay loam.

Waurika soils are somewhat poorly drained. Runoff is slow. Permeability is very slow, and available water capacity is high. Natural fertility and organic matter content are moderate.

Renfrow soils are in plane to slightly concave areas. They have a surface layer of friable, slightly acid, grayish brown loam about 9 inches thick. The subsoil is very firm, dark grayish brown, neutral clay to a depth of 19 inches; very firm, calcareous, brown clay to a depth of 36 inches; firm, calcareous, yellowish red silty clay to a depth of 54 inches; and firm, calcareous, yellowish red silty clay loam to a depth of 65 inches or more.

Renfrow soils are well drained. Runoff is slow. Permeability is very slow, and available water capacity is high. Natural fertility and organic matter content are moderate.

Included with these soils in mapping are small areas of Anocon soils. Anocon soils make up less than 15 percent of any one mapped area.

The soils in this complex can be cultivated, but are used mainly as rangeland. Potential for native range plants is medium. The climax plant community is a mixture of mid grasses such as sideoats grama, blue grama, meadow dropseed, and silver bluestem. There are also small areas of short and tall grasses. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for wheat and grain sorghum is medium. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity.

Potential for pasture production is medium. Improved grasses such as King Ranch bluestem, Coastal bermudagrass, Kleingrass, and weeping lovegrass are suited to the soils in this complex.

The soils in this complex have low potential for most urban and recreational uses. Shrinking and swelling with changes in moisture, low strength, very slow permeability, and wetness are the main limitations. Capability subclass IIw; Claypan Prairie range site.

42—Windthorst loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping soil is in slightly convex areas on uplands. Slopes are smooth and average about 2 percent. Areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of very friable, brown, slightly acid loamy fine sand about 4 inches thick. The subsurface layer is very friable, light brown, slightly acid loamy fine sand that extends to a depth of 10 inches. The upper part of the subsoil is firm, red, medium acid sandy clay that extends to a depth of 32 inches; it has pale brown mottles in the lower 14 inches. The lower part of the subsoil is firm, light red, neutral sandy clay that has brown and light gray mottles. It extends to a depth of 51 inches. The underlying material, to a depth of 60 inches or more, is friable, calcareous, massive, light gray clay loam.

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is medium.

Included with this soil in mapping are small areas of Duffau and Chaney soils. Also included are a few areas of soils that have slopes of more than 5 percent. There are small eroded areas in most old cultivated fields, and sheet erosion by wind and water occurs on the upper parts of slopes and in convex areas. These eroded areas have a thin surface layer of loamy fine sand that is redder than the surface layer in uneroded areas because some material from the subsoil has been mixed into it by tillage. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland or pastureland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential is high for peanuts and medium for grain sorghum. Crop residues left on or near the surface help conserve moisture, control soil blowing, and maintain tilth. Contour farming and terracing are needed in most areas to prevent water erosion. Peaches, apples, and melons are well suited to the soil.

Potential for pasture production is high. Improved grasses such as Coastal bermudagrass, weeping lovegrass, and Kleingrass are well suited to this soil.

Potential for most urban or recreational uses is medium. Shrinking and swelling upon wetting and drying, low strength, and the sandy surface layer are the main limitations. Capability subclass IIIe; Loamy Sand range site.

43—Windthorst fine sandy loam, 2 to 5 percent slopes. This deep, gently sloping soil is in slightly convex areas on uplands. Slopes are smooth and average about 3 percent. Areas are irregularly shaped and range from 10 to several hundred acres.

This soil has a surface layer of very friable, grayish brown, mildly alkaline fine sandy loam about 5 inches thick. The subsurface layer is very friable, very pale

brown, neutral fine sandy loam that extends to a depth of 10 inches. The subsoil is firm, yellowish red, slightly acid sandy clay to a depth of 21 inches; firm, mottled red and reddish yellow, medium acid sandy clay to a depth of 36 inches; and firm, reddish yellow, slightly acid sandy clay loam to a depth of 55 inches. The underlying material is firm, light gray, moderately alkaline clay loam that extends to a depth of 60 inches or more (fig. 10).

This soil is moderately well drained. Runoff is medium. Permeability is moderately slow, and available water capacity is high.

Included with this soil in mapping are areas of Duffau and Chaney soils. Also included are a few areas of soils that have slopes of less than 2 percent. There are small eroded areas in most old cultivated fields, and sheet erosion occurs on the upper parts of slopes and in convex areas. These eroded areas have a thinner surface layer of fine sandy loam that is redder than the surface layer in uneroded areas because some material from the subsoil has been mixed into it by tillage. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland and pastureland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for pasture production is medium. Improved grasses such as King Ranch bluestem, Kleingrass, weeping lovegrass, and Coastal bermudagrass are well suited to this soil.

Potential for peanuts, grain sorghum, and oats is medium. Crop residue left on or near the surface help conserve moisture, control soil blowing, and maintain tilth. Terraces and contour farming help control water erosion. Peaches and apples are also well suited to the soil.

Potential for most urban or recreational uses is medium. Low strength, shrinking and swelling with changes in moisture, and the clayey subsoil are the main limitations. These limitations can be overcome by good design and careful installation procedures. Capability subclass IIIe; Sandy Loam range site.

44—Windthorst fine sandy loam, 5 to 8 percent slopes. This deep, sloping soil is on uplands. Slopes are slightly convex and average about 6 percent. Areas are irregularly shaped to long and narrow and range from 10 to several hundred acres.

This soil has a surface layer of very friable, dark grayish brown, neutral fine sandy loam about 4 inches thick. The subsurface layer is very friable, very pale brown, slightly acid fine sandy loam that extends to a depth of 8 inches. The subsoil is firm, red, medium acid sandy clay to a depth of 21 inches; firm, reddish yellow, neutral sandy clay to a depth of 30 inches; and firm, reddish yellow and light gray, moderately alkaline clay loam to a depth of 46 inches. The underlying material is massive, light gray, moderately alkaline clay loam.

This soil is moderately well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is medium. The hazard of water erosion is high.

Included with this soil in mapping are areas of Duffau soils. There are small gullied areas in most old cultivated fields, and sheet erosion occurs on the upper parts of slopes and in convex areas. These eroded areas have a thin surface layer of fine sandy loam that is redder and contains more clay than the surface layer in uneroded areas because material from the subsoil has been mixed with it by tillage. Also included are a few areas of soils that have a sandy surface layer. These included soils make up less than 20 percent of any one mapped area.

This soil is suitable for cultivated crops, but is used mainly as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for peanuts, grain sorghum, and oats is medium. Crop residue left on or near the surface helps conserve moisture and maintain tilth. Terraces and contour farming help control water erosion.

Potential for pasture production is medium. Improved grasses such as Coastal bermudagrass, weeping lovegrass, King Ranch bluestem, and Kleingrass are well suited to this soil.

Potential for most urban or recreational uses is medium. Low strength, shrinking and swelling with changes in moisture, slope, and the clayey subsoil are the main limitations. Capability subclass IVe; Sandy Loam range site.

45—Windthorst and Duffau soils, 2 to 8 percent slopes, severely eroded. This is an undifferentiated unit of gently sloping to sloping, eroded soils on uplands. Slopes are slightly convex and average about 5 percent. Gullies, 1 to 25 feet wide and 2 to 10 feet deep, commonly dissect these areas at intervals of 10 to 100 feet. Gullies in the Duffau soils, which are downslope from Windthorst soils, are deep and have vertical sides; gullies in the Windthorst soils are shallower and wider and have sloping sides. Windthorst soils have lost most of their surface layer through erosion; Duffau soils have lost only a part of the surface layer between the gullies. Soil areas are irregularly shaped and range from 8 to 125 acres.

Windthorst soils make up about 56 percent of this map unit; Duffau soils, about 33 percent; and other closely associated, severely eroded soils, about 11 percent. Most mapped areas contain both soils, but in a few areas one or the other is not present. The composition of this map unit is more variable than that of others in the county. Mapping has been controlled well enough, however, for the expected use of the soils involved.

Windthorst soils in this map unit are on the upper, convex parts of slopes. They have a surface layer of friable, slightly acid, dark grayish brown fine sandy loam about 4 inches thick. The subsoil is very firm, dark red, medium acid heavy sandy clay to a depth of 26 inches and firm,

yellowish red, slightly acid sandy clay loam to a depth of 55 inches. The underlying material is massive, very pale brown sandy clay.

Windthorst soils are well drained. Runoff is rapid. Permeability is moderately slow, and available water capacity is medium. The hazard of water erosion is high.

Duffau soils are on the lower parts of slopes. They have a surface layer of friable, dark brown, slightly acid fine sandy loam about 6 inches thick. The subsoil to a depth of 60 inches is friable, yellowish red, slightly acid sandy clay loam.

Duffau soils are well drained. Runoff is medium. Permeability is moderate, and available water capacity is medium. The hazard of water erosion is high.

Included with these soils in mapping are small areas of severely eroded Chaney and Selden soils. Included soils make up less than 20 percent of any one mapped area.

The soils in this map unit are not suitable for cultivated crops. They are used mainly as rangeland or for wildlife habitat.

Potential for native range plants is medium. Forage production is limited by the rapid runoff and by the surface layer of clay in gullied areas. The climax plant community is a mixture of tall and mid grasses, forbs, and oak trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is medium.

Potential for pasture production is medium. Soil areas to be reclaimed need to be shaped and sodded to improved grasses such as Coastal bermudagrass.

These soils have low potential for most urban or recreational uses. Low strength, shrinking and swelling with changes in moisture, and gullied areas are the main limitations. Capability subclass VIe; Sandy Loam range site.

46—Yahola-Gaddy complex, occasionally flooded. This is a complex of nearly level soils on flood plains along the Red River. Slopes are smooth and range from 0 to 1 percent. Most of these soils are subject to flooding about once every 3 to 10 years, but some of the higher areas are rarely flooded. These areas are subject to undercutting by the river. Areas are mostly long and narrow but widen in the bends of the flood plains. They range from 20 to 600 acres.

Yahola soils make up about 42 percent of the complex; Gaddy soils, about 40 percent; and other closely associated soils, about 18 percent. These soils are so intricately mixed that separate mapping was not practical at the scale used.

Yahola soils are in plane to slightly concave areas. They have a surface layer of very friable, calcareous, reddish brown fine sandy loam about 8 inches thick. The underlying material to a depth of 50 inches is very friable, calcareous fine sandy loam that has thin strata of silt loam and loamy fine sand throughout. It is reddish yellow to a depth of 44 inches and pink below.

Yahola soils are well drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is medium. The root zone is deep and easily penetrated by plant roots.

Gaddy soils are in plane to slightly convex areas. Gaddy soils make up a higher percentage of this mapping unit at slightly lower elevations adjacent to the river channel than in higher areas. They have a surface layer of very friable, calcareous, reddish yellow fine sandy loam about 9 inches thick. The underlying material to a depth of 60 inches is very friable, calcareous, light brown loamy fine sand that has a few thin strata of reddish brown clay loam throughout.

Gaddy soils are somewhat excessively drained. Runoff is slow. Permeability is moderately rapid, and available water capacity is low. The root zone is deep and easily penetrated by plant roots.

Included with these soils in mapping are areas of more clayey soils; these soils have texture of clay loam. They are in depressional areas and make up about 18 percent of the mapped area. Gaddy soils that have a surface layer of loamy fine sand make up as much as 10 percent of any mapped area; these soils are on slight ridges. Narrow areas between different levels of the flood plains have slopes of more than 1 percent.

These soils are suitable for cultivated crops but are mainly used as rangeland. Potential for native range plants is high. The climax plant community is a mixture of tall and mid grasses, forbs, and scattered shrubs and trees. Management needs include proper stocking, controlled grazing, and brush management. Potential for wildlife habitat is high.

Potential for wheat, forage sorghum, alfalfa, and grain sorghum is medium. Crop residue left on or near the surface helps conserve moisture and maintain tilth and productivity. Pecans are well suited to the soil.

Potential for pasture production is high. Improved grasses, such as Coastal bermudagrass and Kleingrass, are well suited to the soils in this complex (fig. 11).

These soils have low potential for most urban uses. Flooding is a severe limitation and is very difficult to overcome. Potential for most recreational uses is medium. Capability subclass IIw; Yahola soil in Loamy Bottomland range site, Gaddy soil in Sandy Bottomland 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 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 as sites for buildings, highways and other transportation systems, sanitary facilities, parks and other recreation facilities, and 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

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the needed management practices. 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.

More than 118,620 acres in the survey area were used for crops and pasture in 1967 (4). Of this total, 33,765 acres were used for permanent pasture; 18,659 acres, for row crops; 9,774 acres, for close-grown crops, mainly wheat and oats; 444 acres, for rotation hay and pasture; and the rest was idle cropland.

The potential of the soils in Montague County for increased production of food is high. Many thousand acres of potentially good cropland is currently used as rangeland and pasture. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the county. This soil survey can greatly facilitate the application of such technology.

Soil erosion is the major soil concern on nearly all of the cropland that has slope of more than 2 percent. Water erosion is a hazard on Bolar, Bonti, Chaney, Truce, and Windthorst soils, for example, which have slopes of 2 to 5 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Chaney, Renfrow, Truce, and Windthorst soils, and on soils that have a layer of bedrock that limits the depth of the root zone. Shallow and moderately deep soils that are underlain by bedrock include Hensley, Bolar, Bonti, Lindy, Stoneburg, and Vashti soils. Erosion also reduces productivity on soils that tend to be droughty, such as Renfrow loam and Vernon clay. Second, soil erosion on farmland results in sedimentation. Control of erosion minimizes sedimentation and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils.

Management of residue is an effective practice. A good litter of crop residue kept on the surface protects the soil against packing rains, reduces crusting, decreases runoff, and reduces evaporation of soil moisture. It shades the soil and thus reduces soil temperature. In addition, it adds organic matter to the soil, improves the tilth of the surface soil, and reduces packing by farm machinery. Crop residue should be protected from grazing and burning. Tillage equipment that keeps residue on the surface should be used.

Minimum tillage for grain sorghum, which is common on an increasing acreage, is effective in reducing erosion on sloping land and can be adapted to most soils in the survey area.

Terraces farmed on the contour reduce the length of the slope and reduce runoff and erosion. They are most practical on deep and moderately deep, clayey and loamy soils that have slopes of more than 1 percent.

Soil blowing is a hazard on the sandy Duffau, Selden, Eufaula, and Patilo soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are

dry and bare of vegetation or surface mulch. Stripcropping, vegetative cover, or surface mulch minimizes soil blowing on these soils. Most crops provide adequate cover during the growing season, but do not leave enough residue for soil protection and improvement. Such crops as peanuts need to be followed by a cover crop such as rye and vetch.

Information for the design of erosion control practices for each kind of soil is contained in the Technical Guide, available in local offices of the Soil Conservation Service.

Soil fertility is naturally low in most soils of the uplands in the survey area. These soils are most often deficient in nitrogen and phosphorus and a few sandy soils are also deficient in potash. The soils on flood plains, such as Bosque, Gowen, and Miller soils, are naturally higher in plant nutrients than most soils on uplands.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils with good tilth are granular and porous.

Most of the soils used for crops in the survey area have a surface layer of fine sandy loam or loam that is light in color and low in content of organic matter. Generally the structure of such soils is weak, and intense rainfall causes the formation of a crust on the surface. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help improve soil structure and reduce crust formation.

The dark colored Branyon and Sanger soils are clayey, and tilth is a concern because the soils often stay wet until late spring. If they are wet when plowed, they tend to be very cloddy when dry, and good seedbeds are difficult to prepare. Fall plowing generally results in good tilth in the spring.

Field crops suited to the soils and climate of the survey area include some that are not now commonly grown. Grain sorghum and peanuts are the principal row crops. Cotton, corn, guar, soybeans, castor beans, and similar crops can be grown if economic conditions are favorable.

Wheat, oats and forage sorghum are the common close-growing crops. Rye, barley, vetch, alfalfa, and millet are also grown, and grass seed can be produced from Kleingrass, King Ranch bluestem, and weeping lovegrass.

Special crops grown commercially in the survey area are vegetables, small fruits, tree fruits, and nursery plants. A small acreage throughout the county is used for watermelons, cantaloups, sweet potatoes, sweet corn, tomatoes, peppers, and other vegetables and small fruits. In addition, other areas are adapted to other special crops such as blackberries, grapes, and many vegetables. Apples, peaches, and pecans are the most important tree fruits grown in the county.

Deep soils that have good natural drainage and that warm up early in spring are especially well suited to many vegetables and small fruits. In the survey area these are Teller, Bastrop, Chaney, Duffau, Selden, and Windthorst soils that have slopes of less than 5 percent. Timely irrigation in many years doubles the yields of most horticultural crops. Sprinkler irrigation works satisfactorily on gently sloping soils and is generally the only type suitable for the more sandy soils. Soils in low positions where frost is frequent and air drainage is poor, however, generally are poorly suited to early vegetables, small fruits, and orchards.

Latest information and suggestions for special crops can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Pasture is important in Montague County because the raising of livestock is the main farm enterprise. For the past several years, the trend has been to convert land from other uses to pasture and hay. Land used for pasture and hay usually is planted to introduced grasses that respond to good management. They are used mainly to provide year-round grazing in combination with native range and supplemental pastures.

Among the important grasses are Coastal bermudagrass, common bermudagrass, Kleingrass-75, weeping lovegrass, johnsongrass, indiangrass, switchgrass, King Ranch bluestem, and Caucasian bluestem.

Improved bermudagrass, such as Coastal bermudagrass, and Kleingrass-75 are better suited to deep soils on bottom lands, such as Pulexas, Gowen, and Bosque soils, than to other soils in the county. These two grasses, however, are adapted to most of the soils in the county where a good seedbed can be prepared. Weeping lovegrass is widely suited and provides good yields of forage on moderately coarse textured and coarse textured soils on uplands, such as Bonti, Truce, Windthorst, Chaney, and Duffau soils. King Ranch bluestem and Caucasian bluestem, two drought-resistant grasses, are well suited to such soils as Renfrow loam and Waurika silt loam.

Good management practices for pasture include fertilization, rotational grazing to maintain proper grazing heights of forage, weed and brush management, and an adequate water supply. Good management practices for hay include fertilization and cutting the forage at the correct height and at the proper stage of growth.

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 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil.

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

The yields were estimated assuming that the latest soil and crop management practices were used. Pasture yields were estimated for improved varieties of bermudagrass,

such as Coastal bermudagrass. A few farmers may be obtaining average yields higher than those shown in table 4.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides erosion control and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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

Crops other than those shown in table 4 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 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 or for engineering purposes.

In the capability system, all kinds of soil are grouped at three levels: capability class, subclass, and unit. Capability classes and subclasses 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; they are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is indicated in table 5. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture, for example, soils in capability classes I and II, may be in low-intensity use. Data in this table can be used to determine the farming potential of such soils.

The capability subclass is identified in the description of each soil map unit in the section "Soil maps for detailed planning."

Rangeland

GARY K. WESTMORELAND, range specialist, Soil Conservation Service, helped plan and write this section.

About 75 percent of Montague County, or 433,000 acres, is rangeland. More than 80 percent of the agricultural income is derived from livestock, principally cattle, and the primary source of forage for these livestock is rangeland. Income from wildlife and other recreational enterprises on rangeland is becoming increasingly important.

Most ranches are cow-calf operations, though stocker steers make up a significant percentage of many herds. Several ranches specialize in breeding and selling purebreds and crossbreeds.

On many ranches the forage produced on rangeland is supplemented by tame pastures, crop stubble, and small grain. In winter the native forage is often supplemented with protein concentrate. Creep feeding of calves and yearlings to increase market weight is practiced on some ranches.

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 mesquite brush, weeds, and cactus. 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 soils and for specific range sites.

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 6 shows, for each kind of soil, the name of the range site; the potential production of vegetation in favorable, normal, and unfavorable years; the common plant names; 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 6.

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.

Potential 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.

Common plant names are given for the grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil. 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, an evaluation of the present condition of the 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.

In the western and northwestern parts of the county, the rangeland is generally an open grassland prairie. The soils are loamy and deep or moderately deep and have a subsoil of clay loam or clay. These soils support tall and mid grasses, and potential productivity is medium to high. In much of the central and eastern parts of the county, the rangeland is generally an oak savannah rangeland, commonly called West Cross Timbers. The soils are deep, loamy or sandy, and have a subsoil of sandy clay or sandy clay loam. These soils support post oak and blackjack oak trees and tall grasses such as little bluestem, big bluestem, and indiangrass. The potential productivity is high.

The major management concern on most of the rangeland is the control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. 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 for increasing the productivity of range in the area is good (fig. 12).

Engineering

ROBERT C. BROWN, engineer, Soil Conservation Service, helped plan and write 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 section 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, and the likelihood of flooding. 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 7 shows, for each kind of soil, the degree and kind of limitations for building site development; table 8, for sanitary facilities; and table 10, for water management. Table 9 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 7. A *slight* limitation indicates that soil properties are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

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

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

Dwellings and *small commercial buildings* referred to in table 7 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence from settling or shear failure of the foundation 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, 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 limitation.

Local roads and streets referred to in table 7 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, and shrink-swell potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones 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 8 shows the degree and kind of limitations of each soil for such uses and the degree of suitability 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.

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 may 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 could be installed or the size of the absorption field could 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 high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soils affect the performance of embankments.

Sanitary landfill refers to 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 thin layers of soil. 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 may 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.

In the trench type of landfill, ease of excavation also affects the suitability of a soil for this purpose, so the soil must be deep to bedrock and free of large stones and boulders. Where the seasonal water table is high, water seeps into trenches and causes problems in filling.

Unless otherwise stated, the limitations in table 8 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.

In the area type of sanitary landfill, refuse is placed on the surface of the soil and covered daily with topsoil. The limitations caused by soil texture, depth to bedrock, and content of stones do not apply to this type of landfill. Soil wetness, however, can be a limitation because of difficulty in operating equipment.

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 9 by ratings of good, fair, poor, or unsuited. 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 13 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 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 9 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 13.

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 10 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.

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

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

The information in table 11 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 8, and interpretations for dwellings without basements and for local roads and streets, given in table 7.

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

Wildlife resources are important in Montague County as a source of recreation and income. Deer, turkey, quail, dove, squirrel, and rabbit are the main kinds of wildlife in the county. Important furbearers include racoon, fox, bobcat, skunk, and opossum. Ducks and geese are attracted to lakes and ponds during migration. Most farm ponds and flood prevention lakes are stocked with channel catfish, black bass, and sunfish.

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. If any one of these elements is missing, inadequate, or 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 12, 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. Examples are corn, wheat, oats, and barley. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Examples are Kleingrass, lovegrass, johnsongrass, and alfalfa. 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. Examples are bluestem, indiangrass, western wheatgrass, partridgepea, and ragweed. 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.

Shrubs and the associated trees and vines produce fruit, buds, twigs, bark, or foliage used by wildlife and provide cover and shade for some species of wildlife. Examples of native shrubs and vines include skunkbush, greenbrier, roughleaf dogwood, grape, and sumac; examples of hardwood trees include post oak, blackjack oak, live oak, elm, and hawthorn. Major soil properties that affect the growth of shrubs and trees are depth of the root zone, available water capacity, salinity, and moisture.

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. Examples of wetland plants are smartweed, wild millet, rushes, sedges, and reeds. 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 devices in marshes or streams. Examples are waterfowl feeding areas and ponds. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed.

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

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

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

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include white-tailed deer, bobcat, coyote, raccoon, skunk, meadowlark, and lark bunting.

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 classification, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 13 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 13 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 13 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 13. Also in table 13 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. Ranges in

liquid limit and plasticity index are estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

In some surveys, the estimates are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterburg limits extend a marginal amount across classification boundaries (1 or 2 percent), the classification in the marginal zone is omitted in table 13.

Physical and chemical properties

Table 14 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 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.

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

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment (*6*). 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 15 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 to deep, moderately well drained to 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 rainfall or snowmelt and water in swamps and marshes is not considered flooding. 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 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 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 soil mapping. 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.

Classification of the soils

In this section, the soil series recognized in the survey area are described, the current system of classifying soils is defined, and the soils in the area are classified according to the current system.

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 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(*5*). Unless otherwise noted, colors described are for dry 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."

Aledo series

The Aledo series consists of shallow, gravelly soils that formed over fractured limestone bedrock. Slope ranges from 1 to 20 percent, but is dominantly 1 to 8 percent.

Typical pedon of Aledo gravelly clay loam, 1 to 8 percent slopes; from the intersection of Farm Road 455 and Farm Road 922 in Forestburg, about 5.6 miles southeast of Farm Road 922 to its intersection with county road; 1 mile southwest and 0.6 mile southeast on county road; and 27 feet northeast of county road right-of-way in native grass pasture:

A11—0 to 5 inches; dark grayish brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; many fine roots; many worm casts; about 30 percent by volume limestone gravel 1/2 inch to 3 inches in diameter; calcareous; moderately alkaline; clear irregular boundary.

A12—5 to 14 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; many fine roots; many worm casts; about 75 percent by volume limestone fragments mostly less than 6 inches across the long axis; calcareous; moderately alkaline; abrupt wavy boundary.

R—14 to 18 inches; indurated limestone that is fractured.

The solum ranges from 8 to 20 inches in thickness over fractured limestone bedrock. Average content of limestone fragments ranges from 5 to 50 percent in the A11 horizon and from 40 to 80 percent in the A12 horizon. The calcium carbonate equivalent ranges from 40 to 80 percent.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, dark brown, or brown. The A12 horizon is gravelly loam, gravelly clay loam, very gravelly loam, or very gravelly clay loam.

Anocon series

The Anocon series consists of deep, loamy soils on uplands. These soils formed in materials weathered from sandstone and shaly clay. Slope ranges from 1 to 5 percent.

Typical pedon of Anocon fine sandy loam in an area of Anocon-Stoneburg association, undulating; from the intersection of Farm Road 103 and Farm Road 1759 in Nocona, about 5.6 miles west and north on Farm Road 1759 to its intersection with county road; 0.3 mile east on county road; 0.25 mile southeast on pasture road; and 12 feet north of pasture road:

A1—0 to 16 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable; many fine roots; many fine pores; common worm casts; slightly acid; gradual smooth boundary.

B21t—16 to 26 inches; reddish brown (5YR 4/4) sandy clay, dark reddish brown (5YR 3/4) moist; common fine distinct mottles of yellowish red; moderate fine and medium subangular blocky structure; very hard, very firm; many fine roots; thin clay films; few black concretions; neutral; gradual smooth boundary.

B22t—26 to 39 inches; brown (7.5YR 5/4) sandy clay, dark brown (7.5YR 4/4) moist; common fine faint mottles of reddish yellow; coatings on peds are brown (10YR 5/3); strong medium blocky structure; very hard, very firm; common fine roots; thin continuous clay films; few black concretions; noncalcareous; moderately alkaline; gradual smooth boundary.

B3t—39 to 65 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 5/6) moist; few fine faint mottles of light brownish gray; coatings on peds are reddish brown (5YR 5/3); moderate medium subangular blocky structure; very hard, firm; few fine roots; common fine pores; few thin patchy clay films; common black concretions; few weakly cemented medium masses of calcium carbonate; common threads and films of fine gypsum crystals in lower part; calcareous; moderately alkaline.

Solum thickness ranges from 60 to more than 80 inches.

The A horizon is dark grayish brown, grayish brown, or brown. It is slightly acid or neutral.

The B1t horizon, where present, is brown loam or sandy clay loam. The B2t horizon is sandy clay, clay loam, or clay and has clay content of 35 to 50 percent. It has few to common reddish, yellowish, or brownish mottles; in places below a depth of 30 inches it has a few gray or grayish brown mottles. The B21t horizon is reddish brown, brown, or yellowish brown. It is slightly acid or neutral. The B22t horizon is reddish yellow, brown, or yellowish brown. It is slightly acid through mildly alkaline. The B3t horizon is yellowish red, reddish yellow, brown, or yellowish brown and has mottles similar in color to the B22t horizon. It is neutral through moderately alkaline. Fragments of sandstone are in some pedons in the form of discontinuous remnant stone lines.

Bastrop series

The Bastrop series consists of deep, loamy soils on uplands. These soils formed in geologic terrace materials, mostly along the Red River. Slope ranges from 2 to 8 percent.

Typical pedon of Bastrop loam, 2 to 5 percent slopes; from the intersection of Farm Road 2849 and Farm Road 103 at Prairie Valley, about 3.3 miles north and east on Farm Road 103 to its intersection with county road; 0.5 mile east and 0.5 mile north on county road; 340 feet east of county road on field road; and 20 feet north of field road in native pasture:

A1—0 to 7 inches; brown (7.5YR 5/2) loam, dark brown (7.5YR 4/2) moist; moderate very fine subangular blocky structure; slightly hard, very friable; many fine roots; many worm casts; few fine siliceous pebbles; slightly acid; gradual smooth boundary.

B21t—7 to 30 inches; red (2.5YR 5/6) loam, reddish brown (2.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; common fine pores; many worm casts; common thin patchy clay films; few fine siliceous pebbles; slightly acid; diffuse smooth boundary.

B22t—30 to 61 inches; red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine pores; common thin clay films; few fine siliceous pebbles; neutral; gradual smooth boundary.

B3t—61 to 70 inches; light red (2.5YR 6/6) loam, red (2.5YR 5/6) moist; moderate medium subangular blocky structure; hard, friable; few fine roots; few fine pores; few thin clay films; few weakly cemented concretions of calcium carbonate; few very fine pockets of uncoated sand grains; few fine siliceous pebbles; calcareous; moderately alkaline.

The solum ranges from 60 to about 90 inches in thickness. Small siliceous pebbles make up from none to 15 percent, by volume, of the soil.

The A horizon is brown, reddish brown, or yellowish brown. It is slightly acid or neutral.

The B2t horizon is red, reddish brown, yellowish red, or reddish yellow loam, clay loam, or sandy clay loam. It is slightly acid through mildly alkaline. The B3t horizon is light red or reddish yellow and is mildly alkaline or moderately alkaline.

Bolar series

The Bolar series consists of moderately deep, calcareous, loamy soils that formed over limestone bedrock. Slope ranges from 2 to 8 percent.

Typical pedon of Bolar clay loam, 2 to 5 percent slopes; from the intersection of Farm Road 455 and Farm Road 1655 in Forestburg, about 4.2 miles southeast on Farm Road 455 to its intersection with county road; 0.7 mile east on county road; and 100 feet north of county road right-of-way in native grass pasture:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, friable; many fine roots; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21ca—9 to 15 inches; grayish brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; moderate very fine subangular blocky structure; hard, friable; many fine roots; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—15 to 23 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate very fine subangular blocky structure; hard, friable; common fine roots; common fine concretions of calcium carbonate; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—23 to 27 inches; pale brown (10YR 6/3) very gravelly clay loam, brown (10YR 5/3) moist; moderate very fine subangular blocky structure; hard, friable; few fine roots; estimated 60 percent by volume weakly cemented fragments of limestone from 0.2 inch to 3 inches in diameter; common fine soft masses of calcium carbonate; common worm casts; calcareous; moderately alkaline; abrupt smooth boundary.

R—27 to 30 inches; fractured limestone bedrock.

The solum ranges from 20 to 40 inches in thickness. Limestone fragments of gravel to stone size in the solum range from a few to 30 percent, by volume. Calcium carbonate content of the control section is 40 to 75 percent.

The A horizon is brown, dark grayish brown, or grayish brown clay loam or stony clay loam.

The B2ca horizon is brown, grayish brown, pale brown, or very pale brown loam, clay loam, or silty clay loam. Noncarbonate clay content ranges from 20 to 35 percent.

The R layer is fractured limestone that is interbedded with calcareous, clayey marl.

Bonti series

The Bonti series consists of moderately deep, loamy soils that are clayey in the lower part. These soils are on uplands. They formed in interbedded sandstone and clays. Slope ranges from 2 to 20 percent.

Typical pedon of Bonti fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 1806 and Texas Highway 59 in Montague, about 4.8 miles west on Farm Road 1806 to its intersection with county road; 0.5 mile south on county road; and 15 feet west of county road right-of-way in native grass pasture:

A1—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, very friable; many fine roots; slightly acid; clear smooth boundary.

A2—5 to 8 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, very friable; common fine roots; few round siliceous pebbles; slightly acid; clear smooth boundary.

B21t—8 to 19 inches; yellowish red (5YR 5/6) sandy clay, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; very hard, firm; common fine roots and few tree roots; common thin clay films on faces of peds; few sandstone pebbles less than 25 mm in diameter; strongly acid; gradual smooth boundary.

B22t—19 to 29 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; common fine distinct strong brown mottles; moderate fine subangular blocky structure; very hard, firm; few fine roots; common thin clay films on faces of peds; few thin layers of sandstone fragments about 4 inches in diameter in lower part; strongly acid; abrupt boundary.

R—29 to 32 inches; brownish yellow, strongly cemented sandstone.

The solum ranges from 20 to 40 inches in thickness over sandstone. Sandstone fragments vary in amount from none to about 30 percent, by volume, and in size from 0.5 inch to 24 inches in diameter.

The A1 horizon is brown, grayish brown, or light brown fine sandy loam or stony fine sandy loam. It is medium acid through neutral. The A2 horizon is pale brown, light brown, or reddish yellow. It is slightly acid or neutral.

The B21t horizon is yellowish red, reddish brown, or red. The B22t horizon is yellowish red, reddish brown, brown, or strong brown. The B2t horizon is clay, clay loam, or sandy clay and has clay content of 35 to 45 percent. It is medium acid or strongly acid.

The underlying sandstone is strongly cemented and is interbedded with clay.

Bosque series

The Bosque series consists of deep, loamy soils on flood plains. These soils formed in calcareous alluvial sediments. Slope ranges from 0 to 1 percent.

Typical pedon of Bosque loam, occasionally flooded; from the intersection of Texas Highway 59 and U.S. Highway 82 at Saint Jo, about 3.2 miles southwest on Texas Highway 59 to its intersection with county road; 1.7 miles northwest on county road; and 75 feet north of county road right-of-way in pasture:

A1—0 to 22 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; hard, friable; many fine roots; common fine pores; common worm casts; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

B21—22 to 44 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores; common fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

B22—44 to 65 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; few fine faint yellowish brown mottles; weak fine subangular blocky structure; hard, friable; many threads and films of calcium carbonate; common fine concretions of calcium carbonate; calcareous; moderately alkaline.

The 10- to 40-inch control section is loam or clay loam; clay content ranges from 20 to 35 percent.

The A horizon is dark grayish brown, brown, or very dark grayish brown. It ranges from 20 to 50 inches in thickness.

The B2 horizon is brown, pale brown, or yellowish brown loam or clay loam. Lenses of fine sandy loam are in some pedons.

Branyon series

The Branyon series consists of deep, clayey soils on uplands. These soils formed in ancient alluvium or outwash materials. Slope ranges from 1 to 3 percent.

Typical pedon of Branyon silty clay, 1 to 3 percent slopes; from the intersection of Texas Highway 59 and U.S. Highway 82 at Saint Jo, about 5.2 miles southwest on Texas Highway 59 to intersection with oilfield road; 2.0 miles south on oilfield road; 0.4 mile west and north of oil tanks on field road to pond dam; and 120 feet north of pond dam in a microhigh in native grass pasture:

A11—0 to 33 inches; very dark gray (10YR 3/1) silty clay, black (10YR 2/1) moist; moderate fine angular blocky structure; very hard, very firm; many fine roots; few fine snail fragments and few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A12—33 to 48 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; coarse intersecting slickensides and parallelepipeds; common fine roots; few fine snail fragments and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A13—48 to 65 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; common fine faint mottles of yellowish brown (10YR 5/4); weak medium angular blocky structure; few intersecting slickensides; few fine strongly and weakly cemented concretions of calcium carbonate; few fine black concretions; calcareous; moderately alkaline.

The solum ranges from 60 to more than 100 inches in thickness. When the soil is dry, cracks 1 to 3 inches wide extend from the surface to a depth of 20 to 50 inches or more. The A horizon is very dark gray or dark gray.

The AC horizon, where present, is gray, grayish brown, light brownish gray, or light yellowish brown and contains few to common distinct brownish or yellowish mottles. It is clay or silty clay, and limestone pebbles make up as much as 10 percent, by volume, of the horizon.

Chaney series

The Chaney series consists of deep soils on uplands. These soils have a sandy surface layer and a clayey subsoil. They formed in materials weathered from shaly clay and soft sandstone. Slope ranges from 2 to 5 percent.

Typical pedon of Chaney loamy fine sand, 2 to 5 percent slopes; from the intersection of Farm Road 1749 and Texas Highway 114 in Sunset, about 5.5 miles northwest

on Texas Highway 114 to its intersection with county road; 0.3 mile southeast on county road to intersection with paved road; 300 feet south on paved road; and 25 feet east of road right-of-way in cultivated peach orchard:

Ap—0 to 6 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 4/3) moist; single grained; loose; few fine roots; common fine siliceous pebbles; slightly acid; abrupt smooth boundary.

A2—6 to 10 inches; very pale brown (10YR 7/3) loamy fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; few fine roots; common fine siliceous pebbles; slightly acid; abrupt smooth boundary.

B21t—10 to 23 inches; reddish yellow (7.5YR 6/6) sandy clay, strong brown (7.5YR 5/6) moist; common fine distinct red mottles; moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine siliceous pebbles; medium acid; clear wavy boundary.

B22t—23 to 47 inches; mottled reddish yellow (7.5YR 6/8) and light gray (10YR 6/1) sandy clay, strong brown (7.5YR 5/8), and light gray (10YR 6/1) moist; common medium prominent red (2.5YR 4/8) mottles; moderate coarse subangular blocky structure; very hard, firm; few fine roots; few fine siliceous pebbles; medium acid; gradual wavy boundary.

C—47 to 52 inches; mottled reddish yellow (7.5YR 6/8) and light gray (10YR 6/1) clay; massive; very hard, very firm; medium acid.

The solum ranges from 40 to 60 inches in thickness.

The A1 horizon is brown, pale brown, light brownish gray, or grayish brown. It is medium acid, slightly acid, or neutral. The A2 horizon is pale brown or very pale brown. Cultivation usually mixes the A1 and A2 horizons.

The B2t horizon is red, reddish brown, reddish yellow, yellowish red, yellowish brown, or brownish yellow. It contains few to many mottles of shades of red, brown, yellow, gray, and olive. The B2t horizon is sandy clay or clay and is medium acid or slightly acid.

The C horizon ranges from sandy clay loam to shaly clay. Some pedons have weakly cemented, discontinuous sandstone layers in the C horizon. The C horizon is medium acid through mildly alkaline.

Cona series

The Cona series consists of moderately deep, stony soils on uplands. These soils formed in materials weathered from interbedded shaly clays. Slope ranges from 5 to 25 percent.

Typical pedon of Cona stony sandy loam in an area of Cona association, hilly; from the intersection of State Highway ll4 and Farm Road 1749 in Sunset, about 3.5 miles northwest on State Highway 114 to intersection with county road; 0.4 mile northeast and 0.1 mile southeast on county road; and 10 feet west of county road right-of-way in a wooded pasture:

A1—0 to 4 inches; brown (10YR 5/3) stony sandy loam, brown (10YR 4/3) moist; weak very fine subangular blocky structure; soft, very friable; many fine roots; about 5 percent by volume rounded quartz pebbles; about 15 percent surface cover of partially rounded conglomerate sandstone fragments and stones 3 to 20 inches across long axis and few stones embedded in horizon; neutral; clear wavy boundary.

A2—4 to 8 inches; very pale brown (10YR 7/4) stony sandy loam, light yellowish brown (10YR 6/4) moist; structureless; soft, very friable; many fine roots; about 15 percent by volume rounded quartz pebbles and about 25 percent by volume partially rounded conglomerate sandstone fragments and stones; neutral; abrupt wavy boundary.

B21t—8 to 17 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; common medium distinct mottles of reddish yellow (7.5YR 6/6); moderate medium subangular blocky structure; very hard, very firm; common fine roots; thin continuous clay films; few pockets of clean sand grains; about 5 to 10 percent by volume rounded quartz pebbles; strongly acid; clear wavy boundary.

B22t—17 to 27 inches; mottled red (2.5YR 4/6) and reddish yellow (7.5YR 6/6) clay, dark red (2.5YR 3/6), and strong brown (7.5YR 5/6) moist; moderate medium blocky structure; very hard, very firm; common fine roots; few rounded quartz pebbles; thin continuous clay films; few pockets of clean sand grains; strongly acid; gradual wavy boundary.

B3t—27 to 33 inches; pale yellow (2.5Y 7/4) clay, light yellowish brown (2.5Y 6/4) moist; common fine and medium mottles of red (2.5YR 4/8) and reddish yellow (7.5YR 6/6); common fine and medium light gray (2.5Y 7/2) bodies of shale; moderate medium blocky structure; very hard, very firm; few fine roots; few rounded quartz pebbles; thin patchy clay films; strongly acid; gradual wavy boundary.

Cr—33 to 45 inches; light gray (2.5Y 7/2) shaly clay; common fine and medium distinct mottles of red (2.5YR 4/8) and strong brown (7.5YR 5/6); weak platy and blocky structure; retains part of apparent original rock structure; very hard, very firm; few fine tree roots; strongly acid.

The solum ranges from 20 to 40 inches in thickness.

The A1 horizon is brown, grayish brown, or dark grayish brown. The A2 horizon is pale brown, very pale brown, or light brown. Coarse fragments of siliceous pebbles and conglomerate sandstone make up 5 to 50 percent of the volume of the A horizon. Reaction is slightly acid through mildly alkaline.

The B21t horizon is red, yellowish red, or reddish yellow. Some pedons have mottles of reddish yellow or strong brown. The B22t and B3t horizons are mottled red, reddish yellow, yellowish red, strong brown, yellow, or light gray. The gray colors are inherited from the gray, shaly parent material.

The B2t and B3t horizons are sandy clay or clay. They are strongly acid through slightly acid. Quartz pebbles are common.

The Cr horizon is reddish, brownish, or grayish shaly clay or clay loam which retains part of the original rock structure. It is strongly acid through slightly acid.

Duffau series

The Duffau series consists of deep, loamy and sandy soils on uplands. These soils formed in loamy and sandy materials. Slope ranges from 1 to 8 percent.

Typical pedon of Duffau fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 1749 and Texas Highway 114 in Sunset, about 3.8 miles northeast on Farm Road 1749 to its intersection with county road; 2.0 miles southeast; 1.5 miles northeast to intersection with another county road; 0.1 mile southeast on county road; and 10 feet northeast of county road right-of-way in wooded pasture:

A1—0 to 5 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak very fine subangular blocky structure; slightly hard, friable; many fine roots; common worm casts; mildly alkaline; gradual smooth boundary.

A2—5 to 12 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary.

B21t—12 to 26 inches; yellowish red (5YR 5/8) sandy clay loam, dark yellowish red (5YR 4/8) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine pores; common worm holes and casts; thin patchy clay films; few fine hard black concretions; slightly acid; gradual smooth boundary.

B22t—26 to 45 inches; reddish yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; moderate coarse subangular blocky structure; hard, friable; common fine pores; common worm holes and casts; thin patchy clay films; few fine hard black concretions;

few fine pockets of clean sand grains in lower part; medium acid; gradual smooth boundary.

B23t—45 to 70 inches; red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; common fine and medium distinct reddish yellow (5YR 7/6) mottles; moderate coarse subangular blocky structure; hard, friable; few fine roots; common fine pores; thin patchy clay films; slightly acid.

The solum ranges from 60 to more than 80 inches in thickness.

The A1 horizon is brown, pale brown, dark grayish brown, or grayish brown. The A2 horizon is brown, pale brown, light brown, or very pale brown. The A horizon is fine sandy loam or loamy fine sand. It is slightly acid, neutral, or mildly alkaline.

The B21t, B22t, and B23t horizons are yellowish red, reddish yellow, red, light red, or strong brown. They are sandy clay loam, loam, or clay loam and have clay content of about 20 to 35 percent. They are slightly acid through mildly alkaline.

The C horizon, where present, is reddish or yellowish sandy clay loam, loam, fine sandy loam, or weakly cemented sandstone.

Eufaula series

The Eufaula series consists of deep, sandy soils on uplands. These soils formed in thick, sandy materials. Slope ranges from 1 to 8 percent.

Typical pedon of Eufaula fine sand in an area of Eufaula-Patilo complex, 1 to 8 percent slopes; from the intersection of Farm Road 103 and Farm Road 1956 in Nocona, 12.1 miles east on Farm Road 1956 to farmhouse and pasture entrance gate; 0.8 mile north on pasture road to electric transmission line; and 500 feet east of road in native pasture:

A1—0 to 4 inches; pale brown (10YR 6/3) fine sand, brown (10YR 4/3) moist; single grained; loose; many fine roots; slightly acid; clear smooth boundary.

A21—4 to 60 inches; pink (7.5YR 8/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose; common fine roots; neutral; gradual smooth boundary.

A22&B2t—60 to 80 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose; lamellae of yellowish red (5YR 5/6) fine sandy loam (B2t); the lamellae are massive; lamellae are slightly hard, friable; lamellae are wavy and discontinuous, are 1/8 to 1/2 inch thick and have estimated combined thickness of 3 inches; the lamellae have clay bridges between sand grains; neutral.

The solum ranges from 72 to 120 inches in thickness. Reaction ranges from strongly acid through neutral.

The A1 horizon is pale brown, light brownish gray, grayish brown, brown, or yellowish brown. The A21 and A22 horizons are very pale brown or pink fine sand or loamy fine sand.

The B2t horizon is reddish yellow, yellowish red, or strong brown. It mainly exists as lamellae, but some pedons have a continuous B2t horizon of loamy fine sand. The lamellae are fine sandy loam or loamy fine sand.

The Eufaula soils of Montague County are outside the range of the series because the combined thickness of the lamellae is too thin to qualify as an argillic horizon. Use, behavior, and management, however, are similar to those of the Eufaula series.

Exray series

The Exray series consists of shallow, loamy soils on uplands. These soils formed over sandstone. Slope ranges from 5 to 25 percent.

Typical pedon of Exray stony fine sandy loam in an area of Bonti-Exray complex, 5 to 25 percent slopes; from the intersection of U.S. Highway 81-287 and Texas Highway 59 in Bowie; about 0.7 mile southwest on Texas Highway 59 to intersection with county road; 2.0 miles west on county road; and 3 feet south of county road right-of-way in wooded pasture:

A1—0 to 3 inches; brown (10YR 5/3) stony fine sandy loam, dark brown (10YR 3/3) moist; weak very fine subangular blocky structure; hard, friable; many fine roots; common fine pores; few fine pebbles of quartz; few sandstone pebbles; surface has 2 percent cover of sandstone fragments 3 to 15 inches in diameter; slightly acid; clear smooth boundary.

A2—3 to 6 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; hard, friable; common fine roots; many fine pebbles of quartz; estimated 15 percent by volume sandstone pebbles 0.3 inch to 3 inches in diameter; medium acid; clear smooth boundary.

B2t—6 to 13 inches; red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; very hard, firm; common fine roots; common fine pores; thin continuous clay films on surfaces of peds; common earthworm casts; estimated 15 percent by volume subrounded sandstone fragments 0.5 inch to 3 inches in diameter; medium acid; abrupt wavy boundary.

R—13 to 16 inches; strongly cemented yellowish brown sandstone; coarsely fractured; slightly acid.

The solum ranges from 10 to 20 inches in thickness over sandstone.

The A1 horizon is brown or dark grayish brown. The A2 horizon is light yellowish brown, very pale brown, light brown, or brown. The A1 and A2 horizons are neutral or slightly acid. Sandstone fragments vary in amount from a few to about 30 percent, by volume, and in size from 3 to 30 inches in diameter.

The B2t horizon is yellowish red, reddish brown, or red clay loam, sandy clay, or clay. It is medium acid or slightly acid.

The underlying sandstone is strongly cemented and is coarsely fractured in the upper part.

Gaddy series

The Gaddy series consists of deep, reddish, sandy soils on flood plains. These soils formed in sandy alluvium along the Red River. Slope ranges from 0 to 1 percent.

Typical pedon of Gaddy loamy fine sand in an area of Gaddy soils, frequently flooded; from the intersection of Farm Road 2849 and Farm Road 103 at Prairie Valley, 2.1 miles west on Farm Road 2949 to intersection with county road; 2.8 miles north on county road; and 700 feet west of county road right-of-way in native pasture:

A1—0 to 4 inches; light reddish brown (5YR 6/4) loamy fine sand, reddish brown (5YR 5/4) moist; single grained; soft, very friable; common fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

C1—4 to 16 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; single grained; soft, very friable; few fine roots; common fine strata of slightly darker fine sandy loam; calcareous; moderately alkaline; abrupt smooth boundary.

C2—16 to 45 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose; few thin strata of slightly darker fine sandy loam; calcareous; moderately alkaline.

The A1 horizon is light reddish brown, reddish yellow, or light brown loamy fine sand or fine sandy loam. Reaction is mildly alkaline or moderately alkaline.

The C horizon is reddish yellow, pink, or light brown loamy fine sand or fine sand and has thin strata of fine sandy loam.

Gowen series

The Gowen series consists of deep, loamy soils on flood plains. These soils formed in loamy alluvium. Slope ranges from 0 to 1 percent.

Typical pedon of Gowen loam, occasionally flooded; from the intersection of Texas Highway 59 and Farm Road 2583 southwest of Bowie, about 4.2 miles southwest on Texas Highway 59; and 500 feet east of highway right-of-way in Coastal bermudagrass pasture:

A1—0 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable; common fine roots; neutral; clear smooth boundary.

A12—13 to 28 inches; dark grayish brown (10YR 4/2) loam, dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; many fine pores; neutral; gradual smooth boundary.

C1—28 to 52 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure in upper part becoming massive in lower part; hard, friable; few fine roots; few fine pores; neutral.

The A horizon is 24 to 48 inches thick. It is brown, dark grayish brown, dark gray, or grayish brown loam or clay loam. It is neutral through moderately alkaline. A light colored overwash of fine sandy loam less than 20 inches thick over a buried mollic epipedon is common in areas that are frequently flooded.

Some pedons have a B horizon of higher chroma than the A horizon.

The C horizon is brown, yellowish brown, or dark yellowish brown loam or clay loam. It is neutral through moderately alkaline.

Hensley series

The Hensley series consists of shallow, loamy soils. These soils formed over limestone. Slope ranges from 1 to 5 percent, but is dominantly 1 to 3 percent.

Typical pedon of Hensley loam, 1 to 5 percent slopes; from the intersection of Farm Road 677 and U.S. Highway 82 in Saint Jo, about 1.9 miles southwest on Farm Road 677, 90 feet west of Farm Road right-of-way in native grass pasture:

A1—0 to 4 inches; brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure and weak platy structure in upper 1 inch; hard, friable; many fine roots; mildly alkaline; clear smooth boundary.

B2t—4 to 16 inches; dark reddish brown (2.5YR 3/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate very fine and fine angular blocky structure; extremely hard, very firm; thin distinct continuous clay films on faces of peds; common fine roots; mildly alkaline; abrupt smooth boundary.

R—16 to 20 inches; indurated limestone bedrock; slightly fractured.

The solum is 10 to 20 inches thick over indurated limestone.

The A horizon is brown or reddish brown. It is slightly acid through mildly alkaline.

The B2t horizon is reddish brown, dark reddish brown, red, or dark red. It is clay loam or clay and had clay content of 35 to 55 percent. It is neutral through moderately alkaline.

Knoco series

The Knoco series consists of very shallow to shallow, clayey soils on uplands. These soils formed in calcareous, clayey red-bed shale. Slope ranges from 5 to 25 percent.

Typical pedon of Knoco stony clay in an area of Vernon-Knoco complex, 5 to 25 percent slopes, severely eroded; from the intersection of U.S. Highway 81 and U.S. Highway 82 in Ringgold, about 2.1 miles east on U.S. Highway 82; and 100 feet north of highway right-of-way in native rangeland:

A1—0 to 7 inches; reddish brown (2.5YR 5/4) stony clay, reddish brown (2.5YR 4/4) moist; moderate fine and medium blocky structure; very hard, very firm; common fine roots; 70 percent cover of calcareous sandstone, siltstone, and siliceous pebbles from 1/4 inch to 3 inches in diameter; 5 percent cover of calcareous sandstone 3 to 24 inches in diameter; calcareous; moderately alkaline; gradual smooth boundary.

C1r—7 to 22 inches; reddish brown (2.5YR 5/4) shaly clay, reddish brown (2.5YR 4/4) moist; common fine gray and brown bodies of shale; rock (shale) structure that parts to fine angular fragments; few fine roots in upper part in cracks; calcareous; moderately alkaline; gradual smooth boundary.

C2r—22 to 28 inches; reddish gray (2.5YR 5/2) and light gray (N 7/0) clayey shale; massive; extremely hard, extremely firm; calcareous; moderately alkaline.

The solum ranges from 3 to 12 inches in thickness over shale. Fragments of sandstone and pebbles of quartz are on the surface and in the A horizon of most pedons.

The A1 horizon is red, reddish brown, or yellowish red.

The Cr horizon is red, olive, or blue; these colors are inherited from the original sediments. These colors in many places are intermingled as strata, pockets, or small bodies. The Cr horizon is weakly consolidated clayey shale or shaly clay.

Lindy series

The Lindy series consists of moderately deep, loamy soils on uplands. These soils formed over limestone. Slope ranges from 1 to 3 percent.

Typical pedon of Lindy clay loam, 1 to 3 percent slopes; from the intersection of Farm Road 2382 and U.S. Highway 82 in Saint Jo, about 0.8 mile northeast on Farm Road 2382 to intersection with county road; 0.55 mile east on county road; and 50 feet south of county road right-of-way in wooded pasture:

A1—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; many fine roots; mildly alkaline; clear smooth boundary.

B21t—6 to 24 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; very hard, very firm; many fine roots; thin clay films on surfaces of peds; noncalcareous; moderately alkaline; gradual smooth boundary.

B22t—24 to 31 inches; reddish brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate fine subangular blocky structure; very hard, very firm; common fine roots; thin clay films on surfaces of peds; noncalcareous; moderately alkaline; abrupt wavy boundary.

R—31 to 35 inches; indurated limestone, coarsely fractured.

The solum ranges from 20 to 40 inches in thickness over fractured limestone bedrock.

The A horizon is dark grayish brown, grayish brown, brown, or reddish brown. It is slightly acid, neutral, or mildly alkaline.

The B21t and B22t horizons are dark reddish brown, reddish brown, or red clay loam or clay. Content of limestone gravel ranges from 0 to 15 percent.

The underlying hard limestone is white, pinkish white, or light gray. It contains some reddish brown clay in the crevices of the upper part.

Miller series

The Miller series consists of deep, reddish, clayey soils on flood plains. These soils formed in clayey alluvium along the Red River. Slope ranges from 0 to 1 percent.

Typical pedon of Miller clay, occasionally flooded; from the intersection of U.S. Highway 81 and U.S. Highway 82 in Ringgold, 0.9 mile east on U.S. Highway 82 to intersection with county road; 0.2 mile east and 2.5 miles north on county road to pasture entrance gate at a barn; 0.4 mile east and north on pasture road; and 50 feet east of road in native pasture:

A11—0 to 9 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; weak fine blocky structure; very hard, firm; common fine roots; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

A12—9 to 17 inches; reddish brown (5YR 5/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine blocky structure; very hard, very firm; common fine roots; few very fine masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21—17 to 39 inches; reddish brown (5YR 5/4) clay, reddish brown (5YR 4/4) moist; moderate fine blocky structure; very hard, very firm; common fine roots; few very fine masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—39 to 50 inches; red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; few soft masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

IIC—50 to 60 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; soft, very friable; calcareous; moderately alkaline.

The solum is 30 to 60 inches in thickness.

The A horizon is reddish brown or dark reddish gray.

The B horizon is reddish brown, yellowish red, or red clay, silty clay, or silty clay loam.

The IIC horizon is reddish yellow, yellowish red, red, or reddish brown fine sandy loam to loam. It is stratified with layers of loamy fine sand, silt loam, or silty clay loam.

Owens series

The Owens series consists of shallow, clayey soils on uplands. These soils formed in calcareous, clayey shale. Slope ranges from 5 to 20 percent.

Typical pedon of Owens clay in an area of Truce-Owens complex, 5 to 20 percent slopes; from the intersection of Farm Road 1749 and State Highway 114 in Sunset, about 3.5 miles northwest on State Highway 114 to intersection with county road south of Fruitland; 2.3 miles southwest on county road; and 174 feet west of pasture gate in rangeland pasture:

A1—0 to 4 inches; brown (10YR 5/3) clay, brown (10YR 4/3) moist; moderate fine and medium angular blocky structure; very hard, very firm; many fine roots; common fine siliceous pebbles; calcareous; moderately alkaline; clear smooth boundary.

Bca—4 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium angular blocky structure; extremely hard, very firm; common fine roots; few medium masses of calcium carbonate; few fine siliceous pebbles; calcareous; moderately alkaline; gradual wavy boundary.

Cr—18 to 30 inches; light gray (2.5YR 6/1) shaly clay, gray (2.5YR 5/1) moist; weak platy structure; extremely hard, very firm; few fine roots in cracks and fractures; few fine masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 10 to 20 inches in thickness.

The A1 horizon is brown, light olive brown, grayish brown, or reddish brown. It is moderately alkaline, but some pedons are noncalcareous in the A horizon. Fragments of sandstone and pebbles of quartz are on the surface of some pedons.

The B2 horizon is grayish brown, light olive brown, brown, or reddish brown clay or clay loam.

The Cr horizon is olive, light gray, light yellowish brown, or reddish brown shaly clay.

Patilo series

The Patilo series consists of deep, sandy soils on uplands. These soils formed in thick beds of sandy material. Slope ranges from 1 to 8 percent, but is dominantly 2 to 5 percent.

Typical pedon of Patilo fine sand in an area of Eufaula-Patilo complex, 1 to 8 percent slopes; from the intersection of Farm Road 103 and Farm Road 1956 in Nocona, 12.1 miles east on Farm Road 1956 to farmhouse and pasture entrance gate; 0.8 mile north on pasture road to electric transmission line; and 400 feet east of road in native pasture:

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; single grained; loose; many fine roots; slightly acid; clear smooth boundary.

A2—4 to 45 inches; pink (7.5YR 8/3) fine sand, light brown (7.5YR 6/4) moist; single grained; loose; common fine roots in upper part; slightly acid; clear smooth boundary.

B21t—45 to 52 inches; mottled light gray (10YR 7/1), reddish yellow (7.5YR 6/6), and red (2.5YR 4/6) sandy clay loam; moderate coarse subangular blocky structure; hard, firm; few thin continuous clay films on surfaces of peds; strongly acid; gradual smooth boundary.

B22t—52 to 65 inches; mottled light gray (10YR 7/1) and reddish yellow (7.5YR 6/6) sandy clay loam; common medium prominent mottles of dark red (2.5YR 3/6); moderate coarse subangular blocky structure; hard, firm; thin patchy clay films on surfaces of peds; common fine pockets of clean sand grains; strongly acid.

The solum ranges from 65 to more than 100 inches in thickness.

The A1 horizon is grayish brown, brown, light brownish gray, or dark grayish brown. It is medium acid through neutral. The A2 horizon is very pale brown, pale brown, or light gray. It is medium acid through neutral.

The B21t and B22t horizons are mottled yellowish red, red, reddish yellow, strong brown, light gray, or gray. They are dominantly sandy clay loam, and clay content is 25 to 35 percent. Reaction is slightly acid through strongly acid.

Pulexas series

The Pulexas series consists of deep, loamy soils on flood plains. These soils formed in loamy alluvium. Slope ranges from 0 to 1 percent.

Typical pedon of Pulexas fine sandy loam in an area of Pulexas soils, frequently flooded; about 3.5 miles southwest of Bowie on Texas Highway 59 to its intersection with Farm Road 2583; 0.5 mile south on Farm Road 2583 to its intersection with county road; 0.3 mile east on county road; and 30 feet south of county road right-of-way in pasture:

A—0 to 5 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak fine granular structure; hard, friable; many fine roots; common fine pores; common worm casts; neutral; abrupt smooth boundary.

C1—5 to 30 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; thin strata of brown fine sandy loam with distinct bedding planes; slightly hard, very friable; common fine roots; few fine pores; common worm casts; mildly alkaline; gradual smooth boundary.

C2—30 to 42 inches; brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; massive; common faint bedding planes; slightly hard, friable; few fine roots; common fine pores; common worm casts; moderately alkaline; clear smooth boundary.

C3—42 to 60 inches; brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; massive; hard, friable; few fine roots; common fine pores; common worm casts; moderately alkaline.

The A horizon is grayish brown, light brownish gray, brown, pale brown, light brown, yellowish brown, or light yellowish brown. It is medium acid through moderately alkaline.

The C horizon is grayish brown, light brownish gray, brown, light brown, yellowish brown, light yellowish brown, or pale brown. Some pedons contain dark buried horizons below a depth of 30 inches. Texture is dominantly fine sandy loam, sandy loam, or loam stratified with thin lenses of loamy fine sand, sandy clay loam, or clay loam. Reaction is medium acid through moderately alkaline.

Renfrow series

The Renfrow series consists of deep soils that have a loamy surface layer and a clayey subsoil. These soils are on uplands. They formed in materials weathered from clays and shaly clays. Slope ranges from 0 to 4 percent.

Typical pedon of Renfrow loam, 1 to 4 percent slopes; from the intersection of U.S. Highway 287 and Farm Road 174 northwest of Bowie, 4.0 miles northwest on U.S. Highway 287 to a pasture road opposite county road; 0.1 mile north and east of railroad gate on pasture road; and 15 feet north of fence in a field:

A1—0 to 11 inches; dark brown (7.5YR 4/2) loam, very dark brown (5YR 3/2) moist; moderate fine granular structure; hard, friable, common fine roots; slightly acid; gradual smooth boundary.

B21t—11 to 31 inches; reddish brown (5YR 4/4) clay; dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, very firm; few fine roots; few black ironstone pebbles less than 5 mm in diameter; thin continuous clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B22t—31 to 65 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, very firm; common hard concretions of calcium carbonate and few ironstone pebbles less than 5 mm in diameter; thin continuous clay films on faces of peds; calcareous; moderately alkaline.

The solum ranges from 60 to 80 inches in thickness. The A1 horizon is brown, dark brown, reddish brown, or grayish brown. It is slightly acid, neutral, or mildly alkaline.

The B21t and B22t horizons are reddish brown, red, or yellowish red clay or silty clay. They are slightly acid through moderately alkaline. Most pedons are calcareous in the lower part.

Sanger series

The Sanger series consists of deep, clayey soils on uplands. These soils formed in calcareous material weathered from clays and shaly clays. Slope ranges from 3 to 12 percent.

Typical pedon of Sanger silty clay, 3 to 5 percent slopes; from the intersection of Farm Road 455 and Farm Road 1655 in Forestburg, 4.5 miles southeast on Farm Road 455 to intersection with county road; 0.5 mile southwest on county road; and 300 feet north of county road right-of-way in native pasture:

A1—0 to 8 inches; dark gray (10YR 4/1) silty clay, very dark gray (10YR 3/1) moist; moderate fine subangular blocky and moderate medium granular structure; very hard, very firm; many fine roots; many worm casts; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC1—8 to 46 inches; dark grayish brown (2.5Y 4/2) silty clay, very dark grayish brown (2.5Y 3/2) moist; moderate fine angular blocky structure; very hard, very firm; common fine roots; common worm casts; common fine concretions of calcium carbonate; shiny ped faces; few tilted slickensides; calcareous; moderately alkaline; gradual wavy boundary.

AC2—46 to 60 inches; grayish brown (2.5Y 5/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak coarse blocky structure; extremely hard; very firm; common fine concretions of calcium carbonate; few tilted slickensides in upper part; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. The A horizon is dark gray, very dark grayish brown, or dark grayish brown silty clay or stony clay.

The A horizon is dominantly calcareous, but ranges to mildly alkaline and noncalcareous in the upper 12 inches in some pedons. Flat fragments of limestone cover from none to about 10 percent of the surface and make up from none to about 10 percent of the A horizon.

The AC horizon is dark grayish brown, grayish brown, olive gray, olive, or pale olive. There are no mottles to few mottles of brownish yellow or olive yellow. The AC horizon is silty clay or clay.

Selden series

The Selden series consists of deep soils that have a sandy surface layer and a loamy subsoil. These soils are on uplands. They formed in thick beds of loamy and sandy materials. Slope ranges from 1 to 5 percent.

Typical pedon of Selden fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 455 and State Highway 59 in Montague, about 1.9 miles west on Farm Road 455 to intersection with pasture road; 0.1 mile northwest on pasture road; and 10 feet west of road in wooded pasture:

A1—0 to 7 inches; brown (10YR 5/3) fine sand, dark brown (10YR 3/3) moist; weak very fine subangular blocky structure; soft, very friable; many fine roots; neutral; clear smooth boundary.

A2—7 to 15 inches; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) moist; single grained; soft, very friable; many fine roots; neutral; clear smooth boundary.

B21t—15 to 25 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; few fine distinct red mottles; moderate medium subangular blocky structure; hard, friable; common fine roots; few patchy clay films on surfaces of peds; medium acid; gradual smooth boundary.

B22t—25 to 34 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; few fine distinct light brownish gray mottles and common fine distinct red mottles; hard, firm; common fine roots; few patchy clay films on surfaces of peds; medium acid; gradual smooth boundary.

B23t—34 to 58 inches; coarsely and prominently mottled red (2.5YR 4/8), reddish yellow (7.5YR 6/6), and light gray (10YR 7/1) sandy clay loam; moderate medium and coarse subangular blocky structure; very hard, firm; few fine roots; common patchy clay films on surfaces of peds; neutral; gradual smooth boundary.

B3t—58 to 66 inches; mottled light red (2.5YR 6/8) and light gray (10YR 7/1) clay loam; weak coarse subangular blocky structure; very hard, firm; few fine roots; few clay films; neutral.

The solum ranges from 60 to more than 80 inches in thickness.

The A1 horizon is brown, light brown, grayish brown, dark grayish brown, or light grayish brown. The A2 horizon is light brown, very pale brown, pale brown, or light yellowish brown. The A1 and A2 horizons are strongly acid through neutral.

The B21t and B22t horizons are reddish yellow, brownish yellow, light yellowish brown, yellowish brown, or yellowish red and have varying amounts of red, yellow, and gray mottles. Reaction is medium acid or slightly acid. The B23t and B3t horizons have varying amounts of red, yellow, and gray mottles. They are sandy clay loam or clay loam and medium acid or slightly acid.

Stoneburg series

The Stoneburg series consists of moderately deep, loamy soils on uplands. These soils formed in loamy materials weathered from sandstone. Slope ranges from 1 to 8 percent, but is dominantly 1 to 3 percent.

Typical pedon of Stoneburg fine sandy loam in an area of Stoneburg-Anocon association, gently undulating; about 5.7 miles north on U.S. Highway 81 from intersection of Farm Road 1806 and U.S. Highway 82 at Stoneburg; and 650 feet northeast of highway in rangeland pasture:

A1—0 to 11 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable; many fine roots; common worm casts; slightly acid; clear smooth boundary.

B1t—11 to 16 inches; reddish brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, friable; many fine roots; common very fine pores; common worm casts; few thin clay films; slightly acid; clear smooth boundary.

B21t—16 to 26 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; common thin clay films; few fine black concretions; few siliceous pebbles; slightly acid; gradual smooth boundary.

B22t—26 to 35 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; common fine distinct mottles of red and reddish yellow; moderate fine subangular blocky structure; hard, firm; common fine roots; common very fine pores; common thin clay films; few fine black concretions; about 15 percent by volume partially rounded fragments of sandstone mostly less than 3 inches across the long axis; slightly acid; abrupt smooth boundary.

R—35 to 40 inches; brownish yellow (10YR 6/6), strongly cemented sandstone; neutral.

Solum thickness and depth to contact with strongly cemented to indurated sandstone is 20 to 40 inches.

The A horizon is dark grayish brown, grayish brown, or brown. It is slightly acid or neutral.

The B1t horizon, where present, is brown or reddish brown loam or sandy clay loam. It is strongly acid or neutral.

The B2t horizon is clay loam or sandy clay loam and has clay content of 25 to 35 percent. The B21t horizon is reddish brown or yellowish red. It is slightly acid or neutral. The B22t horizon is yellowish red, reddish yellow, or reddish brown and has few to common mottles of red, reddish yellow, strong brown, or yellowish brown. Rock fragments make up from 0 to 15 percent, by volume, of the B22t horizon.

Teller series

The Teller series consists of deep, loamy soils on uplands. These soils formed in terrace deposits, mostly along the Red River. Slope ranges from 0 to 1 percent.

Typical pedon of Teller loam, 0 to 1 percent slopes; from the intersection of Farm Road 103 and Farm Road 2849 at Prairie Valley, about 4.5 miles north and east on Farm Road 103 to intersection with county road; 0.5 mile north on county road; and 75 feet northeast of corner of county road right-of-way:

Ap—0 to 7 inches; brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; common worm casts; slightly acid; abrupt smooth boundary.

A12—7 to 14 inches; brown (7.5YR 4/3) loam, dark brown (7.5YR 3/2) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; common fine pores; common worm casts; slightly acid; gradual smooth boundary.

B21t—14 to 28 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak fine and medium subangular blocky structure; hard, friable; common fine roots; common fine pores; few patchy clay films; common worm casts; slightly acid; diffuse smooth boundary.

B22t—28 to 45 inches; reddish brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; few fine roots; many fine pores; few patchy clay films; slightly acid; diffuse smooth boundary.

B3—45 to 62 inches; brown (7.5YR 5/4) loam, brown (7.5YR 4/4) moist; weak fine subangular blocky structure; hard, friable; common fine pores; few clay films; slightly acid; diffuse smooth boundary.

C—62 to 70 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; few fine faint brownish yellow mottles; massive; hard, friable; few fine black concretions; few siliceous pebbles; neutral.

The solum ranges from 60 to more than 75 inches in thickness. The Ap and A12 horizons are reddish brown, brown, or dark brown. They are medium acid or slightly acid.

The B21t and B22t horizons are reddish brown or yellowish red sandy clay loam, loam, or clay loam. They are medium acid or slightly acid.

The B3t and C horizons are yellowish red, yellowish brown, or brown very fine sandy loam, loam, or fine sandy loam.

Truce series

The Truce series consists of deep soils that have a loamy surface layer and a clayey subsoil. These soils are on uplands. They formed in materials weathered from shales and shaly clays. Slope ranges from 2 to 20 percent, but is dominantly 2 to 5 percent.

Typical pedon of Truce fine sandy loam, 2 to 5 percent slopes; from the intersection of State Highway 59 and Farm Road 2583, 4.8 miles southwest on State Highway 59 to intersection with county road; 1.0 mile south on county road to cattle guard on west side of road; about 60 feet north of cattle guard and 10 feet west of county road right-of-way in pasture:

A1—0 to 3 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine subangular blocky structure; weak medium platy structure at surface; hard, friable; many fine roots; neutral; clear smooth boundary.

A2—3 to 6 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; hard, friable; many fine roots; neutral; abrupt smooth boundary.

B21t—6 to 16 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate fine and medium blocky structure; very hard, very firm; common fine roots; thin continuous clay films on peds; vertical crack extends through lower boundary; neutral; clear smooth boundary.

B22t—16 to 25 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; few fine yellowish brown mottles; moderate medium blocky structure; very hard, very firm; common fine roots; thin continuous clay films on peds; few fine black concretions; cracks extend from horizon above into upper part; neutral; gradual wavy boundary.

B3—25 to 45 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; weak medium blocky structure; very hard, very firm; few soft masses and concretions of calcium carbonate in lower part; few fine black concretions; calcareous; moderately alkaline; gradual wavy boundary.

Cr—45 to 55 inches; mottled light gray (10YR 7/2) and brownish yellow (10YR 6/6) clayey shale; massive; few soft masses of calcium carbonate and gypsum crystals in upper part; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness.

The A1 horizon is brown, pale brown, or dark grayish brown fine sandy loam or stony fine sandy loam. Content of sandstone fragments varies from none to about 20 percent, by volume. The fragments range in size from 3 to 25 inches in diameter. Reaction is slightly acid or neutral. The A2 horizon is brown, pale brown, or light yellowish brown. It is medium acid, slightly acid, or neutral.

The B21t horizon is reddish brown, dark reddish brown, red, or yellowish red clay or sandy clay. It is slightly acid through mildly alkaline.

The B22t horizon is brown, yellowish brown, reddish brown, brownish yellow, or yellowish red clay or sandy clay. Reaction is neutral through moderately alkaline.

The B3 horizon is light yellowish brown, strong brown, or brownish yellow clay, clay loam, or sandy clay. Reaction is neutral through moderately alkaline.

Vashti series

The Vashti series consists of moderately deep, loamy soils on uplands. These soils formed in loamy materials weathered from sandstone. Slope ranges from 2 to 5 percent.

Typical pedon of Vashti fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 1759 and Farm Road 103 in Nocona, 2.0 miles west on Farm Road 1759 to intersection with county road; 2.8 miles north on county road; and 70 feet west of county road right-of-way in a cultivated field:

Ap—0 to 5 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; neutral; abrupt smooth boundary.

A2—5 to 10 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine roots; neutral; clear smooth boundary.

B21t—10 to 19 inches; light yellowish brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; moderate medium subangular blocky structure; hard, friable; common fine roots; common fine pores; thin continuous clay films on faces of peds; few small sandstone fragments less than 3 inches in diameter; slightly acid; gradual smooth boundary.

B22t—19 to 27 inches; yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) moist; common fine distinct mottles of brownish yellow and light yellowish brown; moderate medium subangular blocky structure; hard, friable; few fine roots; common fine pores; thin continuous clay films on faces of peds; few small fragments of sandstone less than 3 inches in diameter; neutral; abrupt smooth boundary.

B23t—27 to 31 inches; mottled light gray (5Y 7/2) and yellow (2.5Y 7/6) sandy clay loam, light olive gray (5Y 6/2) and olive yellow (2.5Y 6/6) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; common fine pores; common fine black concretions; lower part is 30 percent soft lenses of sandstone; neutral; abrupt smooth boundary.

R—31 to 33 inches; strongly cemented brownish sandstone.

The solum ranges from 20 to 40 inches in thickness over strongly cemented sandstone.

The Ap horizon is brown, grayish brown, or light yellowish brown. The A2 horizon is pale brown, light gray, light yellowish brown, or brown. The Ap and A2 horizons are slightly acid or neutral.

The B21t, B22t, and B23t horizons are yellowish brown, brownish yellow, strong brown, brown, or yellow or are light gray and have grayish, reddish, and yellowish mottles. They are sandy clay loam or clay loam. Reaction ranges from neutral through medium acid.

Venus series

The Venus series consists of deep, loamy soils on uplands. These soils formed in thick beds of calcareous, loamy sediments. Slope ranges from 5 to 8 percent.

Typical pedon of Venus loam, 5 to 8 percent slopes; from the intersection of U.S. Highway 82 and Farm Road 2382 in Saint Jo, about 0.8 mile east on U.S. Highway 82 to intersection with county road; 0.5 mile southeast on county road; and 50 feet southwest of county road right-of-way in native pasture:

A1—0 to 12 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; many fine roots; common fine pores; few fine limestone pebbles less than 1 cm in diameter; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—12 to 48 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common fine pores; common fine threads and films of calcium carbonate; few fine pitted concretions of calcium carbonate; about 16 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—48 to 60 inches; light yellowish brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; weak medium subangular blocky structure; common fine threads of calcium carbonate in pores; few very fine calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness.

The A1 horizon is brown, dark brown, dark grayish brown, or grayish brown.

The B21ca and B22ca horizons are brown, pale brown, very pale brown, grayish brown, or yellowish brown loam or clay loam. Calcium carbonate concretions, films, threads, or soft masses make up from 5 to 20 percent, by volume, of these horizons.

Vernon series

The Vernon series consists of moderately deep, clayey soils on uplands. These soils formed in calcareous clays weathered from clayey shales. Slope ranges from 1 to 25 percent, but is dominantly 3 to 8 percent.

Typical pedon of Vernon clay, 1 to 5 percent slopes; from the intersection of U.S. Highway 81 and Farm Road 1806 in Stoneburg about 3.4 miles north on U.S. Highway 81 and 54 feet east of highway right-of-way in rangeland pasture:

A1—0 to 4 inches; reddish brown (5YR 5/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure parting to moderate fine platy and very fine blocky; very hard, very firm; calcareous; moderately alkaline; clear smooth boundary.

B2—4 to 29 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure parting to moderate very fine blocky; very hard, very firm; common fine roots; common worm casts; common fine concretions of calcium carbonate; common fine siliceous pebbles; calcareous; moderately alkaline; gradual smooth boundary.

Cr—29 to 35 inches; mottled weak red (2.5YR 5/3) and light gray (5Y 7/1) shaly clay; massive; common films of soft calcium carbonate.

Depth to bedrock ranges from 20 to 40 inches. Fragments of sandstone and pebbles of quartz are on the surface of some pedons.

The A1 horizon is reddish brown, dark reddish brown, reddish gray, or brown.

The B2 horizon is reddish brown, dark red, red, or weak red clay or silty clay.

The Cr horizon is red, yellowish red, or reddish brown, massive clay, shaly clay, or clayey shale.

Waurika series

The Waurika series consists of deep soils that have a loamy surface layer and a clayey subsoil. These soils are on uplands. They formed in thick beds of clayey sediments. Slope ranges from 0 to 1 percent.

Typical pedon of Waurika silt loam in an area of Waurika-Renfrow complex, 0 to 1 percent slopes; from the intersection of U.S. Highway 287 and Farm Road 174 northwest of Bowie, 4.0 miles northwest on U.S. Highway 287 to intersection with county road; 159 feet south on county road; 84 feet west of county road right-of-way in a native grass pasture:

A1—0 to 11 inches; grayish brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

A2—11 to 14 inches; light brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable; common fine roots; slightly acid; abrupt smooth boundary.

B21t—14 to 24 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; weak medium blocky structure; very hard; very firm; common fine roots; continuous thin clay films on faces of peds; neutral; gradual smooth boundary.

B22t—24 to 33 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium blocky structure; very hard; very firm; common fine roots; continuous thin clay films on faces of peds; moderately alkaline; gradual smooth boundary.

B3ca—33 to 54 inches; brown (7.5YR 5/2) silty clay, dark brown (7.5YR 4/2) moist; weak medium blocky structure; very hard; very firm; few fine roots; few soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

C—54 to 64 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; massive; very hard; firm; common fine gypsum crystals and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

The A1 horizon is grayish brown, dark grayish brown, very dark grayish brown, or dark brown. It is medium acid through neutral. The A2 horizon is light grayish brown, brown, or grayish brown silt loam or loam. It is medium acid through neutral.

The B21t and B22t horizons are grayish brown, dark grayish brown, very dark grayish brown, dark brown, or brown clay or silty clay. Reaction is neutral through moderately alkaline.

The B3ca horizon is brown, gray, or light brownish gray silty clay loam, clay loam, or silty clay. Reaction is mildly alkaline or moderately alkaline.

The C horizon is light brownish gray, light olive brown, reddish brown, or brown silty clay loam or clay loam.

Windthorst series

The Windthorst series consists of deep, loamy and sandy soils on uplands. These soils formed in thick beds of clayey and loamy materials. Slope ranges from 1 to 8 percent.

Typical pedon of Windthorst fine sandy loam, 2 to 5 percent slopes; from the intersection of Farm Road 455 and Farm Road 677 in Forestburg, 1.5 miles on Farm Road 455 to intersection with cemetery road, and 10 feet northwest in native pasture:

A1—0 to 5 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; neutral; clear smooth boundary.

A2—5 to 10 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; neutral; abrupt smooth boundary.

B21t—10 to 21 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; moderate fine and medium subangular blocky structure; very hard, firm; many fine roots; few worm casts; common distinct clay films; slightly acid; gradual smooth boundary.

B22t—21 to 36 inches; mottled red (2.5YR 5/8) and reddish yellow (7.5YR 6/6) sandy clay, red (2.5YR 4/8) and strong brown (7.5YR 5/6) moist; few fine distinct very pale brown mottles; moderate medium blocky structure; very hard, firm; common fine roots; common thin clay films; medium acid; gradual wavy boundary.

B3—36 to 55 inches; reddish yellow (7.5YR 6/8) sandy clay loam, strong brown (7.5YR 5/8) moist; common medium prominent red (2.5YR 4/8) and light gray (10YR 7/1) mottles; weak medium blocky structure; very hard, firm; few fine roots; slightly acid; gradual wavy boundary.

C—55 to 60 inches; light gray (10YR 7/1) clay loam; common fine distinct brownish yellow mottles; massive; very hard, firm; moderately alkaline.

The solum ranges from 35 to 60 inches in thickness. Content of siliceous pebbles ranges from none to 8 percent.

The A1 horizon is brown, grayish brown, or dark grayish brown. The A2 horizon is very pale brown, pale brown, light brown, or pink. The A1 and A2 horizons are fine sandy loam or loamy fine sand. They are medium acid through neutral.

The B21t horizon is red, dark red, yellowish red, or reddish yellow sandy clay or clay. It is medium acid or slightly acid.

The B22t horizon is yellowish red, reddish yellow, or red and has faint to prominent red, yellowish brown, strong brown, or very pale brown mottles. It is sandy clay, clay, or clay loam. It is neutral through medium acid.

The B3 horizon is prominently mottled with red, yellowish red, reddish yellow, pale brown, and gray. It is clay, sandy clay, sandy clay loam, or clay loam. It is moderately alkaline through medium acid.

The C horizon is red, brownish yellow, or gray. It is massive clayey shale, clay, sandy clay, or sandy clay loam. In some pedons, the soil is underlain by weakly cemented sandstone.

Yahola series

The Yahola series consists of deep, loamy soils on flood plains. These soils formed in calcareous, loamy alluvium along the Red River. Slope ranges from 0 to 1 percent.

Typical pedon of Yahola fine sandy loam in an area of Yahola-Gaddy complex, occasionally flooded; from the intersection of U.S. Highway 82 and U.S. Highway 81 in Ringgold, about 0.9 mile east on U.S. Highway 81 to intersection with county road; 1.1 miles east on county road; 2.8 miles north on county road to gate and pasture road; 0.1 mile northwest on pasture road and 40 feet north of pasture road:

A1—0 to 8 inches; reddish brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak fine subangular blocky structure; slightly hard, very friable; many fine roots; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

C1—8 to 24 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive; slightly hard, very friable; common fine roots; few worm casts; few thin strata of loamy fine sand and silt loam; calcareous; moderately alkaline; clear smooth boundary.

C2—24 to 44 inches; reddish yellow (5YR 7/6) fine sandy loam, reddish yellow (5YR 6/6) moist; massive; soft, very friable; few fine roots; few thin strata of loamy fine sand and silt loam; calcareous; moderately alkaline; gradual smooth boundary.

C3—44 to 50 inches; pink (5YR 7/4) fine sandy loam, reddish yellow (5YR 6/6) moist; single grained; loose; stratified; calcareous; moderately alkaline.

The A horizon is reddish brown, light reddish brown, yellowish red, or brown. It is mildly alkaline or moderately alkaline.

The C horizon is light brown, light reddish brown, yellowish red, reddish yellow, or pink fine sandy loam or loam and has thin strata of coarser or finer textured materials throughout. Some pedons are loamy fine sand below a depth of 40 inches.

Classification

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to the latest literature available (*7*).

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 16, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Calciustolls (*Calc*, meaning calcareous horizons, plus *ustoll*, the suborder of Mollisols that has a burnt 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 preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Calciustolls.

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

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. An example is the Venus series, which is in the fine-loamy, mixed, thermic family of Typic Calciustolls.

Formation of the soils

In this section, the processes of soil formation are discussed and related to the soils in the survey area.

Factors of soil formation

Soil is a natural, three-dimensional body on the earth's surface. It supports plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

The interaction of five main factors results in differences among the soils. These factors are the physical and chemical composition of the parent material; the climate during and after the accumulation of the parent material; the kind of plants and organisms living in the soil; the relief of the land and its effect on runoff; and the length of time it took the soil to form.

The effect of one factor can differ from place to place, but the interaction of all the factors determines the kind of soil that forms. In the following paragraphs the factors of soil formation are discussed as they relate to the soils in the survey area.

Climate.—Montague County has a subhumid, warm-temperate, continental climate. The subhumid climate has promoted moderately rapid soil development. Climate is uniform throughout the county, although its effect has been modified locally by relief and runoff.

Living organisms.—Plants, micro-organisms, earthworms, and other forms of animal life are important in the formation of soils.

Vegetation, including grasses and hardwood plants, has affected soil formation in the survey area more than other living organisms. The hardwood vegetation produces soils that generally are low in organic matter, such as Windthorst and Duffau soils, while grass produces soils that generally are high in organic matter, such as Branyon, Teller, and Anocon soils.

Parent material.—Parent material is the unconsolidated mass from which the soils were formed. It determines the limits of the chemical and mineral composition of the soil. In Montague County, soils developed from materials of four different geological systems: the Pennsylvanian, Permian, Cretaceous, and Quaternary (*3*).

Most of the soils in the southwestern part of the county formed in sandstones and shales of the Pennsylvanian System. Mainly these are the Bonti, Vashti, and Exray soils, which are underlain by sandstone, and the Truce soils, which formed in shale.

The Permian System covers the western and northwestern parts of the county. It consists of red-bed shales, clays, and sandstones. The soils in this area are Renfrow and Vernon soils, which formed in clays and shales, and Stoneburg soils, which formed over sandstone.

Most of the soils in the central and eastern parts of the county formed in material associated with the Cretaceous System. The Windthorst, Duffau, and Selden soils formed in materials of the Antlers Sand of the Trinity Group. Above the Trinity Group are rocks of the Fredericksburg Group, represented in this area by the Goodland Limestone Formation. This limestone is white, semicrystalline, and massive, and is about 25 feet thick. The Aledo, Bolar, and Hensley soils formed in materials weathered from this limestone. The Kiamichi Formation lies above the Goodland Limestone; it consists of clayey material from which the Sanger soils were derived.

The Quaternary System consists of Pleistocene and Recent deposits in the county. The Pleistocene deposits are on second bottoms of streams and on old, high terraces along the Red River and a few of the major creeks. The materials are mostly loamy and are many feet thick. Deep soils, such as Teller and Bastrop soils, formed in these materials.

The Recent alluvial deposits are on flood plains and are subject to overflow. This material consists of sand, silt, and clay. The soils that formed in Recent alluvium are the Bosque, Gaddy, Gowen, Miller, Pulexas, and Yahola soils.

Topography.—Topography, or relief, affects soil formation through its influence on drainage, runoff, erosion, plant cover, and soil temperature. The topography of the survey area ranges from a flat, featureless plain with little stream dissection northeast of Spanish Fort to broad interstream divides with strongly sloping sides in the southwestern and eastern parts of the county.

Time.—A long time generally is required for the formation of soils that have distinct horizons. The differences in length of time that parent material has been in place, therefore, are commonly reflected in the degree of development of the soil profile. The soils in the survey range from young to old. The young soils have very little profile development, and the old soils have well expressed soil horizons. Pulexas soils are an example of young soils showing little development; except for a slight accumulation of organic matter and darkening of the surface layer, Pulexas soils retain most of the characteristics of the loamy parent material. Windthorst soils are an example of older soils showing well developed soil horizons; they have distinct A and Bt horizons that bear little resemblance to the original parent material.

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Glossary

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

Alkaline soil. Generally, a soil that is alkaline throughout most or all of the part occupied by plant roots. Precisely, any soil having a pH value greater than 7.0. Practically, a soil having a pH above 7.3.

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

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

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

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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

Buried soil. A developed soil that was once exposed but is now overlain by a more recently formed soil.

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.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

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.

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

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

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

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

Concave slope. A land surface that is curved like the interior of a sphere or arch.

Conglomerate. Rock composed of gravel and rounded stones cemented together by hardened clay, lime, iron oxide, or silica.

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.

Convex slope. A land surface that is curved like the exterior of a sphere or arch.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

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

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

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."

Droughty. Soil holds too little water for plants during dry periods.

Erodes easily. Water erodes soil easily.

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

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

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.

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.

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

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.

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.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. 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.

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.

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.

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

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

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.

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.

Not needed. Practice not applicable.

Organic matter. A general term for plant and animal material, in or on the soil, in all stages of decomposition.

Parallelepipeds. Six-sided prisms having faces that are parallelogram.

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.

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

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

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

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

Piping. 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.

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

Pores, soil. Open channels in the soil material caused by roots and forms of animal life, such as earthworms and insects.

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.

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.

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.

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.

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.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

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.

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.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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.

Too clayey. Soil slippery and sticky when wet and slow to dry.

Too sandy. Soil soft and loose; droughty and low in fertility.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Wetness. Soil wet during period of use.

Illustrations

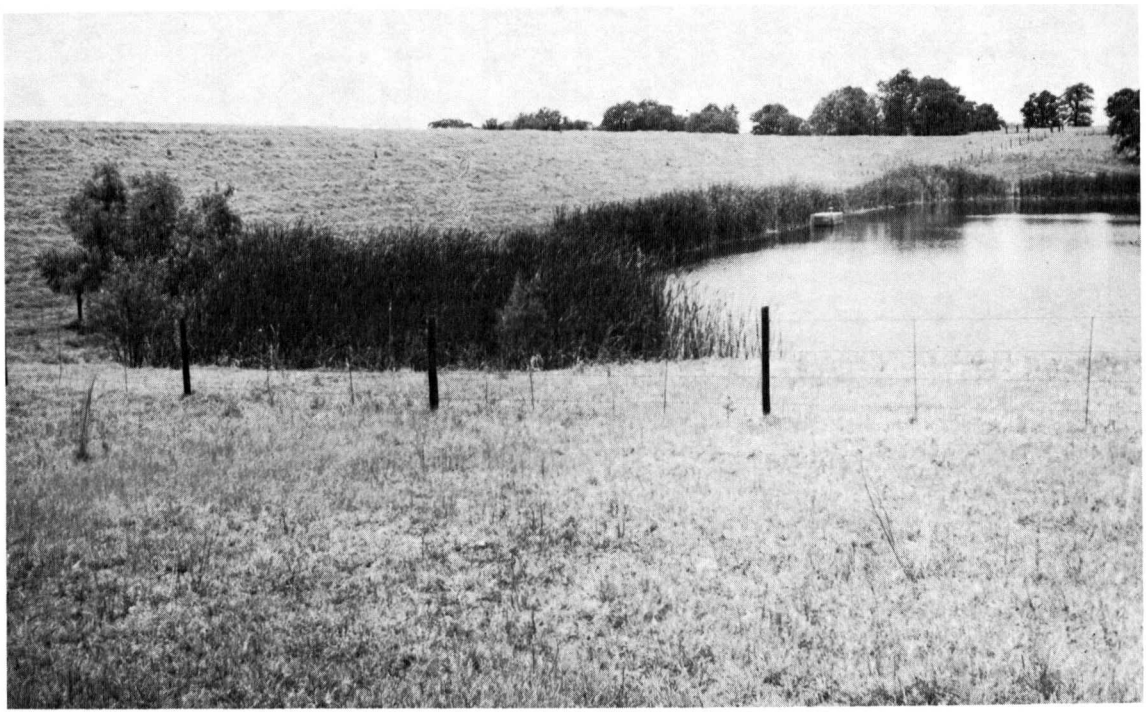

Figure 1.—Floodwater retarding structure in an area of Duffau fine sandy loam, 5 to 8 percent slopes. Cattails break up wave action and help prevent erosion along the front of the dam.

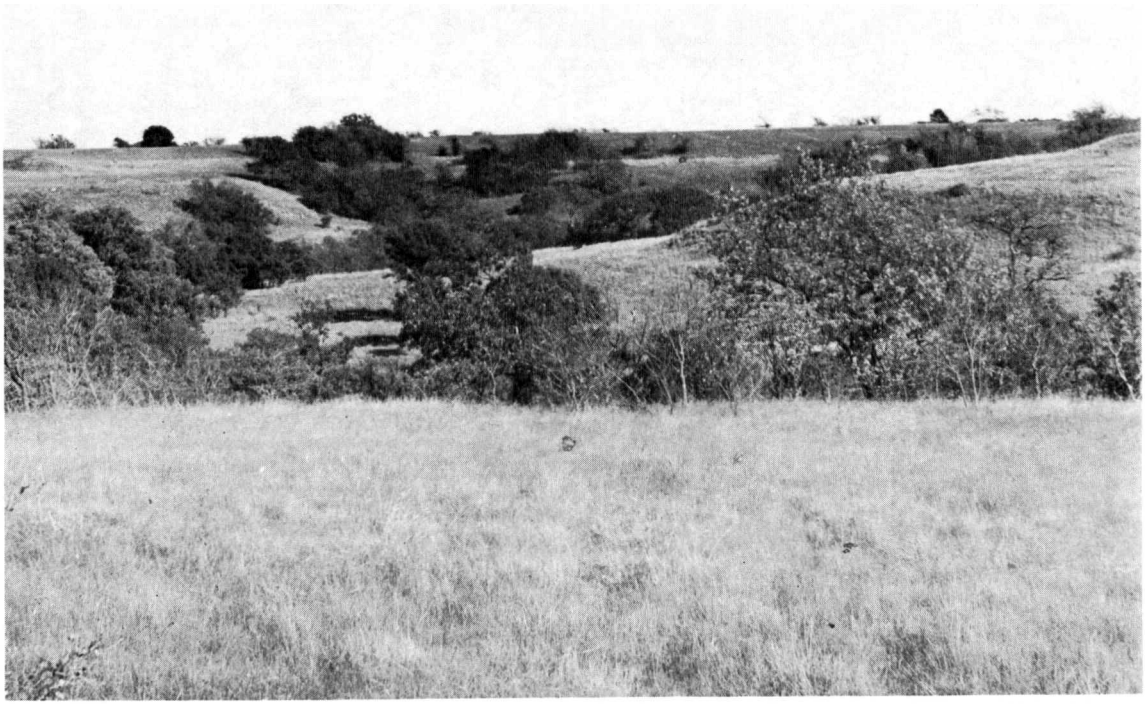

Figure 2.—Area of Bolar-Aledo complex, 3 to 20 percent slopes.

Figure 3.—Area of Bonti-Exray complex, 5 to 25 percent slopes, in Sandstone Hills range site.

Figure 4.—Young apple orchard on Chaney loamy fine sand, 2 to 5 percent slopes.

Figure 5.—This area of Duffau fine sandy loam, 2 to 5 percent slopes, has been cleared and planted to Ermelo lovegrass.

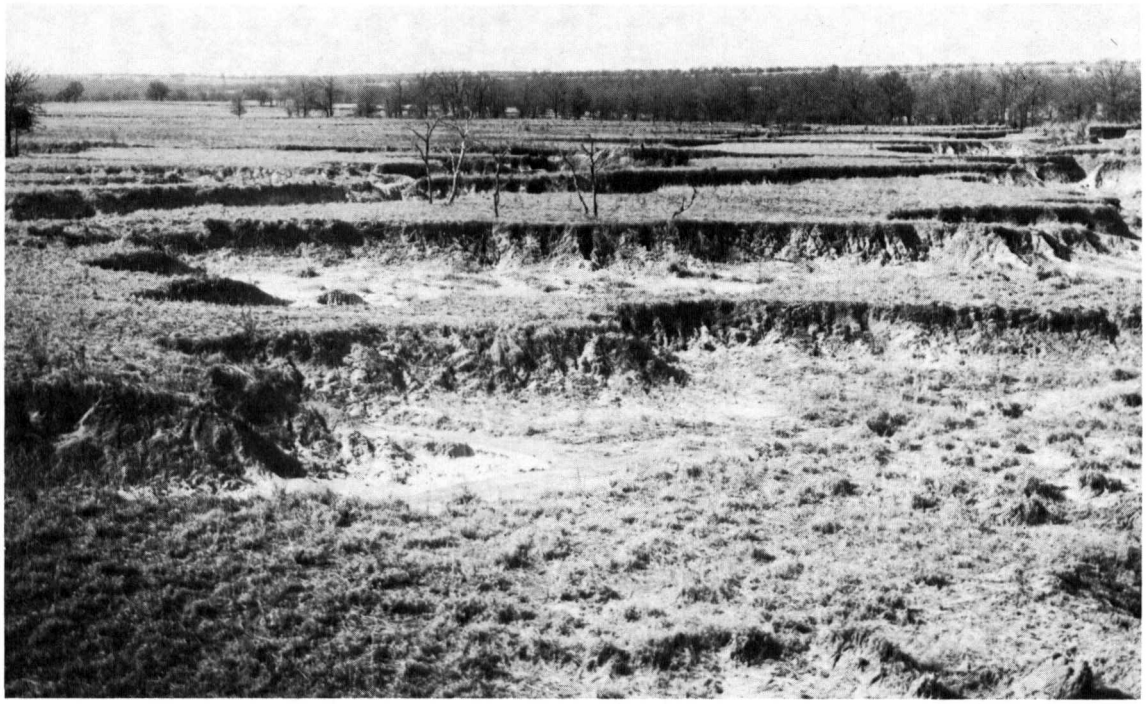

Figure 6.—Area of Duffau and Windthorst soils, gullied. Gullies are as deep as 30 feet in areas of Duffau soils on the lower parts of slopes.

Figure 7.—Native hayland meadow on Sanger silty clay, 3 to 5 percent slopes.

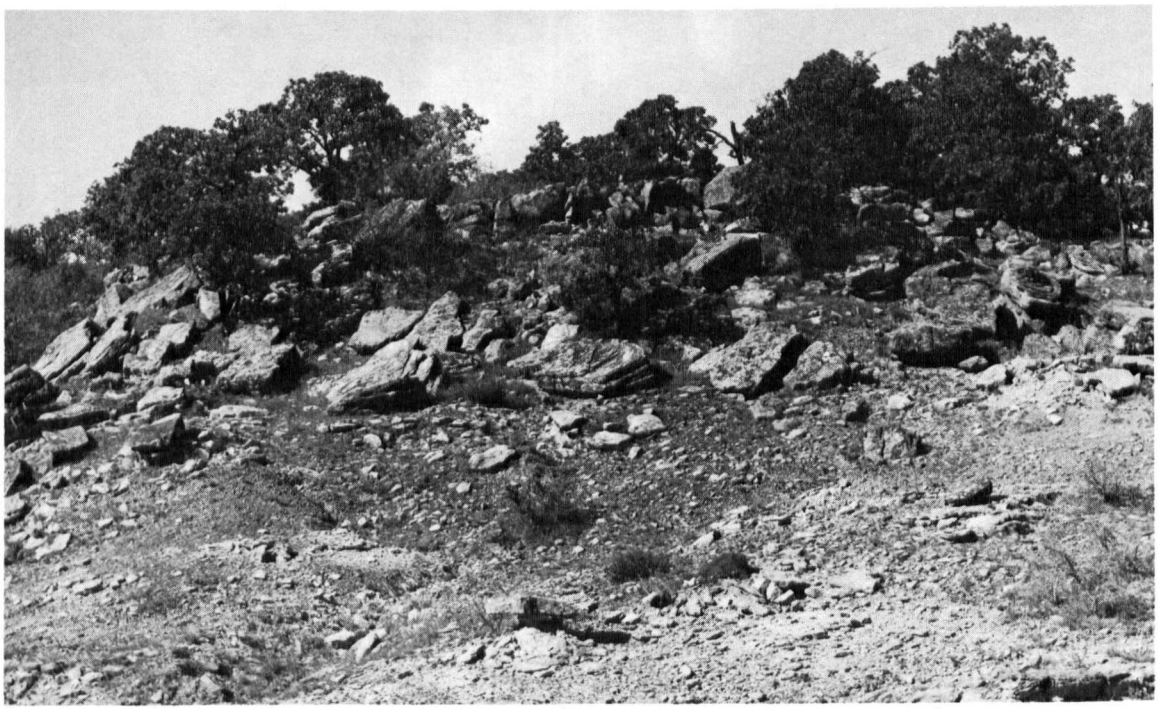

Figure 8.—Area of Owens stony clay in an area of Truce-Owens complex, 5 to 20 percent slopes. The sandstone outcrops are common in areas of this mapping unit.

Figure 9.—Area of Ustolls-Rock outcrop association, steep.

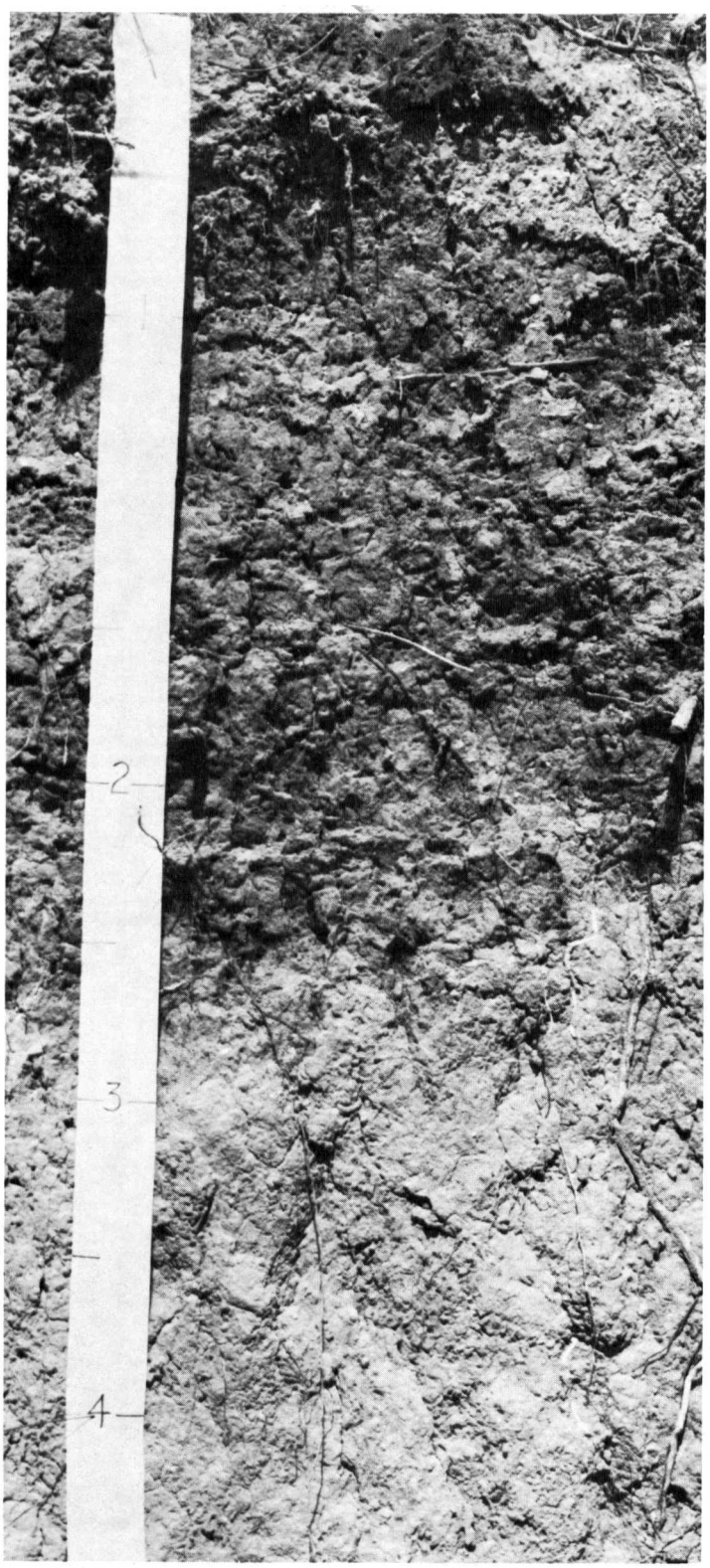

Figure 10.—Profile of Windthorst fine sandy loam, 2 to 5 percent slopes. Note the blocky structure of the sandy clay material between depths of 10 and 36 inches.

Figure 11.—Coastal bermudagrass on Yahola-Gaddy complex, occasionally flooded.

Figure 12.—Sandy Loam range site showing recovery of native tall grasses following mechanical brush control and deferred grazing. The soil is Duffau fine sandy loam, 2 to 5 percent slopes.

Tables

TABLE 1.—TEMPERATURE AND PRECIPITATION DATA

[Data from Bowie, elevation 1,124 feet. Period of record 1956-67]

Month	Temperature		Precipitation									
				Probability of receiving—						Average number of days with—		
	Average daily maximum	Average daily minimum	Average	0 inches	0.5 inch or more	1 inch or more	2 inches or more	4 inches or more	6 inches or more	0.1 inch or more	0.5 inch or more	1 inch or more
	F	F	In	Pct	Pct	Pct	Pct	Pct	Pct			
January	54.8	30.4	1.69	1	80	60	35	10	1	3	1	1
February	59.5	34.7	1.38	1	85	70	45	20	5	4	1	(1)
March	67.7	41.7	1.93	1	90	75	40	15	1	3	2	1
April	77.7	53.8	3.45	1	97	90	70	30	10	5	2	1
May	83.8	61.7	4.29	1	99	97	85	60	30	6	3	1
June	91.0	68.8	3.17	1	95	85	65	30	15	4	2	1
July	96.5	72.9	2.06	1	85	70	40	15	4	3	1	1
August	96.8	72.1	2.37	4	75	60	45	15	5	4	1	1
September	88.1	65.1	4.12	4	80	70	50	25	7	6	3	1
October	78.6	55.1	3.01	2	85	85	55	22	11	3	2	1
November	66.7	43.7	2.91	4	75	60	35	10	4	4	2	1
December	57.6	34.8	1.98	3	80	70	35	10	4	3	2	(1)
Year	76.6	52.9	32.36							48	22	10

[1]Less than half a day.

TABLE 2.—POTENTIALS AND LIMITATIONS OF MAP UNITS FOR SPECIFIED USES

Map unit	Extent of area	Cultivated farm crops	Rangeland	Pastureland	Urban uses	Wildlife habitat	Recreation
	Pct						
1. Windthorst-Duffau	37	Medium: erosion.	High	High	Medium: shrink-swell, low strength.	High	Medium: slope, slow percolation.
2. Renfrow-Stoneburg-Anocon	24	Medium: slow percolation.	High	High	Medium: shrink-swell, low strength.	High	Medium: slope, slow percolation.
3. Bonti-Cona-Truce	17	Medium: slope, large stones.	High	Medium: large stones, rooting depth.	Medium: shrink-swell, slope, depth to rock.	High	Medium: slope, slow percolation.
4. Aledo-Venus-Bolar	8	Medium: slope, rooting depth, large stones.	Medium: rooting depth.	Medium: rooting depth, large stones.	Medium: depth to rock, shrink-swell.	Medium: rooting depth, clayey surface.	Medium: slope, slow percolation, clayey surface.
5. Fulexas-Gowen	8	Medium: floods.	High	High	Low: floods.	High	Medium: floods.
6. Bastrop-Teller	4	High	High	High	High	High	High.
7. Gaddy-Miller-Yahola	2	Medium: floods, too sandy.	High	High	Low: floods.	Medium: floods, too sandy.	Medium: floods.

TABLE 3.—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Aledo gravelly clay loam, 1 to 8 percent slopes	8,970	1.5
2	Anocon-Stoneburg association, undulating	30,140	5.0
3	Bastrop loam, 2 to 5 percent slopes	13,970	2.3
4	Bastrop loam, 5 to 8 percent slopes	3,190	0.5
5	Bolar clay loam, 2 to 5 percent slopes	1,210	0.2
6	Bolar-Aledo complex, 3 to 20 percent slopes	12,840	2.1
7	Bonti fine sandy loam, 2 to 5 percent slopes	21,520	3.6
8	Bonti-Exray complex, 5 to 25 percent slopes	27,526	4.6
9	Bosque loam, occasionally flooded	4,020	0.7
10	Bosque soils, frequently flooded	760	0.1
11	Branyon silty clay, 1 to 3 percent slopes	2,800	0.5
12	Chaney loamy fine sand, 2 to 5 percent slopes	10,710	1.8
13	Cona association, hilly	26,850	4.5
14	Duffau loamy fine sand, 1 to 5 percent slopes	23,770	4.0
15	Duffau fine sandy loam, 2 to 5 percent slopes	21,090	3.5
16	Duffau fine sandy loam, 5 to 8 percent slopes	25,150	4.2
17	Duffau and Windthorst soils, gullied	6,040	1.0
18	Eufaula-Patilo complex, 1 to 8 percent slopes	1,770	0.3
19	Gaddy soils, frequently flooded	4,470	0.7
20	Gowen loam, occasionally flooded	4,200	0.7
21	Gowen soils, frequently flooded	14,210	2.4
22	Hensley loam, 1 to 5 percent slopes	2,080	0.3
23	Lindy clay loam, 1 to 3 percent slopes	1,750	0.3
24	Miller clay, occasionally flooded	1,530	0.3
25	Miller soils, frequently flooded	1,860	0.3
26	Pulexas fine sandy loam, occasionally flooded	8,060	1.3
27	Pulexas soils, frequently flooded	23,370	3.9
28	Renfrow loam, 1 to 4 percent slopes	37,590	6.3
29	Sanger silty clay, 3 to 5 percent slopes	2,650	0.4
30	Sanger stony clay, 5 to 12 percent slopes	890	0.1
31	Selden fine sand, 1 to 5 percent slopes	18,890	3.2
32	Stoneburg-Anocon association, gently undulating	34,000	5.7
33	Teller loam, 0 to 1 percent slopes	9,070	1.5
34	Truce fine sandy loam, 2 to 5 percent slopes	17,390	2.9
35	Truce-Owens complex, 5 to 20 percent slopes	4,090	0.7
36	Ustolls-Rock outcrop association, steep	2,130	0.4
37	Vashti fine sandy loam, 2 to 5 percent slopes	3,520	0.6
38	Venus loam, 5 to 8 percent slopes	7,810	1.3
39	Vernon clay, 1 to 5 percent slopes	9,470	1.6
40	Vernon-Knoco complex, 5 to 25 percent slopes, severely eroded	10,990	1.8
41	Waurika-Renfrow complex, 0 to 1 percent slopes	19,760	3.3
42	Windthorst loamy fine sand, 1 to 5 percent slopes	10,800	1.8
43	Windthorst fine sandy loam, 2 to 5 percent slopes	40,980	6.8
44	Windthorst fine sandy loam, 5 to 8 percent slopes	23,430	3.9
45	Windthorst and Duffau soils, 2 to 8 percent slopes, severely eroded	36,980	6.2
46	Yahola-Gaddy complex, occasionally flooded	3,400	0.6
	Water	1,984	0.3
	Total	599,680	100.0

TABLE 4.—YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Grain sorghum	Wheat	Peanuts	Improved bermuda-grass	Oats	Peaches
	Bu	Bu	Lb	AUM[1]	Bu	Bu
Aledo:						
1	—	—	—	—	—	—
Anocon:						
2[2]:						
Anocon part	40	20	—	6.0	40	—
Stoneburg part	40	20	—	5.0	40	—
Bastrop:						
3	45	25	—	6.0	40	—
4	40	20	—	5.5	35	—
Bolar:						
5	35	25	—	5.0	35	—
2[6]	—	—	—	—	—	—
Bonti:						
7	35	20	—	3.5	30	—
2[8]	—	—	—	—	—	—
Bosque:						
9	65	30	—	6.5	60	—
2[10]	—	—	—	6.5	—	—
Branyon:						
11	70	30	—	6.5	60	—
Chaney:						
12	35	20	1,200	6.0	35	95
Cona:						
2[13]	—	—	—	—	—	—
Duffau:						
14	40	20	1,400	6.5	35	100
15	40	20	1,200	6.0	35	95
16	30	20	800	5.5	30	—
2[17]	—	—	—	—	—	—
Eufaula:						
2[18]	—	—	—	4.0	—	—
Gaddy:						
2[19]	—	—	—	6.0	—	—
Gowen:						
20	70	30	—	7.0	60	—
2[21]	—	—	—	7.0	—	—
Hensley:						
22	20	15	—	3.0	35	—
Lindy:						
23	50	25	—	5.0	45	—
Miller:						
24	60	30	—	6.5	55	—

See footnotes at end of table.

TABLE 4.—YIELDS PER ACRE OF CROPS AND PASTURE—Continued

Soil name and map symbol	Grain sorghum	Wheat	Peanuts	Improved bermuda-grass	Oats	Peaches
	Bu	Bu	Lb	AUM[1]	Bu	Bu
Miller:						
[2]25	—	—	—	5.5	—	—
Pulexas:						
26	70	30	1,200	7.0	50	—
[2]27	—	—	—	7.0	—	—
Renfrow:						
28	30	25	—	3.5	35	—
Sanger:						
29	55	20	—	6.0	45	—
30	—	—	—	3.5	—	—
Selden:						
31	40	20	1,400	5.5	35	100
Stoneburg:						
[2]32:						
Stoneburg part	40	20	—	5.0	40	—
Anocon part	40	20	—	6.0	40	—
Teller:						
33	60	30	—	7.0	50	—
Truce:						
34	30	20	—	4.0	20	—
[2]35	—	—	—	—	—	—
Ustolls:						
[2]36:						
Ustolls part	—	—	—	—	—	—
Rock outcrop part.						
Vashti:						
37	35	20	900	5.0	35	—
Venus:						
38	50	20	—	6.0	35	—
Vernon:						
39	15	10	—	—	20	—
[2]40	—	—	—	—	—	—
Waurika:						
[2]41	40	25	—	4.5	40	—
Windthorst:						
42	30	20	1,200	6.0	30	150
43	35	20	1,000	5.0	35	125
44	30	20	800	4.5	25	—
[2]45	—	—	—	3.5	—	—
Yahola:						
[2]46	45	25	—	6.5	50	—

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

[2]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 5.—CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas excluded. Dashes mean no acreage]

Class	Total acreage	Major management concerns		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	9,070	—	—	—
II	42,240	2,800	39,440	—
III	291,510	289,980	1,530	—
IV	72,900	71,130	—	1,770
V	44,670	—	44,670	—
VI	86,530	45,950	—	40,580
VII	50,776	8,170	—	42,606
VIII	—	—	—	—

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Aledo:					
1	Shallow	Favorable	3,000	Little bluestem	20
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,800	Indiangrass	15
				Big bluestem	10
				Other perennial grasses	25
				Perennial forbs	5
				Trees	5
Anocon:					
[1]2:					
Anocon part	Loamy Prairie	Favorable	7,000	Little bluestem	30
		Normal	5,000	Indiangrass	20
		Unfavorable	3,500	Big bluestem	15
				Sideoats grama	10
				Other perennial grasses	15
				Other annual grasses	5
				Perennial forbs	5
Stoneburg part	Loamy Prairie	Favorable	7,000	Little bluestem	30
		Normal	5,000	Indiangrass	20
		Unfavorable	3,500	Big bluestem	15
				Sideoats grama	10
				Other perennial grasses	15
				Other annual grasses	5
				Perennial forbs	5
Bastrop:					
3, 4	Sandy Loam	Favorable	5,500	Little bluestem	50
		Normal	4,500	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Other perennial grasses	15
				Perennial forbs	5
				Trees	5
Bolar:					
5	Clay Loam	Favorable	6,000	Little bluestem	30
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Perennial forbs	15
				Other perennial grasses	15
				Trees	5
[1]6:					
Bolar part	Clay Loam	Favorable	6,000	Little bluestem	30
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Perennial forbs	15
				Other perennial grasses	10
				Trees	10
Aledo part	Shallow	Favorable	3,000	Little bluestem	20
		Normal	2,000	Sideoats grama	20
		Unfavorable	1,800	Indiangrass	15
				Big bluestem	10
				Other perennial grasses	25
				Perennial forbs	5
				Trees	5

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Bonti:					
7	Sandy Loam	Favorable	4,500	Little bluestem	30
		Normal	3,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Sideoats grama	10
				Perennial forbs	10
				Other perennial grasses	15
				Trees	10
				Other annual grasses	5
[1]8:					
Bonti part	Sandstone Hills	Favorable	4,000	Little bluestem	35
		Normal	3,000	Indiangrass	10
		Unfavorable	2,500	Sideoats grama	10
				Other perennial grasses	15
				Trees	15
				Other annual grasses	10
				Perennial forbs	5
Exray part	Sandstone Hills	Favorable	4,000	Little bluestem	35
		Normal	3,000	Indiangrass	10
		Unfavorable	2,500	Sideoats grama	10
				Other perennial grasses	15
				Trees	15
				Other annual grasses	10
				Perennial forbs	5
Bosque:					
9, [1]10	Loamy Bottomland	Favorable	6,500	Indiangrass	20
		Normal	5,000	Little bluestem	20
		Unfavorable	3,500	Switchgrass	10
				Big bluestem	10
				Other perennial grasses	25
				Trees	10
				Perennial forbs	5
Branyon:					
11	Blackland	Favorable	7,000	Little bluestem	40
		Normal	5,500	Indiangrass	13
		Unfavorable	3,500	Big bluestem	12
				Meadow dropseed	10
				Other perennial grasses	10
				Perennial forbs	10
				Trees	5
Chaney:					
12	Loamy Sand	Favorable	4,500	Little bluestem	30
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Post oak	10
				Other perennial grasses	30
				Perennial forbs	5
				Other trees	5
Cona:					
[1]13	Sandstone Hills	Favorable	4,000	Little bluestem	40
		Normal	3,000	Indiangrass	10
		Unfavorable	2,000	Post oak	10
				Other perennial grasses	25
				Other trees	10
				Perennial forbs	5
Duffau:					
14	Loamy Sand	Favorable	4,500	Little bluestem	30
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Post oak	10
				Other perennial grasses	30
				Perennial forbs	5
				Other trees	5

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Duffau:					
15, 16	Sandy Loam	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Other perennial grasses	30
				Perennial forbs	10
				Trees	10
[1]17:					
Duffau part	Sandy Loam	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Other perennial grasses	30
				Perennial forbs	10
				Trees	10
Windthorst part	Sandy Loam	Favorable	6,000	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Other perennial grasses	30
				Perennial forbs	10
				Trees	10
Eufaula:					
[1]18:					
Eufaula part	Deep Sand	Favorable	4,000	Little bluestem	25
		Normal	2,800	Big bluestem	10
		Unfavorable	2,000	Sand lovegrass	10
				Other perennial grasses	30
				Trees	20
				Perennial forbs	5
Patilo part	Deep Sand	Favorable	4,000	Little bluestem	25
		Normal	2,800	Post oak	15
		Unfavorable	2,000	Blackjack oak	10
				Sand lovegrass	10
				Other perennial grasses	15
				Perennial forbs	10
				Other annual grasses	10
				Other trees	5
Gaddy:					
[1]19	Sandy Bottomland	Favorable	4,000	Little bluestem	20
		Normal	3,000	Switchgrass	15
		Unfavorable	2,500	Big bluestem	10
				Indiangrass	10
				Annual forbs	15
				Trees	15
				Other perennial grasses	15
Gowen:					
20, [1]21	Loamy Bottomland	Favorable	8,000	Little bluestem	20
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	10
				Switchgrass	10
				Other perennial grasses	20
				Trees	15
				Perennial forbs	5
				Shrubs	5
Hensley:					
22	Redland	Favorable	5,000	Little bluestem	30
		Normal	4,000	Indiangrass	20
		Unfavorable	2,500	Sideoats grama	10
				Other perennial grasses	25
				Perennial forbs	10
				Shrubs	5

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Lindy:					
23	Deep Redland	Favorable	6,000	Little bluestem	25
		Normal	5,000	Big bluestem	15
		Unfavorable	4,000	Indiangrass	15
				Other perennial grasses	35
				Perennial forbs	5
				Shrubs	5
Miller:					
24, [1]25	Clayey Bottomland	Favorable	5,000	Sideoats grama	35
		Normal	3,500	Western wheatgrass	15
		Unfavorable	2,000	Arizona cottontop	10
				Switchgrass	5
				Trees	10
				Other perennial grasses	10
				Perennial forbs	10
				Sedges	5
Pulexas:					
26, [1]27	Loamy Bottomland	Favorable	6,500	Indiangrass	20
		Normal	5,000	Little bluestem	20
		Unfavorable	3,500	Switchgrass	15
				Big bluestem	10
				Other perennial grasses	20
				Trees	10
				Perennial forbs	5
Renfrow:					
28	Claypan Prairie	Favorable	4,000	Sideoats grama	35
		Normal	2,800	Blue grama	15
		Unfavorable	2,000	Meadow dropseed	10
				Texas needlegrass	10
				Other perennial grasses	20
				Perennial forbs	10
Sanger:					
29, 30	Blackland	Favorable	6,000	Little bluestem	40
		Normal	5,000	Big bluestem	10
		Unfavorable	3,000	Meadow dropseed	10
				Other perennial grasses	25
				Perennial forbs	10
				Other annual grasses	5
Selden:					
31	Loamy Sand	Favorable	5,000	Little bluestem	30
		Normal	4,200	Big bluestem	10
		Unfavorable	3,500	Indiangrass	10
				Post oak	10
				Other perennial grasses	30
				Perennial forbs	5
				Other trees	5
Stoneburg:					
[1]32:					
Stoneburg part	Loamy Prairie	Favorable	7,000	Little bluestem	30
		Normal	5,000	Indiangrass	20
		Unfavorable	3,500	Big bluestem	15
				Sideoats grama	10
				Other perennial grasses	15
				Other annual grasses	5
				Perennial forbs	5
Anocon part	Loamy Prairie	Favorable	7,000	Little bluestem	30
		Normal	5,000	Indiangrass	20
		Unfavorable	3,500	Big bluestem	15
				Sideoats grama	10
				Other perennial grasses	15
				Other annual grasses	5
				Perennial forbs	5

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Teller:					
33	Loamy Prairie	Favorable	6,000	Little bluestem	30
		Normal	4,500	Big bluestem	20
		Unfavorable	3,000	Indiangrass	10
				Switchgrass	10
				Other perennial grasses	20
				Perennial forbs	10
Truce:					
34	Tight Sandy Loam	Favorable	4,000	Sideoats grama	30
		Normal	3,000	Silver bluestem	10
		Unfavorable	2,000	Vine-mesquite	10
				Other perennial grasses	30
				Perennial forbs	10
				Trees	10
[1]35:					
Truce part	Sandstone Hills	Favorable	4,000	Little bluestem	25
		Normal	3,000	Sideoats grama	20
		Unfavorable	2,500	Indiangrass	10
				Trees	15
				Other perennial grasses	15
				Other annual grasses	10
				Perennial forbs	5
Owens part	Rocky Hills	Favorable	1,700	Sideoats grama	30
		Normal	1,200	Silver bluestem	15
		Unfavorable	900	Buffalograss	10
				Vine-mesquite	10
				Other perennial grasses	25
				Perennial forbs	5
				Shrubs	5
Ustolls:					
[1]36:					
Ustolls part	Steep Rocky	Favorable	3,500	Little bluestem	50
		Normal	3,000	Indiangrass	10
		Unfavorable	2,500	Other perennial grasses	25
				Trees	10
				Perennial forbs	5
Rock outcrop part.					
Vashti:					
37	Sandy Loam	Favorable	6,000	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Sideoats grama	10
				Other perennial grasses	20
				Perennial forbs	10
				Trees	10
Venus:					
38	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Other perennial grasses	25
				Perennial forbs	15
				Trees	5
Vernon:					
39	Shallow Clay	Favorable	1,750	Sideoats grama	40
		Normal	1,500	Buffalograss	15
		Unfavorable	900	Meadow dropseed	15
				Other perennial grasses	20
				Perennial forbs	5
				Shrubs	5

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Vernon:					
[1]40:					
Vernon part	Shallow Clay	Favorable	1,750	Sideoats grama	40
		Normal	1,500	Buffalograss	15
		Unfavorable	900	Silver bluestem	15
				Other perennial grasses	20
				Perennial forbs	5
				Shrubs	5
Knoco part	Shallow Clay	Favorable	1,400	Sideoats grama	40
		Normal	1,000	Buffalograss	20
		Unfavorable	600	Silver bluestem	15
				Other perennial grasses	20
				Perennial forbs	5
Waurika:					
[1]41:					
Waurika part	Claypan Prairie	Favorable	3,500	Sideoats grama	30
		Normal	2,800	Blue grama	10
		Unfavorable	1,500	Vine-mesquite	10
				White tridens	10
				Meadow dropseed	10
				Other perennial grasses	20
				Perennial forbs	10
Renfrow part	Claypan Prairie	Favorable	4,000	Sideoats grama	40
		Normal	2,800	Blue grama	10
		Unfavorable	2,000	Texas needlegrass	10
				Buffalograss	10
				Other perennial grasses	20
				Perennial forbs	10
Windthorst:					
42	Loamy Sand	Favorable	5,000	Little bluestem	25
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Post oak	10
				Other perennial grasses	35
				Other trees	5
				Perennial forbs	5
43, 44	Sandy Loam	Favorable	6,000	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Other perennial grasses	30
				Perennial forbs	10
				Trees	10
[1]45:					
Windthorst part	Sandy Loam	Favorable	6,000	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Other perennial grasses	30
				Perennial forbs	10
				Trees	10
Duffau part	Sandy Loam	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Indiangrass	10
				Other perennial grasses	30
				Perennial forbs	10
				Trees	10

See footnote at end of table.

TABLE 6.—RANGE PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITES—Continued

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Yahola: [1]46:					
Yahola part	Loamy Bottomland	Favorable	7,000	Little bluestem	30
		Normal	4,900	Big bluestem	10
		Unfavorable	3,500	Indiangrass	10
				Switchgrass	10
				Other perennial grasses	15
				Trees	10
				Annual forbs	10
				Sedges	5
Gaddy part	Sandy Bottomland	Favorable	3,800	Little bluestem	20
		Normal	3,000	Switchgrass	15
		Unfavorable	2,000	Indiangrass	10
				Big bluestem	10
				Other perennial grasses	10
				Annual forbs	15
				Trees	10

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 7.—BUILDING SITE DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Aledo:					
1	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Anocon:					
[1]2:					
Anocon part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Severe: low strength.
Stoneburg part	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Bastrop:					
3	Slight	Slight	Slight	Slight	Moderate: low strength.
4	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Bolar:					
5	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
[1]6:					
Bolar part	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Severe: low strength.
Aledo part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Bonti:					
7	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Severe: depth to rock.	Moderate: depth to rock.	Severe: low strength.
[1]8:					
Bonti part	Severe: depth to rock.	Moderate: depth to rock, shrink-swell.	Moderate: depth to rock, shrink-swell.	Severe: slope, large stones.	Severe: low strength.
Exray part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.
Bosque:					
9, [1]10	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Branyon:					
11	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Chaney:					
12	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Cona:					
[1]13	Severe: large stones, too clayey.	Severe: slope, large stones, shrink-swell.	Severe: slope, large stones, shrink-swell.	Severe: slope, large stones, shrink-swell.	Severe: slope, low strength, shrink-swell.

See footnote at end of table.

TABLE 7.—BUILDING SITE DEVELOPMENT—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Duffau: 14, 15, 16	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
[1]17: Duffau part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Windthorst part	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Eufaula: [1]18: Eufaula part	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
Patilo part	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Slight.
Gaddy: [1]19	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Gowen: 20	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.	Moderate: shrink-swell, floods.
[1]21	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Hensley: 22	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Lindy: 23	Severe: depth to rock, too clayey.	Moderate: shrink-swell, low strength.	Severe: depth to rock.	Moderate: shrink-swell, low strength.	Severe: low strength.
Miller: 24, [1]25	Severe: floods, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.
Pulexas: 26	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
[1]27	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Renfrow: 28	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Sanger: 29, 30	Severe: cutbanks cave, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 7.—BUILDING SITE DEVELOPMENT—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Selden:					
31	Moderate: wetness.	Slight	Moderate: wetness.	Slight	Moderate: low strength.
Stoneburg:					
132:					
Stoneburg part	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Anocon part	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell.	Severe: low strength.
Teller:					
33	Slight	Slight	Slight	Slight	Moderate: low strength.
Truce:					
34	Severe: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
135:					
Truce part	Severe: too clayey, large stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: slope.	Severe: low strength.
Owens part	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell.
Ustolls:					
136:					
Ustolls part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.
Rock outcrop part.					
Vashti:					
37	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock, wetness.	Moderate: depth to rock.	Moderate: depth to rock.
Venus:					
38	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Vernon:					
39	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
140:					
Vernon part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Knoco part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Waurika:					
141:					
Waurika part	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.

See footnote at end of table.

TABLE 7.—BUILDING SITE DEVELOPMENT—Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Waurika:					
Renfrow part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Windthorst:					
42, 43	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
44	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
[1]45:					
Windthorst part	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Duffau part	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
Yahola:					
[1]46:					
Yahola part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
Gaddy part	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 8.—SANITARY FACILITIES

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aledo:					
1	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones.
Anocon:					
[1]2:					
Anocon part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Stoneburg part	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.
Bastrop:					
3, 4	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Bolar:					
5	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
[1]6:					
Bolar part	Severe: depth to rock.	Severe: slope, depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
Aledo part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, small stones.
Bonti:					
7	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: depth to rock.
[1]8:					
Bonti part	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: large stones.
Exray part	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Moderate: slope.	Poor: thin layer, large stones.
Bosque:					
9, [1]10	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Branyon:					
11	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Chaney:					
12	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: thin layer.
Cona:					
[1]13	Severe: slope, percs slowly.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Fair: large stones, too clayey.

See footnote at end of table.

TABLE 8.—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
Duffau: 14, 15, 16	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
[1]17: Duffau part	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Windthorst part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Eufaula: [1]18: Eufaula part	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
Patilo part	Moderate: percs slowly.	Severe: seepage.	Moderate: too sandy, wetness.	Moderate: seepage.	Poor: too sandy.
Gaddy: [1]19	Severe: floods.	Severe: seepage, floods.	Severe: seepage, too sandy, floods.	Severe: floods, seepage.	Fair: too sandy.
Gowen: 20	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
[1]21	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Hensley: 22	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Lindy: 23	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer, too clayey.
Miller: 24, [1]25	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: too clayey, hard to pack.
Pulexas: 26, [1]27	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Renfrow: 28	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
Sanger: 29	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
30	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, large stones.
Selden: 31	Severe: percs slowly.	Moderate: slope.	Slight	Slight	Good.

See footnote at end of table.

TABLE 8.—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
Stoneburg:					
32:					
Stoneburg part	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock.	Slight	Fair: thin layer.
Anocon part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Teller:					
33	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
Truce:					
34	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
35:					
Truce part	Severe: percs slowly.	Severe: slope, large stones.	Severe: too clayey, large stones.	Moderate: slope.	Poor: thin layer, large stones.
Owens part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, area reclaim.
Ustolls:					
36:					
Ustolls part	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope, large stones.	Severe: slope.	Poor: slope, large stones.
Rock outcrop part.					
Vashti:					
37	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: wetness.	Fair: thin layer, area reclaim.
Venus:					
38	Slight	Moderate: seepage.	Slight	Slight	Good.
Vernon:					
39	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
40:					
Vernon part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Knoco part	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Severe: slope.	Poor: too clayey.
Waurika:					
41:					
Waurika part	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: thin layer.
Renfrow part	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: thin layer.
Windthorst:					
42, 43, 44	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
45:					
Windthorst part	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.

See footnote at end of table.

TABLE 8.—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
Windthorst:					
Duffau part	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
Yahola: [1]46:					
Yahola part	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Gaddy part	Severe: floods.	Severe: seepage, floods.	Severe: seepage, too sandy, floods.	Severe: floods, seepage.	Fair: too sandy.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 9.—CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Aledo:				
1	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Anocon:				
12:				
Anocon part	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Stoneburg part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bastrop:				
3, 4	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Bolar:				
5	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
16:				
Bolar part	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Aledo part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Bonti:				
7	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
18:				
Bonti part	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Exray part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Bosque:				
9, 110	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Branyon:				
11	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Chaney:				
12	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Cona:				
113	Poor: low strength, large stones, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones, thin layer.

See footnote at end of table.

TABLE 9.—CONSTRUCTION MATERIALS—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Duffau:				
14	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
15, 16	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]17:				
Duffau part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Windthorst part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Eufaula:				
[1]18:				
Eufaula part	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Patilo part	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Gaddy:				
[1]19	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Gowen:				
20, [1]21	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Hensley:				
22	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, too clayey.
Lindy:				
23	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Miller:				
24, [1]25	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Pulexas:				
26, [1]27	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Renfrow:				
28	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Sanger:				
29	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
30	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, large stones.
Selden:				
31	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Stoneburg:				
[1]32:				
Stoneburg part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 9.—CONSTRUCTION MATERIALS—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Stoneburg:				
Anocon part	Fair: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Teller:				
33	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Truce:				
34	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]35:				
Truce part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Owens part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Ustolls:				
[1]36:				
Ustolls part	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, large stones.
Rock outcrop part.				
Vashti:				
37	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Venus:				
38	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Vernon:				
39	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
[1]40:				
Vernon part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Knoco part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Waurika:				
[1]41:				
Waurika part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Renfrow part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Windthorst:				
42	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
43, 44	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]45:				
Windthorst part	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 9.—CONSTRUCTION MATERIALS—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Windthorst:				
Duffau part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Yahola: [1]46:				
Yahola part	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Gaddy part	Good	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 10.—WATER MANAGEMENT

["Seepage," and some of the other terms that describe restrictive soil features are defined in the Glossary. Absence of an entry means soil was not evaluated]

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Aledo:					
1	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Depth to rock, rooting depth.	Droughty, rooting depth.
Anocon:					
[1]2:					
Anocon part	Slight	Slight	Not needed	Favorable	Favorable.
Stoneburg part	Severe: depth to rock.	Moderate: thin layer.	Not needed	Favorable	Favorable.
Bastrop:					
3, 4	Moderate: seepage.	Moderate: piping.	Not needed	Favorable	Favorable.
Bolar:					
5	Severe: seepage, depth to rock.	Moderate: thin layer.	Depth to rock	Favorable	Favorable.
[1]6:					
Bolar part	Severe: seepage, depth to rock.	Moderate: thin layer.	Depth to rock	Large stones	Large stones.
Aledo part	Severe: depth to rock.	Severe: thin layer.	Depth to rock	Depth to rock, rooting depth.	Droughty, rooting depth.
Bonti:					
7	Severe: depth to rock.	Moderate: thin layer.	Not needed	Favorable	Favorable.
[1]8:					
Bonti part	Severe: depth to rock.	Severe: large stones.	Not needed	Large stones, slope.	Large stones, slope.
Exray part	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock, large stones.	Large stones, rooting depth.
Bosque:					
9, [1]10	Moderate: seepage.	Moderate: compressible.	Not needed	Floods	Floods.
Branyon:					
11	Slight	Moderate: compressible, piping.	Percs slowly, cutbanks cave.	Percs slowly	Percs slowly.
Chaney:					
12	Slight	Moderate: erodes easily.	Percs slowly	Piping, erodes easily.	Erodes easily.
Cona:					
[1]13	Slight	Severe: large stones.	Not needed	Complex slope, erodes easily, large stones.	Not needed.
Duffau:					
14	Moderate: seepage.	Moderate: erodes easily, piping.	Not needed	Soil blowing, erodes easily.	Erodes easily.
15, 16	Moderate: seepage.	Moderate: erodes easily, piping.	Not needed	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 10.—WATER MANAGEMENT—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Duffau: [1]17:					
Duffau part	Moderate: seepage.	Moderate: erodes easily, piping.	Not needed	Erodes easily	Erodes easily.
Windthorst part	Moderate: seepage.	Moderate: compressible.	Percs slowly	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Eufaula: [1]18:					
Eufaula part	Severe: seepage.	Moderate: unstable fill, piping.	Not needed	Seepage, fast intake, droughty.	Erodes easily, droughty, fast intake.
Patilo part	Severe: seepage.	Moderate: seepage, piping.	Cutbanks cave	Piping, erodes easily.	Droughty.
Gaddy: [1]19	Severe: seepage.	Moderate: unstable fill, piping.	Not needed	Erodes easily	Erodes easily.
Gowen: 20	Moderate: seepage.	Moderate: compressible.	Not needed	Favorable	Favorable.
[1]21	Moderate: seepage.	Moderate: compressible.	Not needed	Wetness	Favorable.
Hensley: 22	Severe: depth to rock.	Severe: thin layer.	Not needed	Depth to rock	Percs slowly, rooting depth.
Lindy: 23	Severe: depth to rock.	Moderate: piping, thin layer.	Not needed	Rooting depth	Rooting depth.
Miller: 24, [1]25	Slight	Moderate: unstable fill, compressible.	Floods, percs slowly.	Not needed	Percs slowly.
Pulexas: 26, [1]27	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Not needed	Not needed	Favorable.
Renfrow: 28	Slight	Moderate: unstable fill, compressible.	Not needed	Erodes easily, percs slowly.	Erodes easily, percs slowly.
Sanger: 29	Slight	Moderate: unstable fill, compressible.	Slope, percs slowly.	Percs slowly	Percs slowly, slope.
30	Slight	Moderate: unstable fill, low strength.	Not needed	Large stones, slope, percs slowly.	Percs slowly, slope, large stones.
Selden: 31	Moderate: seepage.	Slight	Percs slowly	Erodes easily	Erodes easily.

See footnote at end of table.

TABLE 10.—WATER MANAGEMENT—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Stoneburg:					
132:					
Stoneburg part	Severe: depth to rock.	Moderate: thin layer.	Not needed	Favorable	Favorable.
Anocon part	Slight	Slight	Not needed	Favorable	Favorable.
Teller:					
33	Severe: seepage.	Moderate: unstable fill, piping.	Not needed	Favorable	Favorable.
Truce:					
34	Slight	Moderate: low strength.	Not needed	Favorable	Favorable.
135:					
Truce part	Slight	Severe: large stones.	Not needed	Slope, large stones.	Slope, large stones.
Owens part	Slight	Moderate: compressible.	Not needed	Slope, rooting depth.	Droughty, erodes easily.
Ustolls:					
136:					
Ustolls part	Severe: slope	Severe: large stones.	Not needed	Slope, large stones.	Slope, large stones.
Rock outcrop part.					
Vashti:					
37	Severe: depth to rock.	Moderate: thin layer.	Depth to rock	Depth to rock	Favorable.
Venus:					
38	Severe: seepage.	Moderate: piping.	Not needed	Slope	Favorable.
Vernon:					
39	Slight	Moderate: compressible, low strength, shrink-swell.	Not needed	Complex slope, percs slowly.	Droughty, percs slowly, slope.
140:					
Vernon part	Slight	Moderate: compressible, low strength, shrink-swell.	Not needed	Complex slope, percs slowly.	Droughty, percs slowly, slope.
Knoco part	Slight	Moderate: low strength, shrink-swell.	Not needed	Not needed	Not needed.
Waurika:					
141:					
Waurika part	Slight	Moderate: compressible, unstable fill, shrink-swell.	Wetness	Not needed	Not needed.
Renfrow part	Slight	Moderate: unstable fill, compressible.	Not needed	Not needed	Not needed.
Windthorst:					
42, 43, 44	Moderate: seepage.	Moderate: compressible.	Percs slowly	Percs slowly, erodes easily.	Percs slowly, erodes easily.

See footnote at end of table.

TABLE 10.—WATER MANAGEMENT—Continued

Soil name and map symbol	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Terraces and diversions	Grassed waterways
Windthorst: [1]45:					
Windthorst part	Moderate: seepage.	Moderate: compressible.	Percs slowly	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Duffau part	Moderate: seepage.	Moderate: erodes easily, piping.	Not needed	Erodes easily	Erodes easily.
Yahola: [1]46:					
Yahola part	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Not needed	Not needed	Not needed.
Gaddy part	Severe: seepage.	Moderate: unstable fill, piping.	Not needed	Erodes easily	Erodes easily.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 11.—RECREATIONAL DEVELOPMENT

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Aledo: 1	Moderate: too clayey.	Moderate: too clayey.	Severe: depth to rock, small stones.	Moderate: too clayey.
Anocon: [1]2:				
Anocon part	Slight	Slight	Moderate: slope.	Slight.
Stoneburg part	Slight	Slight	Moderate: slope.	Slight.
Bastrop: 3, 4	Slight	Slight	Moderate: slope.	Slight.
Bolar: 5	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
[1]6:				
Bolar part	Moderate: large stones.	Moderate: large stones.	Severe: large stones.	Moderate: large stones.
Aledo part	Moderate: too clayey.	Moderate: slope.	Severe: depth to rock, small stones.	Moderate: too clayey.
Bonti: 7	Moderate: percs slowly.	Slight	Moderate: depth to rock, slope.	Slight.
[1]8:				
Bonti part	Moderate: slope, large stones.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
Exray part	Moderate: percs slowly.	Moderate: slope.	Severe: slope, large stones.	Moderate: large stones.
Bosque: 9, [1]10	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
Branyon: 11	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Chaney: 12	Moderate: percs slowly.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Cona: [1]13	Severe: slope, large stones.	Severe: slope.	Severe: large stones, slope.	Moderate: slope, large stones.
Duffau: 14	Moderate: too sandy.	Moderate: too sandy.	Severe: soil blowing.	Moderate: too sandy.

See footnote at end of table.

TABLE 11.—RECREATIONAL DEVELOPMENT—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Duffau:				
15	Slight	Slight	Moderate: slope.	Slight.
16	Slight	Slight	Severe: slope.	Slight.
[1]17:				
Duffau part	Slight	Slight	Moderate: slope.	Slight.
Windthorst part	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
Eufaula:				
[1]18:				
Eufaula part	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy.	Severe: too sandy.
Patilo part	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Gaddy:				
[1]19	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Gowen:				
20	Severe: floods.	Moderate: floods.	Moderate: too clayey, floods.	Moderate: too clayey.
[1]21	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: too clayey, floods.
Hensley:				
22	Moderate: percs slowly.	Slight	Severe: depth to rock.	Slight.
Lindy:				
23	Moderate: percs slowly.	Moderate: too clayey.	Moderate: depth to rock.	Moderate: too clayey.
Miller:				
24	Severe: floods, percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly.	Severe: too clayey.
[1]25	Severe: floods, percs slowly, too clayey.	Severe: floods.	Severe: percs slowly.	Severe: floods.
Pulexas:				
26	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
[1]27	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
Renfrow:				
28	Severe: percs slowly.	Slight	Severe: slope, percs slowly.	Slight.
Sanger:				
29	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.

See footnote at end of table.

TABLE 11.—RECREATIONAL DEVELOPMENT—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Sanger:				
30	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly, large stones.	Severe: too clayey.
Selden:				
31	Moderate: too sandy, percs slowly.	Moderate: too sandy.	Severe: too sandy, soil blowing.	Moderate: too sandy.
Stoneburg:				
[1]32:				
Stoneburg part	Slight	Slight	Moderate: slope.	Slight.
Anocon part	Slight	Slight	Moderate: slope.	Slight.
Teller:				
33	Slight	Slight	Slight	Slight.
Truce:				
34	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
[1]35:				
Truce part	Moderate: large stones, percs slowly.	Moderate: slope, large stones.	Severe: slope, large stones.	Moderate: large stones.
Owens part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: slope, too clayey.	Severe: too clayey.
Ustolls:				
[1]36:				
Ustolls part	Severe: slope, large stones.	Severe: slope.	Severe: slope, large stones.	Severe: slope, large stones.
Rock outcrop part.				
Vashti:				
37	Slight	Slight	Moderate: slope, depth to rock.	Slight.
Venus:				
38	Slight	Slight	Severe: slope.	Slight.
Vernon:				
39	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
[1]40:				
Vernon part	Severe: percs slowly.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Knoco part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.

See footnote at end of table.

TABLE 11.—RECREATIONAL DEVELOPMENT—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Waurika:				
[1]41:				
Waurika part	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
Renfrow part	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Windthorst:				
42	Moderate: percs slowly.	Moderate: too sandy.	Moderate: percs slowly.	Moderate: too sandy.
43	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
44	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
[1]45:				
Windthorst part	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Duffau part	Slight	Slight	Severe: slope.	Slight.
Yahola:				
[1]46:				
Yahola part	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Gaddy part	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 12.—WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for—		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Aledo:									
1	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Very poor.	Poor.
Anocon:									
[1]2:									
Anocon part	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Stoneburg part	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Bastrop:									
3, 4	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Bolar:									
5	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
[1]6:									
Bolar part	Poor	Poor	Fair	Fair	Poor	Very poor.	Poor	Very poor.	Fair.
Aledo part	Poor	Poor	Poor	Fair	Very poor.	Very poor.	Poor	Very poor.	Poor.
Bonti:									
7	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]8:									
Bonti part	Very poor.	Very poor.	Good	Good	Poor	Very poor.	Poor	Very poor.	Good.
Exray part	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Bosque:									
9	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]10	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Branyon:									
11	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
Chaney:									
12	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Cona:									
[1]13	Poor	Fair	Good	Good	Very poor.	Very poor.	Fair	Very poor.	Good.
Duffau:									
14	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
15, 16	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]17:									
Duffau part	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.

See footnote at end of table.

TABLE 12.—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	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Duffau:									
Windthorst part	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Eufaula:									
[1]18:									
Eufaula part	Fair	Fair	Fair	Good	Very poor.	Very poor.	Fair	Very poor.	Fair.
Patilo part	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Gaddy:									
[1]19	Very poor.	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Gowen:									
20	Good	Good	Fair	Good	Poor	Very poor.	Good	Very poor.	Fair.
[1]21	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Hensley:									
22	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Lindy:									
23	Fair	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Miller:									
24	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
[1]25	Poor	Fair	Poor	Fair	Poor	Poor	Poor	Poor	Poor.
Pulexas:									
26	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]27	Very poor.	Poor	Fair	Good	Poor	Very poor.	Poor	Very poor.	Fair.
Renfrow:									
28	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor.	Fair.
Sanger:									
29	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.
30	Poor	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Selden:									
31	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Stoneburg:									
[1]32:									
Stoneburg part	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.
Anocon part	Good	Good	Good	Good	Very poor.	Very poor.	Good	Very poor.	Good.

See footnote at end of table.

TABLE 12.—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	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Teller:									
33	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Truce:									
34	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]35:									
Truce part	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Poor	Very poor.	Good.
Owens part	Very poor.	Very poor.	Fair	Poor	Very poor.	Very poor.	Poor	Very poor.	Poor.
Ustolls:									
[1]36:									
Ustolls part	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Very poor.	Fair.
Rock outcrop part.									
Vashti:									
37	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
Venus:									
38	Fair	Good	Good	Fair	Poor	Very poor.	Good	Very poor.	Fair.
Vernon:									
39	Fair	Fair	Poor	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
[1]40:									
Vernon part	Fair	Fair	Poor	Fair	Poor	Very poor.	Fair	Very poor.	Fair.
Knoco part	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Waurika:									
[1]41:									
Waurika part	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
Renfrow part	Good	Good	Good	Fair	Poor	Very poor.	Good	Very poor.	Fair.
Windthorst:									
42, 43	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
44	Fair	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.
[1]45:									
Windthorst part	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Duffau part	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Very poor.	Good.
Yahola:									
[1]46:									
Yahola part	Good	Good	Good	Good	Poor	Very poor.	Good	Very poor.	Good.

See footnote at end of table.

TABLE 12.—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	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
Yahola: Gaddy part	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Very poor.	Fair.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 13.—ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Aledo:											
1	0–5	Gravelly clay loam.	CL, GC, GM, SC	A–4, A–6	0–20	65–95	60–90	55–90	40–70	30–40	10–20
	5–14	Very gravelly clay loam, very gravelly loam.	GC, GM, SC	A–2–4, A–2–6	5–30	35–55	30–50	25–50	15–35	30–40	10–20
	14–18	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Anocon:											
2:											
Anocon part	0–16	Fine sandy loam	ML, CL–ML, SM, SC	A–4	0	95–100	95–100	85–100	36–70	17–30	3–10
	16–39	Sandy clay, clay, clay loam.	CL, SC	A–6, A–7	0	95–100	95–100	90–100	45–80	30–49	15–30
	39–65	Sandy clay loam, clay loam.	SC, CL	A–6, A–7, A–4	0	90–100	90–100	85–100	40–80	25–45	8–25
Stoneburg part	0–10	Fine sandy loam	ML, CL–ML, SM, SC	A–4	0	95–100	95–100	85–100	40–75	17–30	3–10
	10–39	Clay loam, sandy clay loam.	SC, CL	A–6, A–4	0	95–100	95–100	90–100	45–80	25–40	8–20
	39–42	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
Bastrop:											
3, 4	0–7	Loam	ML, SM, CL–ML, SM–SC	A–4	0	95–100	80–100	80–100	36–70	18–25	2–7
	7–70	Sandy clay loam, clay loam, loam.	CL, SC	A–6	0	95–100	80–100	80–100	40–70	26–40	11–22
Bolar:											
5	0–9	Clay loam	CL, SC	A–6, A–7, A–4	0–5	75–100	75–100	70–98	40–80	25–42	9–25
	9–27	Clay loam, loam, silty clay loam.	CL, SC	A–6, A–7	0–10	75–95	75–95	70–90	40–75	25–42	11–25
	27–30	Weathered bedrock.	—	—	—	—	—	—	—	—	—
6:											
Bolar part	0–13	Stony clay loam	CL, SC	A–6, A–7, A–4	8–20	75–90	75–90	70–85	36–65	25–42	9–25
	13–28	Clay loam, loam, silty clay loam.	CL, SC	A–6, A–7	0–10	75–95	75–95	70–90	40–75	25–42	11–25
	28–30	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Aledo part	0–8	Gravelly clay loam.	CL, GC, GM, SC	A–4, A–6	0–20	65–95	60–90	55–90	40–70	30–40	10–20
	8–15	Weathered bedrock.	—	—	—	—	—	—	—	—	—

See footnote at end of table.

TABLE 13.—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	
Bonti:											
7	0–8	Fine sandy loam	SM, SM–SC, ML, CL–ML	A–4, A–2–4	0–2	90–100	90–100	70–100	25–70	18–30	2–7
	8–29	Clay, clay loam, sandy clay.	CL	A–6, A–7	0–4	80–100	80–100	70–100	51–75	30–45	18–25
	29–32	Weathered bedrock.	—	—	—	—	—	—	—	—	—
[1]8:											
Bonti part	0–10	Stony fine sandy loam.	SM, SM–SC, ML, CL–ML	A–4, A–2–4	8–25	75–90	75–90	55–90	30–55	18–30	2–7
	10–24	Clay, clay loam, sandy clay.	CL	A–6, A–7	0–4	80–100	80–100	70–100	51–75	30–45	18–25
	24–27	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Exray part	0–6	Stony fine sandy loam.	GM–GC, GC, SC, SM–SC	A–2–4, A–4	5–30	65–90	65–85	55–80	30–50	20–30	5–10
	6–13	Clay, sandy clay, clay loam.	CL, SC	A–6, A–7	0–20	80–100	80–100	80–100	48–80	30–45	15–25
	13–16	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Bosque:											
9, [1]10	0–22	Loam	CL, CL–ML	A–4, A–6	0	100	95–100	80–100	55–95	24–40	7–22
	22–44	Loam, clay loam	CL	A–4, A–6, A–7–6	0	100	95–100	95–100	55–80	26–45	10–25
	44–65	Loam, clay loam, clay.	CL, CL–ML	A–4, A–6, A–7–6	0	98–100	95–100	80–100	55–95	24–45	7–25
Branyon:											
11	0–65	Clay, silty clay	CH	A–7–6	0	95–100	75–100	75–100	75–100	60–80	35–55
Chaney:											
12	0–10	Loamy fine sand	SM, SM–SC, SP–SM	A–2–4, A–4, A–3	0	80–100	80–100	65–98	7–45	<25	NP–4
	10–47	Clay, sandy clay	CL, CH	A–7–6	0	90–100	90–100	90–100	51–85	42–60	24–42
	47–52	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A–6, A–7–6, A–2–6	0	90–100	90–100	80–100	30–70	25–55	11–40
Cona:											
[1]13	0–8	Stony sandy loam	SM, SC, SM–SC	A–2–4, A–4	0–30	80–100	70–95	70–80	25–40	15–25	2–8
	8–33	Sandy clay, clay	CL, CH	A–6, A–7	0–20	80–100	75–95	65–90	51–80	36–55	18–35
	33–45	Shaly clay	CL, CH	A–7	0–10	80–100	65–95	55–90	51–85	41–55	20–35
Duffau:											
14	0–11	Loamy fine sand	SM, SM–SC	A–2–4, A–4	0	95–100	95–100	75–98	15–40	<22	NP–4
	11–48	Sandy clay loam, clay loam, loam.	SC, CL	A–6	0	95–100	95–100	80–100	36–65	30–40	15–24
	48–70	Sandy clay loam, loam, fine sandy loam.	SC, CL, CL–ML, SM	A–4, A–6	0	95–100	95–100	80–100	40–65	20–36	2–18

See footnote at end of table.

TABLE 13.—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	
Duffau:											
15, 16	0–12	Fine sandy loam	SM, SM–SC, ML, CL–ML	A–4, A–2–4	0	95–100	95–100	75–90	30–60	<25	NP–7
	12–45	Sandy clay loam, clay loam, loam.	SC, CL	A–6	0	95–100	95–100	80–100	36–65	30–40	15–24
	45–70	Sandy clay loam, loam, fine sandy loam.	SC, CL, CL–ML, SM	A–4, A–6	0	95–100	95–100	80–100	40–65	20–36	2–18
[1]17:											
Duffau part	0–6	Fine sandy loam	SM, SM–SC, ML, CL–ML	A–4, A–2–4	0	95–100	95–100	75–90	30–60	<25	NP–7
	6–39	Sandy clay loam, clay loam, loam.	SC, CL	A–6	0	95–100	95–100	80–100	36–65	30–40	15–24
	39–62	Sandy clay loam, loam, fine sandy loam.	SC, CL, CL–ML, SM	A–4, A–6	0	95–100	95–100	80–100	40–65	20–36	2–18
Windthorst part	0–4	Fine sandy loam	SM, SM–SC, CL–ML	A–4	0	95–100	90–100	75–100	36–75	<28	NP–7
	4–48	Clay, sandy clay, clay loam.	CL, CH	A–6, A–7–6	0	95–100	95–100	85–100	51–90	35–53	20–35
	48–60	Sandy clay loam, clay, fine sandy loam.	SC, CL	A–4, A–6, A–7–6	0	85–100	80–100	75–100	36–90	25–45	8–28
Eufaula:											
[1]18:											
Eufaula part	0–80	Fine sand, loamy fine sand.	SM, SP–SM	A–2, A–3	0	100	98–100	82–100	5–35	——	NP
Patilo part	0–45	Fine sand	SM, SP–SM, SM–SC	A–2–4, A–3	0	100	95–100	85–100	8–28	<25	NP–5
	45–65	Sandy clay loam	SC	A–2, A–4, A–6	0	90–100	90–100	90–100	25–50	22–36	8–20
Gaddy:											
[1]19	0–4	Loamy fine sand	SM	A–2	0	100	98–100	90–100	15–35	——	NP
	4–45	Loamy fine sand, fine sand.	SM	A–2	0	100	98–100	90–100	15–35	——	NP
Gowen:											
20, [1]21	0–28	Loam, clay loam	CL	A–6, A–7–6	0	100	95–100	85–100	60–85	28–43	11–25
	28–52	Clay loam, loam	CL	A–4, A–6, A–7–6	0	100	95–100	85–100	55–85	25–43	10–25
Hensley:											
22	0–4	Loam	CL, CL–ML	A–6, A–4	0–2	80–100	75–100	70–100	60–85	20–40	5–20
	4–16	Clay, clay loam	CL, CH	A–6, A–7	0–10	80–100	75–100	70–100	60–95	35–55	18–35
	16–20	Unweathered bedrock.	——	——	——	——	——	——	——	——	——
Lindy:											
23	0–6	Clay loam	CL, CL–ML	A–4, A–6	0–15	75–100	70–100	70–100	60–85	20–40	5–20
	6–31	Clay loam, clay	CL, CH	A–6, A–7	0–5	80–100	75–100	75–100	65–90	35–60	15–35
	31–35	Unweathered bedrock.	——	——	——	——	——	——	——	——	——

See footnote at end of table.

TABLE 13.—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	
Miller:											
24, [1]25	0-17	Clay	CL, CH	A-6, A-7	0	100	98-100	96-100	80-99	35-60	15-35
	17-39	Clay, silty clay, silty clay loam.	CL, CH	A-7	0	100	98-100	96-100	90-99	41-65	20-40
	39-50	Clay, silty clay, silty clay loam.	CL, CH	A-6, A-7	0	100	98-100	96-100	80-99	35-60	15-35
	50-60	Fine sandy loam, loam.	SM, SC, ML, CL	A-4, A-2	0	100	95-100	90-100	15-85	<30	NP-10
Pulexas:											
26, [1]27	0-5	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	5-42	Stratified fine sandy loam to loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	42-60	Stratified loamy sand to clay loam.	SM, SC, ML, CL	A-4, A-2, A-6	0	100	95-100	90-100	15-85	<30	NP-15
Renfrow:											
28	0-11	Loam	ML, CL	A-4, A-6	0	100	100	96-100	65-97	30-37	8-14
	11-65	Clay, silty clay.	ML, CL, CH, MH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
Sanger:											
29	0-46	Silty clay	CH	A-7-6	0	95-100	95-100	90-100	80-95	51-70	28-42
	46-54	Clay, silty clay	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	85-100	40-60	20-36
30	0-9	Stony clay	CH	A-7-6	2-20	90-100	90-100	85-100	75-95	51-70	28-42
	9-43	Clay, silty clay	CH, CL	A-7-6, A-6	0	90-100	90-100	75-100	70-99	40-60	20-36
	43-65	Clay, silty clay, shaly clay.	CH, CL	A-7-6, A-6	0	90-100	90-100	85-100	80-100	40-55	20-35
Selden:											
31	0-15	Fine sand	SP-SM, SM, SM-SC	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
	15-66	Sandy clay loam, clay loam.	SC, CL	A-2-6, A-6	0	95-100	95-100	90-100	25-55	20-35	11-20
Stoneburg:											
[1]32:											
Stoneburg part	0-11	Fine sandy loam	ML, CL-ML, SM, SC	A-4	0	95-100	95-100	85-100	40-75	17-30	3-10
	11-16	Loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	90-100	40-80	25-35	8-15
	16-26	Clay loam, sandy clay loam.	SC, CL	A-6, A-4	0	95-100	95-100	90-100	45-80	25-40	8-20
	26-35	Clay loam, sandy clay loam.	SC, CL	A-6, A-4	0-15	85-100	85-100	75-98	45-80	25-40	8-20
	35-40	Unweathered bedrock.	—	—	—	—	—	—	—	—	—
Anocon part	0-10	Fine sandy loam	ML, CL-ML, SM, SC	A-4	0	95-100	95-100	85-100	36-70	17-30	3-10
	10-41	Sandy clay, clay, clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	90-100	45-80	30-49	15-30
	41-62	Sandy clay loam, clay loam.	SC, CL	A-6, A-7, A-4	0	90-100	90-100	85-100	40-80	25-45	8-25

See footnote at end of table.

TABLE 13.—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	
Teller:											
33	0–14	Loam	SM, SC, ML, CL	A-4	0	100	100	94–100	36–85	<30	NP–10
	14–45	Sandy clay loam, clay loam, loam	SC, CL	A-6, A-4	0	100	100	90–100	45–85	24–40	7–18
	45–70	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4, A-6	0	100	100	94–100	45–85	20–34	3–13
Truce:											
34	0–6	Fine sandy loam	CL–ML, CL, SM–SC, SC	A-4	0	75–100	75–100	70–100	40–75	18–30	5–10
	6–45	Clay, sandy clay, clay loam.	CL	A-6, A-7	0	80–100	80–100	80–100	50–80	30–45	20–30
	45–55	Shaly weathered bedrock.	—	—	—	—	—	—	—	—	—
[1]35:											
Truce part	0–7	Stony fine sandy loam.	SC, CL–ML, SC	A-4	5–20	70–90	70–85	65–85	36–60	18–30	5–10
	7–41	Clay, sandy clay, clay loam.	CL	A-6, A-7	0–10	80–100	80–100	80–100	50–80	30–45	20–30
	41–48	Shaly weathered bedrock.	—	—	—	—	—	—	—	—	—
Owens part	0–4	Stony clay	CL, CH	A-7-6	5–20	90–100	80–100	70–100	60–95	45–60	22–32
	4–18	Clay, clay loam	CL, CH	A-7-6	0–5	95–100	90–100	85–100	75–95	45–60	22–32
	18–30	Shaly clay bedrock.	CL, CH	A-6, A-7-6	0–5	90–100	85–100	80–100	55–95	40–55	25–35
Ustolls:											
[1]36:											
Ustolls part	0–80	Variable	—	—	—	—	—	—	—	—	—
Rock outcrop part.											
Vashti:											
37	0–10	Fine sandy loam	SM, SC, CL, SM–SC	A-4	0–2	90–100	90–100	70–100	36–70	<25	NP–10
	10–31	Sandy clay loam, clay loam.	SC, CL	A-2-6, A-6	0–2	90–100	90–100	65–95	30–55	25–35	11–20
	31–33	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Venus:											
38	0–12	Loam	CL, CL–ML	A-4, A-6	0	100	95–100	85–100	50–80	20–40	5–20
	12–48	Loam, clay loam, sandy clay loam.	CL, CL–ML	A-4, A-6	0	95–100	95–100	85–100	50–80	20–40	5–20
	48–60	Fine sandy loam, loam, sandy clay loam.	SC, SM–SC, CL, CL–ML	A-4, A-6	0	80–100	70–100	65–100	40–80	20–40	5–20
Vernon:											
39	0–4	Clay	CL, CH	A-6, A-7-6	0	95–100	90–100	90–100	80–98	38–60	20–38
	4–29	Clay, silty clay	CL, CH	A-6, A-7-6	0	95–100	90–100	90–100	80–98	38–60	20–38
	29–35	Shaly clay bedrock.	CL, CH	A-6, A-7-6	0–5	90–100	85–100	65–100	65–95	30–60	15–38

See footnote at end of table.

TABLE 13.—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	
Vernon:											
[1]40:											
Vernon part	0–5	Clay	CL, CH	A–6, A–7–6	0	95–100	90–100	90–100	80–98	38–60	20–38
	5–28	Clay	CL, CH	A–6, A–7–6	0	95–100	90–100	90–100	80–98	38–60	20–38
	28–36	Shaly clay bedrock.	CL, CH	A–6, A–7–6	0–5	90–100	85–100	65–100	65–95	30–60	15–38
Knoco part	0–7	Clay	CL, CH	A–7–6, A–6	0–5	90–100	90–100	90–100	80–98	32–60	14–38
	7–22	Shaly clay, clay	CL, CH	A–7–6, A–6	0–5	90–100	85–100	60–100	60–95	30–60	13–38
	22–28	Clayey shale bedrock.	—	—	—	—	—	—	—	—	—
Waurika:											
[1]41:											
Waurika part	0–14	Silt loam, loam	CL, ML	A–4, A–6	0	100	100	96–100	80–95	22–37	3–14
	14–33	Clay, silty clay	CL, CH, MH	A–7	0	95–100	95–100	90–100	80–98	41–66	20–40
	33–54	Silty clay loam, clay loam, silty clay.	CL, CH, ML, MH	A–6, A–7	0	90–100	90–100	85–100	80–98	38–55	16–30
	54–64	Clay loam, silty clay loam.	CL, ML	A–6, A–7	0	90–100	90–100	80–100	70–98	33–43	12–20
Renfrow part	0–9	Loam	ML, CL	A–4, A–6	0	100	100	96–100	65–97	30–37	8–14
	9–65	Clay, silty clay, silty clay loam.	ML, CL, CH, MH	A–6, A–7	0	100	100	96–100	80–99	37–70	15–38
Windthorst:											
42	0–10	Loamy fine sand	SM, SM–SC	A–4, A–2–4	0	95–100	90–100	80–95	15–40	<21	NP–4
	10–32	Clay, sandy clay, clay loam.	CL, CH	A–6, A–7–6	0	95–100	95–100	85–100	51–90	35–53	20–35
	32–60	Sandy clay loam, clay, clay loam, sandy clay.	SC, CL	A–4, A–6, A–7–6	0	85–100	80–100	75–100	36–90	25–45	8–28
43, 44	0–10	Fine sandy loam	SM, SM–SC, CL–ML	A–4	0	95–100	90–100	75–100	36–75	<28	NP–7
	10–36	Clay, sandy clay, clay loam.	CL, CH	A–6, A–7–6	0	95–100	95–100	85–100	51–90	35–53	20–35
	36–60	Sandy clay loam, clay, clay loam, sandy clay.	SC, CL	A–4, A–6, A–7–6	0	85–100	80–100	75–100	36–90	25–45	8–28
[1]45:											
Windthorst part	0–4	Fine sandy loam	SM, SM–SC, CL–ML	A–4	0	95–100	90–100	75–100	36–75	<28	NP–7
	4–40	Clay, sandy clay, clay loam.	CL, CH	A–6, A–7–6	0	95–100	95–100	85–100	51–90	35–53	20–35
	40–60	Sandy clay loam, clay, clay loam, sandy clay.	SC, CL	A–4, A–6, A–7–6	0	85–100	80–100	75–100	36–90	25–45	8–28

See footnote at end of table.

TABLE 13.—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	
Windthorst:											
Duffau part	0–6	Fine sandy loam	SM, SM–SC, ML, CL–ML	A–4, A–2–4	0	95–100	95–100	75–90	30–60	<25	NP–7
	6–40	Sandy clay loam, clay loam, loam.	SC, CL	A–6	0	95–100	95–100	80–100	36–65	30–40	15–24
	40–60	Sandy clay loam, loam, fine sandy loam.	SC, CL, CL–ML, SM	A–4, A–6	0	95–100	95–100	80–100	40–65	20–36	2–18
Yahola: [1]46:											
Yahola part	0–8	Fine sandy loam	SM, SC, ML, CL	A–4	0	100	95–100	90–100	36–85	<30	NP–10
	8–44	Fine sandy loam, loam.	SM, SC, ML, CL	A–4	0	100	95–100	90–100	36–85	<30	NP–10
	44–50	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A–4, A–2	0	100	95–100	90–100	15–85	<30	NP–10
Gaddy part	0–9	Fine sandy loam	SM, SC, ML, CL	A–4	0	100	98–100	94–100	36–80	<30	NP–10
	9–60	Loamy fine sand, fine sand.	SM	A–2	0	100	98–100	90–100	15–35	—	NP

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Aledo:									
1	0-5	0.6-2.0	0.07-0.18	7.9-8.4	Moderate	Moderate	Low	0.32	1
	5-14	0.6-2.0	0.05-0.12	7.9-8.4	Low	Moderate	Low	0.32	
	14-18	—	—	—	—	—	—	—	
Anocon:									
[1]2:									
Anocon part	0-16	2.0-6.0	0.11-0.18	6.1-7.3	Low	Low	Low	0.32	5
	16-39	0.2-0.6	0.14-0.18	6.1-7.8	Moderate	Moderate	Low	0.32	
	39-65	0.2-0.6	0.12-0.18	6.6-8.4	Moderate	Moderate	Low	0.32	
Stoneburg part	0-10	2.0-6.0	0.11-0.20	6.1-7.3	Low	Low	Low	0.24	2
	10-39	0.2-0.6	0.12-0.20	6.1-7.3	Moderate	Moderate	Low	0.32	
	39-42	—	—	—	—	—	—	—	
Bastrop:									
3, 4	0-7	2.0-6.0	0.11-0.17	5.6-7.3	Low	Low	Low	0.24	5
	7-70	0.6-2.0	0.15-0.19	6.1-8.4	Low	Moderate	Low	0.32	
Bolar:									
5	0-9	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.32	2
	9-27	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.32	
	27-30	—	—	—	—	—	—	—	
[1]6:									
Bolar part	0-13	0.6-2.0	0.10-0.18	7.9-8.4	Moderate	High	Low	0.32	2
	13-28	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.32	
	28-30	—	—	—	—	—	—	—	
Aledo part	0-8	0.6-2.0	0.07-0.18	7.9-8.4	Moderate	Moderate	Low	0.32	1
	8-15	—	—	—	—	—	—	—	
Bonti:									
7	0-8	0.6-2.0	0.11-0.15	5.6-7.3	Low	Low	Moderate	0.37	2
	8-29	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	High	Moderate	0.28	
	29-32	—	—	—	—	—	—	—	
[1]8:									
Bonti part	0-10	0.6-2.0	0.08-0.12	5.6-7.3	Low	Low	Moderate	0.32	2
	10-24	0.2-0.6	0.15-0.20	5.1-6.0	Moderate	High	Moderate	0.28	
	24-27	—	—	—	—	—	—	—	
Exray part	0-6	0.6-2.0	0.08-0.14	6.1-7.3	Low	Low	Low	0.37	1
	6-13	0.2-0.6	0.12-0.20	5.6-6.5	Moderate	High	Moderate	0.32	
	13-16	—	—	—	—	—	—	—	
Bosque:									
9, [1]10	0-22	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	Low	0.28	5
	22-44	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	Low	0.28	
	44-65	0.6-2.0	0.11-0.18	7.9-8.4	Low	High	Moderate	0.28	
Branyon:									
11	0-65	<0.06	0.15-0.18	7.9-8.4	Very high	High	Low	0.32	5
Chaney:									
12	0-10	2.0-6.0	0.05-0.10	5.6-7.3	Very low	Low	Low	0.20	5
	10-47	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	High	Moderate	0.28	
	47-52	0.06-0.2	0.15-0.18	5.6-7.8	Moderate	High	Moderate	0.28	

See footnote at end of table.

TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Cona:									
[1]13	0-8	2.0-6.0	0.12-0.16	6.1-7.8	Low	Low	Low	0.32	3
	8-33	0.2-0.6	0.14-0.18	5.1-6.5	High	High	Moderate	0.37	
	33-45	0.06-0.2	0.06-0.15	5.1-6.0	High	High	Moderate	0.37	
Duffau:									
14	0-11	2.0-6.0	0.07-0.11	6.1-7.8	Very low	Low	Low	0.32	5
	11-48	0.6-2.0	0.12-0.19	6.1-7.8	Low	Moderate	Low	0.32	
	48-70	0.6-2.0	0.10-0.15	6.1-7.8	Low	Moderate	Low	0.32	
15, 16	0-12	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.43	5
	12-45	0.6-2.0	0.12-0.19	6.1-7.8	Low	Moderate	Low	0.32	
	45-70	0.6-2.0	0.10-0.15	6.1-7.8	Low	Moderate	Low	0.32	
[1]17:									
Duffau part	0-6	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.43	5
	6-39	0.6-2.0	0.12-0.19	6.1-7.8	Low	Moderate	Low	0.32	
	39-62	0.6-2.0	0.10-0.15	6.1-7.8	Low	Moderate	Low	0.32	
Windthorst part	0-4	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5
	4-48	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37	
	48-60	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37	
Eufaula:									
[1]18:									
Eufaula part	0-80	6.0-20.0	0.05-0.11	5.1-7.3	Low	Low	Moderate	0.17	5
Patilo part	0-45	6.0-20	0.05-0.08	5.6-7.3	Very low	Low	Low	0.17	5
	45-65	0.2-0.6	0.14-0.18	5.1-6.5	Low	High	Moderate	0.24	
Gaddy:									
[1]19	0-4	6.0-20	0.07-0.11	7.4-8.4	Low	Low	Low	0.17	5
	4-45	6.0-20	0.06-0.10	7.9-8.4	Low	Low	Low	0.17	
Gowen:									
20, [1]21	0-28	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low	0.28	5
	28-52	0.6-2.0	0.15-0.20	6.6-8.4	Moderate	Moderate	Low	0.28	
Hensley:									
22	0-4	0.2-0.6	0.12-0.20	6.1-7.8	Low	High	Low	0.37	1
	4-16	0.06-0.2	0.10-0.20	6.6-8.4	Moderate	High	Low	0.32	
	16-20	—	—	—	—	—	—	—	
Lindy:									
23	0-6	0.6-2.0	0.12-0.20	6.1-7.8	Low	High	Low	0.37	2
	6-31	0.06-0.2	0.10-0.20	6.1-7.8	Moderate	High	Low	0.32	
	31-35	—	—	—	—	—	—	—	
Miller:									
24, [1]25	0-17	0.06-0.2	0.16-0.2	7.4-8.4	High	High	Low	0.32	5
	17-39	<0.06	0.15-0.19	7.4-8.4	High	High	Low	0.32	
	39-50	0.06-0.2	0.15-0.19	7.9-8.4	High	High	Low	0.32	
	50-60	2.0-6.0	0.07-0.16	7.9-8.4	Low	Moderate	Low	0.28	
Pulexas:									
26, [1]27	0-5	2.0-6.0	0.11-0.15	5.6-8.4	Low	Low	Low	0.28	5
	5-42	2.0-6.0	0.11-0.15	5.6-8.4	Low	Low	Low	0.28	
	42-60	2.0-6.0	0.08-0.15	6.1-8.4	Low	Low	Low	0.28	
Renfrow:									
28	0-11	0.6-2.0	0.15-0.24	6.1-7.8	Low	Low	Low	0.37	5
	11-65	<0.06	0.12-0.22	6.1-8.4	High	High	Low	—	
Sanger:									
29	0-46	<0.06	0.12-0.18	7.4-8.4	High	High	Low	0.32	5
	46-54	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.32	

See footnote at end of table.

TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Sanger:									
30	0-9	<0.06	0.10-0.18	7.4-8.4	High	High	Low	0.28	5
	9-43	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.32	
	43-65	<0.06	0.12-0.18	7.9-8.4	High	High	Low	0.32	
Selden:									
31	0-15	2.0-6.0	0.05-0.09	5.6-7.3	Very low	Low	Low	0.17	5
	15-66	0.2-0.6	0.12-0.17	5.1-6.5	Low	High	Moderate	0.24	
Stoneburg:									
[1]32:									
Stoneburg part	0-11	2.0-6.0	0.11-0.20	6.1-7.3	Low	Low	Low	0.24	2
	11-16	0.6-2.0	0.12-0.20	6.1-7.3	Low	Moderate	Low	0.32	
	16-26	0.2-0.6	0.12-0.20	6.1-7.3	Moderate	Moderate	Low	0.32	
	26-35	0.2-0.6	0.12-0.20	6.1-7.8	Moderate	Moderate	Low	0.32	
	35-40	—	—	—	—	—	—	—	
Anocon part	0-10	2.0-6.0	0.11-0.18	6.1-7.3	Low	Low	Low	0.32	5
	10-41	0.2-0.6	0.14-0.18	6.1-7.8	Moderate	Moderate	Low	0.32	
	41-62	0.2-0.6	0.12-0.18	6.6-8.4	Moderate	Moderate	Low	0.32	
Teller:									
33	0-14	2.0-6.0	0.12-0.16	5.6-6.5	Low	Low	Moderate	0.28	5
	14-45	0.6-2.0	0.14-0.18	5.6-6.5	Low	Low	Moderate	0.28	
	45-70	2.0-6.0	0.13-0.17	5.6-7.3	Low	Low	Moderate	0.28	
Truce:									
34	0-6	0.6-2.0	0.11-0.15	5.6-7.3	Low	Low	Low	0.32	3
	6-45	0.06-0.2	0.12-0.18	6.1-8.4	Moderate	High	Low	0.32	
	45-55	—	—	—	—	—	—	—	
[1]35:									
Truce part	0-7	0.6-2.0	0.08-0.12	5.6-7.3	Low	Low	Low	0.24	3
	7-41	0.06-0.2	0.12-0.18	6.1-8.4	Moderate	High	Low	0.32	
	41-48	—	—	—	—	—	—	—	
Owens part	0-4	<0.06	0.10-0.17	7.9-8.4	High	High	Low	0.37	1
	4-18	<0.06	0.13-0.17	7.9-8.4	High	High	Low	0.37	
	18-30	<0.06	0.03-0.08	7.9-8.4	High	High	Low	0.37	
Ustolls:									
[1]36:									
Ustolls part	0-80	—	—	—	—	—	—	—	—
Rock outcrop part.									
Vashti:									
37	0-10	0.6-2.0	0.10-0.15	6.1-7.3	Low	Low	Low	0.24	2
	10-31	0.6-2.0	0.12-0.20	5.6-7.3	Moderate	High	Low	0.28	
	31-33	—	—	—	—	—	—	—	
Venus:									
38	0-12	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.28	5
	12-48	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.28	
	48-60	0.6-2.0	0.13-0.18	7.9-8.4	Low	High	Low	0.28	
Vernon:									
39	0-4	<0.06	0.10-0.17	7.9-8.4	High	High	Low	0.37	2
	4-29	<0.06	0.10-0.15	7.9-8.4	High	High	Low	0.37	
	29-35	<0.06	0.00-0.10	7.9-8.4	High	High	Low	—	
[1]40:									
Vernon part	0-5	<0.06	0.10-0.17	7.9-8.4	High	High	Low	0.37	2
	5-28	<0.06	0.10-0.15	7.9-8.4	High	High	Low	0.37	
	28-36	<0.06	0.00-0.10	7.9-8.4	High	High	Low	0.37	

See footnote at end of table.

TABLE 14.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T
	In	In/hr	In/in	pH					
Vernon:									
Knoco part	0-7	<0.06	0.10-0.17	7.9-8.4	High	High	Low	0.32	1
	7-22	<0.06	0.00-0.08	7.9-8.4	High	High	Low	—	
	22-28	—	—	—	—	—	—	—	
Waurika:									
[1]41:									
Waurika part	0-14	0.6-2.0	0.16-0.20	5.6-7.3	Low	High	Low	0.43	5
	14-33	<0.06	0.13-0.17	6.6-8.4	High	High	Moderate	0.32	
	33-54	0.06-0.2	0.15-0.19	7.4-8.4	Moderate	High	Moderate	0.32	
	54-64	0.06-0.2	0.15-0.19	7.4-8.4	Moderate	High	Moderate	0.32	
Renfrow part	0-9	0.6-2.0	0.15-0.24	6.1-7.8	Low	Low	Low	0.37	5
	9-65	<0.06	0.12-0.22	6.1-8.4	High	High	Low	0.32	
Windthorst:									
42	0-10	2.0-6.0	0.07-0.11	5.6-7.3	Very low	Low	Low	0.24	5
	10-32	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37	
	32-60	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37	
43, 44	0-10	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5
	10-36	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37	
	36-60	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37	
[1]45:									
Windthorst part	0-4	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5
	4-40	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37	
	40-60	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37	
Duffau part	0-6	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.43	5
	6-40	0.6-2.0	0.12-0.19	6.1-7.8	Low	Moderate	Low	0.32	
	40-60	0.6-2.0	0.10-0.15	6.1-7.8	Low	Moderate	Low	0.32	
Yahola:									
[1]46:									
Yahola part	0-8	2.0-6.0	0.12-0.16	7.4-8.4	Low	Low	Low	0.28	5
	8-44	2.0-6.0	0.12-0.16	7.9-8.4	Low	Low	Low	0.28	
	44-50	2.0-6.0	0.07-0.16	7.9-8.4	Low	Low	Low	0.28	
Gaddy part	0-9	2.0-6.0	0.11-0.15	7.4-8.4	Low	Low	Low	0.17	5
	9-60	6.0-20	0.06-0.10	7.9-8.4	Low	Low	Low	0.17	

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 15.—SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "hard" and "rippable." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Aledo: 1	C	None	—	—	>6.0	—	—	8–20	Hard
Anocon: [1]2:									
Anocon part	C	None	—	—	>6.0	—	—	>60	—
Stoneburg part	B	None	—	—	>6.0	—	—	20–40	Rippable
Bastrop: 3, 4	B	None	—	—	>6.0	—	—	>60	—
Bolar: 5	C	None	—	—	>6.0	—	—	20–40	Rippable
[1]6:									
Bolar part	C	None	—	—	>6.0	—	—	20–40	Rippable
Aledo part	C	None	—	—	>6.0	—	—	8–20	Hard
Bonti: 7	C	None	—	—	>6.0	—	—	20–40	Rippable
[1]8:									
Bonti part	C	None	—	—	>6.0	—	—	20–40	Rippable
Exray part	D	None	—	—	>6.0	—	—	10–20	Hard
Bosque: 9, [1]10	B	Rare to common.	Brief	May–Oct	>6.0	—	—	>60	—
Branyon: 11	D	None	—	—	>6.0	—	—	>60	—
Chaney: 12	C	None	—	—	>6.0	—	—	>60	—
Cona: [1]13	C	None	—	—	>6.0	—	—	20–40	Rippable
Duffau: 14, 15, 16	B	None	—	—	>6.0	—	—	>60	—
[1]17:									
Duffau part	B	None	—	—	>6.0	—	—	>60	—
Windthorst part	C	None	—	—	>6.0	—	—	>60	—
Eufaula: [1]18:									
Eufaula part	A	None	—	—	>6.0	—	—	>60	—
Patilo part	B	None	—	—	3.0–6.0	Perched	Apr–Oct	>60	—
Gaddy: [1]19	A	Common	Brief	Apr–Sep	>6.0	—	—	>60	—
Gowen: 20, [1]21	B	Rare to common.	Brief	May–Sep	>6.0	—	—	>60	—
Hensley: 22	D	None	—	—	>6.0	—	—	10–20	Hard

See footnote at end of table.

TABLE 15.—SOIL AND WATER FEATURES—Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Lindy:									
23	C	None	—	—	>6.0	—	—	24-40	Hard
Miller:									
24, [1]25	D	Common	Brief	Apr-Sep	>6.0	—	—	>60	—
Pulexas:									
26, [1]27	B	Common	Brief	Apr-Sep	>6.0	—	—	>60	—
Renfrow:									
28	D	None	—	—	>6.0	—	—	>60	—
Sanger:									
29, 30	D	None	—	—	>6.0	—	—	>60	—
Selden:									
31	C	None	—	—	>6.0	—	—	>60	—
Stoneburg:									
[1]32:									
Stoneburg part	B	None	—	—	>6.0	—	—	20-40	Rippable
Anocon part	C	None	—	—	>6.0	—	—	>60	—
Teller:									
33	B	None	—	—	>6.0	—	—	>60	—
Truce:									
34	C	None	—	—	>6.0	—	—	40-60	Rippable
[1]35:									
Truce part	C	None	—	—	>6.0	—	—	40-60	Rippable
Owens part	D	None	—	—	>6.0	—	—	10-20	Rippable
Ustolls:									
[1]36:									
Ustolls part	—	None	—	—	>6.0	—	—	—	—
Rock outcrop part.									
Vashti:									
37	C	None	—	—	1.5-3.0	Perched	Oct-May	20-40	Hard
Venus:									
38	B	None	—	—	>6.0	—	—	>60	—
Vernon:									
39	D	None	—	—	>6.0	—	—	20-40	Rippable
[1]40:									
Vernon part	D	None	—	—	>6.0	—	—	20-40	Rippable
Knoco part	D	None	—	—	>6.0	—	—	3-12	Rippable
Waurika:									
[1]41:									
Waurika part	D	None	—	—	1.0-2.0	Perched	Mar-May	>60	—
Renfrow part	D	None	—	—	>6.0	—	—	>60	—
Windthorst:									
42, 43, 44	C	None	—	—	>6.0	—	—	>60	—
[1]45:									
Windthorst part	C	None	—	—	>6.0	—	—	>60	—

See footnote at end of table.

TABLE 15.—SOIL AND WATER FEATURES—Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Windthorst:									
Duffau part	B	None	—	—	>6.0	—	—	>60	—
Yahola: [1]46:									
Yahola part	B	Common to rare.	Very brief	Apr-Sep	>6.0	—	—	>60	—
Gaddy part	A	Common to rare.	Very brief	Apr-Sep	>6.0	—	—	>60	—

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit.

TABLE 16.—CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Aledo	Loamy-skeletal, carbonatic, thermic Lithic Haplustolls
Anocon	Fine, mixed, thermic Udic Argiustolls
Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Bolar	Fine-loamy, carbonatic, thermic Typic Calciustolls
Bonti	Fine, mixed, thermic Ultic Paleustalfs
Bosque	Fine-loamy, mixed, thermic Cumulic Haplustolls
Branyon	Fine, montmorillonitic, thermic Udic Pellusterts
Chaney	Fine, mixed, thermic Aquic Paleustalfs
Cona	Fine, mixed, thermic Ultic Paleustalfs
Duffau	Fine-loamy, siliceous, thermic Udic Paleustalfs
*Eufaula	Sandy, siliceous, thermic Psammentic Paleustalfs
Exray	Clayey, mixed, thermic Lithic Rhodustalfs
Gaddy	Sandy, mixed, thermic Typic Ustifluvents
Gowen	Fine-loamy, mixed, thermic Cumulic Haplustolls
Hensley	Clayey, mixed, thermic Lithic Rhodustalfs
Knoco	Clayey, mixed (calcareous), thermic, shallow Ustic Torriorthents
Lindy	Fine, mixed, thermic Udic Haplustalfs
Miller	Fine, mixed, thermic Vertic Haplustolls
Owens	Clayey, mixed, thermic, shallow Typic Ustochrepts
Patilo	Loamy, siliceous, thermic Grossarenic Paleustalfs
Pulexas	Coarse-loamy, mixed, nonacid, thermic Typic Ustifluvents
Renfrow	Fine, mixed, thermic Udertic Paleustolls
Sanger	Fine, montmorillonitic, thermic Udic Chromusterts
Selden	Fine-loamy, siliceous, thermic Aquic Paleustalfs
Stoneburg	Fine-loamy, mixed, thermic Udic Argiustolls
Teller	Fine-loamy, mixed, thermic Udic Argiustolls
Truce	Fine, mixed, thermic Udic Paleustalfs
Ustolls.	
Vashti	Fine-loamy, mixed, thermic Aquic Haplustalfs
Venus	Fine-loamy, mixed, thermic Typic Calciustolls
Vernon	Fine, mixed, thermic Typic Ustochrepts
Waurika	Fine, montmorillonitic, thermic Typic Argialbolls
Windthorst	Fine, mixed, thermic Udic Paleustalfs
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents

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