United States Department of Agriculture

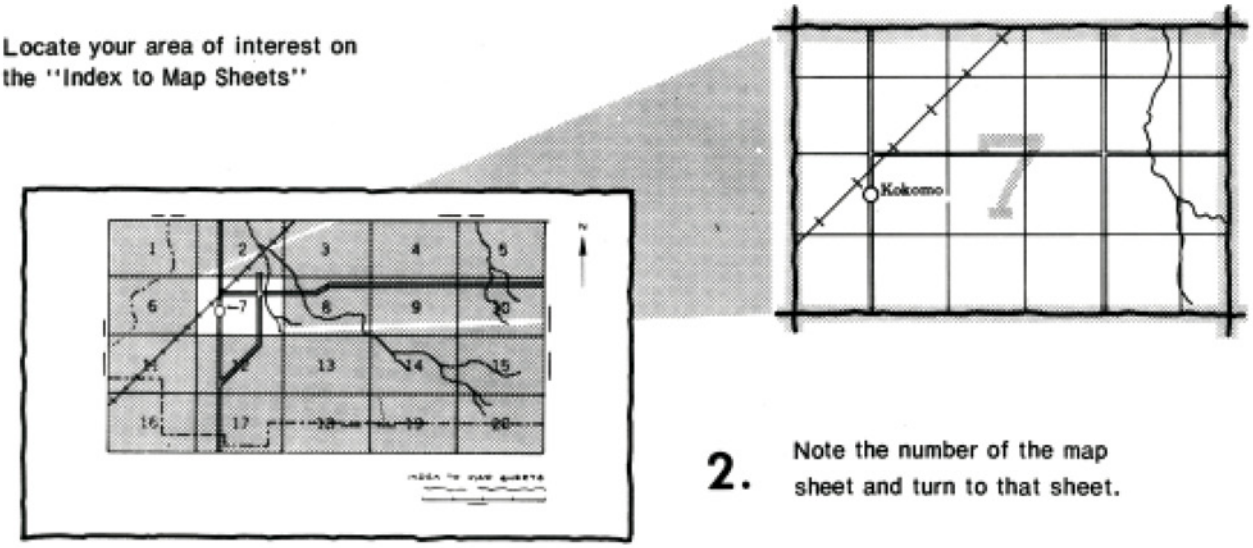
Soil Conservation Service

In cooperation with Texas Agricultural Experiment Station

Soil Survey of Williamson County Texas

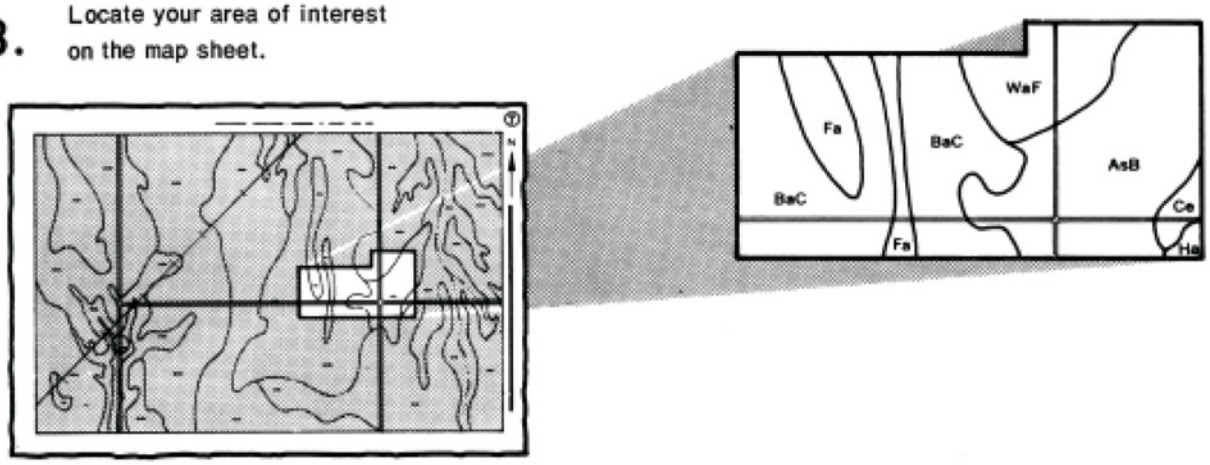
HOW TO USE

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

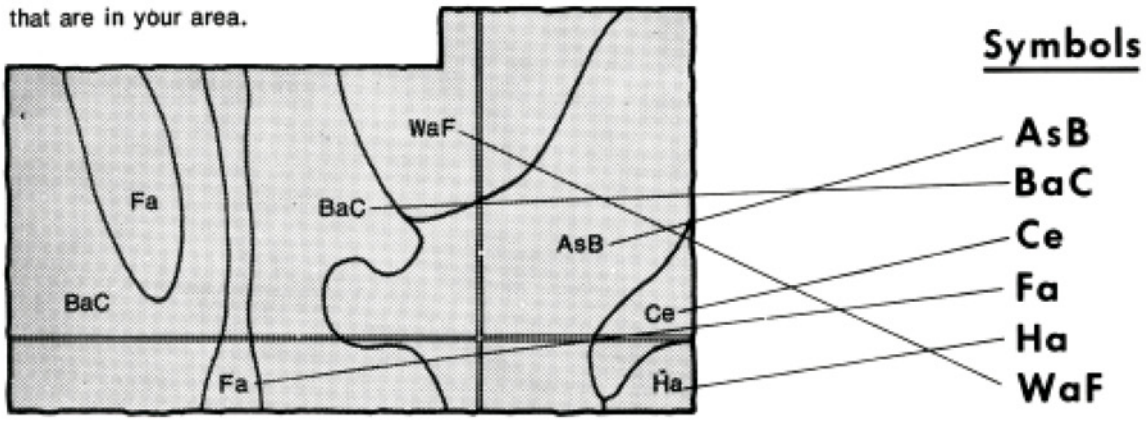


2. Note the number of the map sheet and turn to that sheet.

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

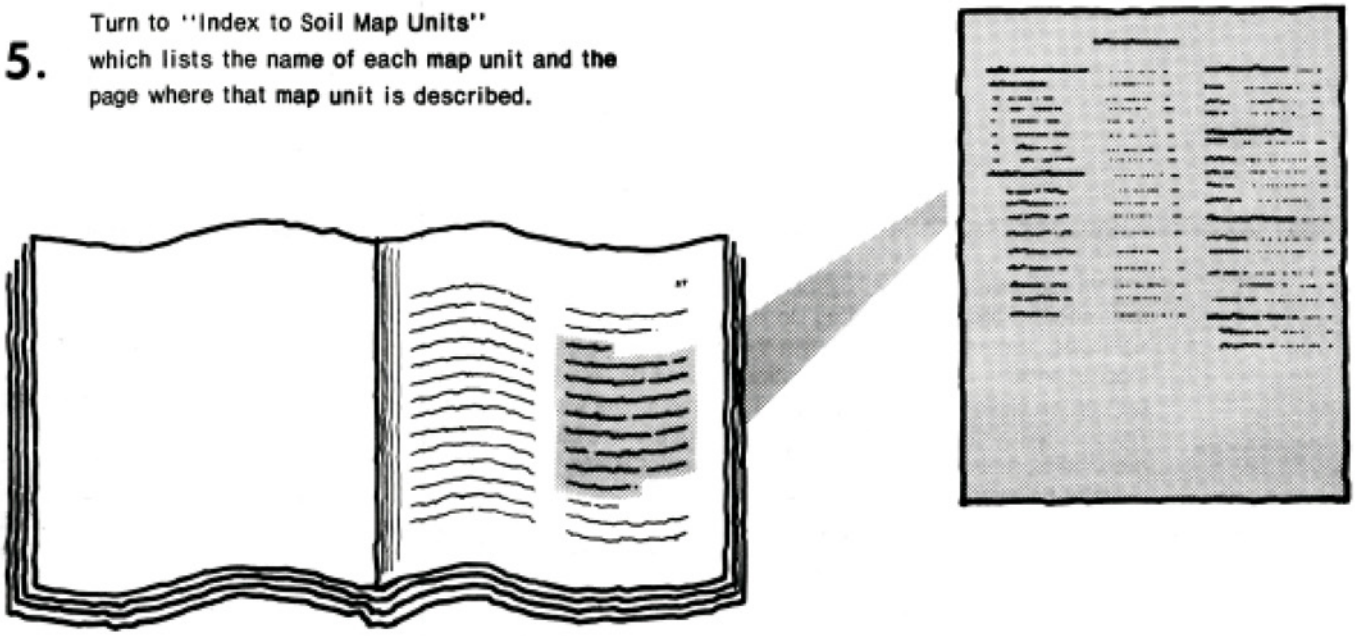


4. List the map unit symbols that are in your area.

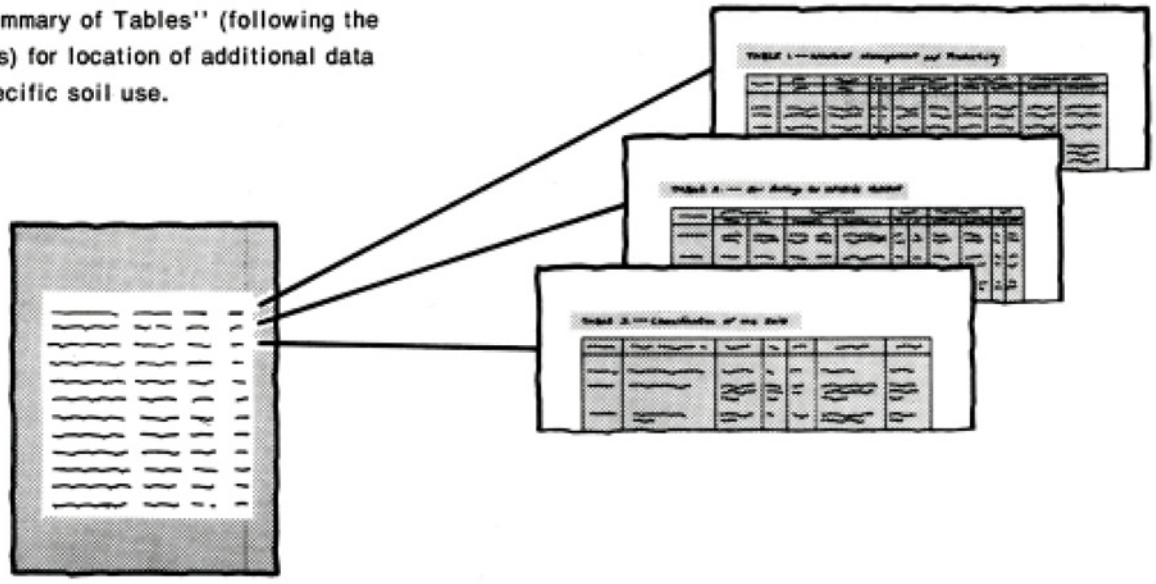


THIS SOIL SURVEY

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

Major fieldwork for this soil survey was performed in the period 1973-80. Soil names and descriptions were approved in 1980. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1980. 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 Taylor Soil and Water Conservation District and the Little River-San Gabriel Soil and Water Conservation District.

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

This soil survey supersedes a soil survey of Williamson County published in 1938.

Cover: Preparing a seedbed on Branyon clay. This is a typical landscape in the Blackland Prairie Land Resource Area in Williamson County.

Contents

Soil series

Issued January 1983

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Summary of tables

Foreword

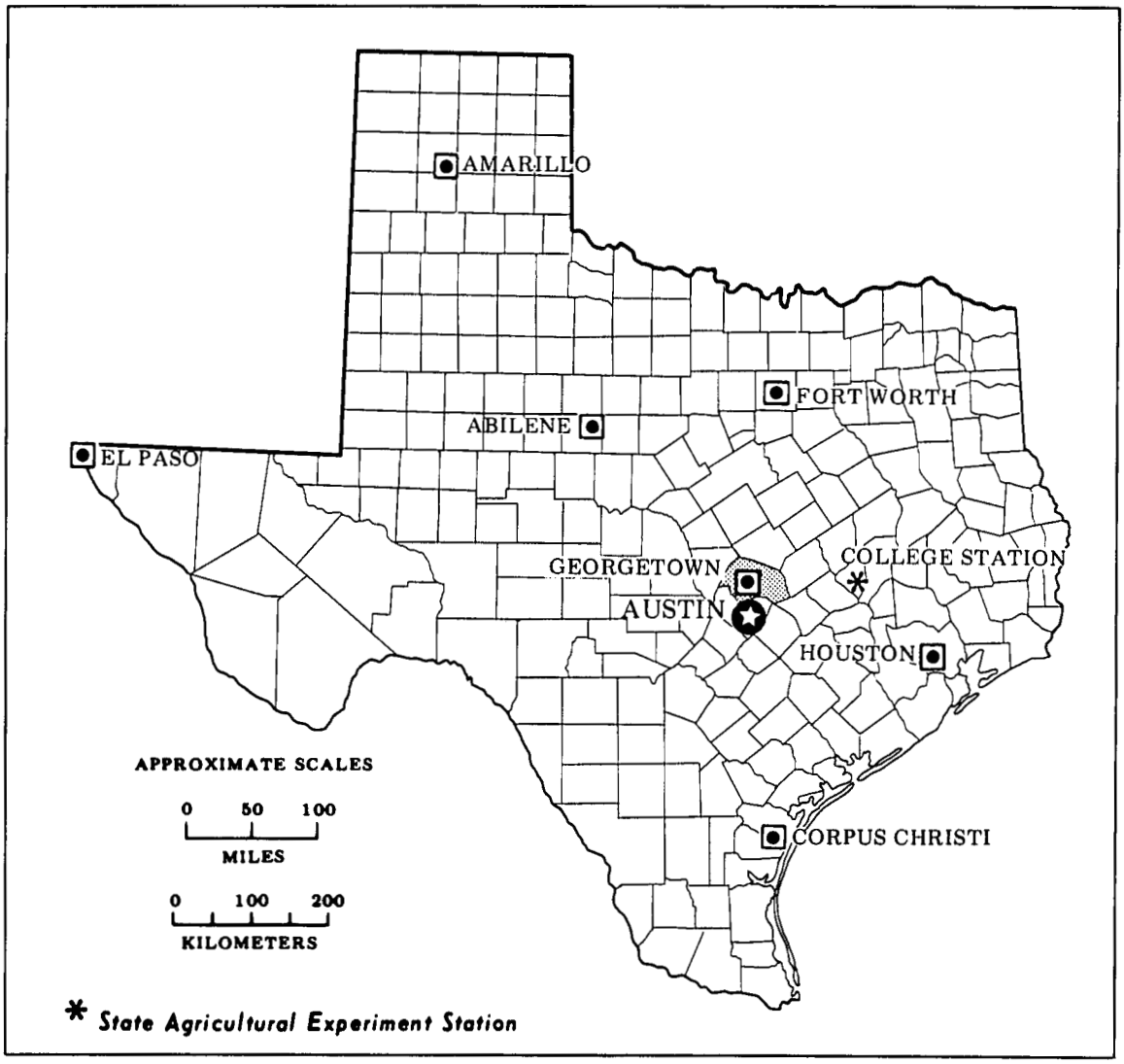
This soil survey contains information that can be used in land-planning programs in Williamson County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

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

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

George C. Marks
State Conservationist
Soil Conservation Service



Location of Williamson County in Texas.

Soil survey of Williamson County, Texas

By Leroy E. Werchan and John L. Coker, Soil Conservation Service

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

WILLIAMSON COUNTY is in east-central Texas. Georgetown is the county seat. Taylor is the leading agricultural community. Urban sprawl is rapid, particularly along Interstate 35 and U.S. Highway 183 in the southwestern part of the county.

Irregular in shape, this county covers 426 square miles, about 720,640 acres. The lakes at Granger and Georgetown make up 5,710 surface acres of water. The 45 Brushy Creek watershed structures, which have a total of 1,318 surface acres of water, and hundreds of farm ponds and several streams add 7,052 surface acres to the water resources of the county.

Of the total land area, about 34,930 acres are in urban uses and other nonagricultural uses, 372,000 acres are used for crops, 62,000 acres are in pasture, and 246,000 acres are in native grass, according to records of the local field office of the Soil Conservation Service.

The main watercourses, the San Gabriel River and Brushy Creek, flow through the county in a west-east direction. All drainage is into the Brazos River watershed.

This soil survey supersedes the soil survey of Williamson County published in 1938 (*4*). This survey provides additional information and larger maps that show the soils in greater detail.

Descriptions, names, and delineations of soils in this soil survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in soil series concepts, intensity of mapping, or the extent of soils within the survey.

General nature of the county

This section provides general information on the history, natural resources, climate, agriculture, industry, and transportation in the county.

History

There were many Indian tribes in Williamson County and the surrounding area in about 1746, when the Spanish established the first missions at the junction of Brushy Creek and the San Gabriel River.

In 1821, settlers from Stephen F. Austin's first colony in adjoining Travis County began to settle along Brushy Creek and the San Gabriel River. By the late 1850's, competition for land drove the price up from 23 cents an acre to about 5 dollars an acre.

Williamson County was established in 1836 from the western part of Milam County and was annexed by the State of Texas in 1845. It was named after Robert McAlpin Williamson, a prominent circuit judge and Texas Ranger. Georgetown was named after George Glasscock, who donated land for the courthouse.

Early agriculture consisted mainly of growing crops and raising livestock to provide the basic food for human consumption. Later, beef cattle were raised for trade. The advent of barbed wire in 1873 made ranching more practical. Cotton became a major cash crop in about 1870. Five railroad lines, built between 1876 and 1900, provided a means for marketing agriculture products outside the county (*3*).

Military wagon trains and others carrying supplies left evidence of their trek through the county in the limestone bed of Brushy Creek in the town of Round Rock (fig. 1). Round Rock was named after the limestone pedestal in Brushy Creek (fig. 2).

Natural resources

The soils are the most important resource in Williamson County. Most of the soils are fertile and are moderately deep to deep. The available water capacity is medium to high. Most of the soils are suitable for agricultural uses.

The soils in the western part of the county are in the Grand Prairie Land Resource Area. These are thin, stony, gently sloping to sloping soils that formed in limestone or in limestone and marl. They are on broad ridges and in intervening long, shallow valleys of deeper soils.

The soils in the central and eastern parts of the county are in the Texas Blackland Prairie Land Resource Area. These are deep to shallow clayey soils that formed in marine marls, ancient clayey alluvium, soft limestone, and chalk. Typically, they are in a series of nearly level to gently sloping broad, ancient stream terraces and undulating uplands.

The soils in the southeastern corner of the county are in the Texas Claypan Land Resource Area. These are loamy and sandy soils on an undulating landscape.

Water is another important resource. There is underground water in most parts of the county. The water table is at a depth of about 400 to 850 feet in the Grand Prairie Area. It is at a depth of 20 to 30 feet in the Texas Blackland Prairie Area and at a depth of 40 to 200 feet in the Texas Claypan Land Resource Area. There are numerous springs in the Grand Prairie Area.

Surface mining of limestone is significant in the Grand Prairie Area.

Climate

Prepared by the National Climatic Center, Asheville, N.C.

Williamson County is hot in summer but cool in winter, when an occasional surge of cold air causes a sharp

Figure 1.—Ruts in the hard limestone bedrock were caused by wagon trains moving over the area in pioneer days. This type of limestone underlies the Eckrant soils along Brushy Creek.

Figure 2.—Rushing waters of Brushy Creek carved this limestone pedestal, for which the town of Round Rock was named. Oakalla soils are adjacent to the creek.

drop in otherwise mild temperatures. Rainfall occurs throughout the year, reaching a slight peak in spring. Snowfall is rare. Annual total precipitation is normally adequate for cotton, feed grains, and small grains.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Taylor, Texas, for the period 1951 to 1978. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 49° F, and the average daily minimum temperature is 38°. The lowest temperature on record, which occurred at Taylor on February 2, 1951, is 2°. In summer, the average temperature is 83°, and the average daily maximum temperature is 95°. The highest recorded temperature, which occurred on July 27, 1954, is 112°.

Growing degree days, shown in table 1, are equivalent to heat units. During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (50° F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

Of the total annual precipitation, 19 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 13 inches. The heaviest 1-day rainfall during the period of record was 6 inches at Taylor on June 17, 1958. Thunderstorms occur on about 40 days each year, and most occur in spring.

A world record rainfall is the 36.4 inches of rain that fell within 18 hours at Thrall, near Taylor, on September 9, 1921 (*3*).

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

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

Agriculture

In the western part of the county, agriculture consists mainly of raising cattle, sheep, or goats. The shallow, stony soils are used as rangeland, and the deeper soils are used for supplementary grazing or hay crops. Some small grains and grain sorghum are also grown. Erosion is a minimal problem because of these crops.

The central part of the county is intensively cultivated. Cotton and grain sorghum are the principal crops, but small grains, corn, hay, and grasses for grazing are also grown. Erosion control and maintenance of tilth and fertility are problems in this area.

In the small southeastern part of the county, a small area of sandy soils is used for improved grass pasture or brushy or wooded range. Fertility is generally low, and the sloping soils are subject to rill and gully erosion. Crops are generally limited to small grains, but peanuts, watermelon, and grain sorghum are also grown. Small areas are used for vegetable gardens. The main livestock is beef cattle.

In bottom land areas, pecan trees are grown in orchards and are used as shade trees in landscaping. Most of the trees are grafted to improved varieties for maximum pecan production.

Industry

Agriculture and agribusiness are the primary industries in the county. Agriculture products include cotton, cottonseed, small grains, grain sorghum, fruits, pecans, vegetables, and forage hay. Livestock and livestock products include beef cattle, dairy products, poultry, mohair, and wool. In 1979, about 51 percent of the farm income in the county was from crops, and 49 percent was from livestock and livestock products (*5*).

Agribusiness includes the manufacture and distribution of animal and poultry feeds; distribution of fuel; meat processing; pecan processing; processing and manufacturing of dairy products; processing and sale of fertilizers, equipment, and seeds; and sale and repair of farm equipment.

In the western part of the county, an area of several hundred acres is mined for limestone. Products from limestone include sheet rock, lime for agriculture, and stones and crushed stone for building and road construction.

Several light industries are located in the major towns. These include garment, furniture, and mattress manufacturing plants.

Several medium-to-heavy industries have moved into the Georgetown-Round Rock area. Consequently, there is a need for more housing in the county, particularly in these towns. There is also a migration to rural areas, especially where commuting distances to work centers are favorable. Most rural residences are on 5 to 15 acres.

Transportation

The county has a network of highways and paved roads. Interstate 35, U.S. Highway 183, and Texas Highways 79 and 95 traverse the county. Railroads cross the southwestern, eastern, and central parts of the county.

How this survey was made

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

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

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

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

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

General soil map units

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

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

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

The land area of the nine soil associations in Williamson County makes up about 98 percent of the total acreage. Water areas of 40 acres or more make up the rest of the acreage.

Soil descriptions

1. Branyon-Houston Black-Burleson

Deep, calcareous and noncalcareous, clayey soils formed in clayey alluvium and marine clays and shales; on ancient stream terraces and uplands

These nearly level to gently sloping soils are on long, broad ridges and in narrow valleys (fig. 3). Slopes range from 0 to 5 percent.

This map unit makes up about 27 percent of the county. Branyon soils make up about 34 percent of the unit, Houston Black soils 21 percent, and Burleson soils 15 percent. Of minor extent and making up about 30

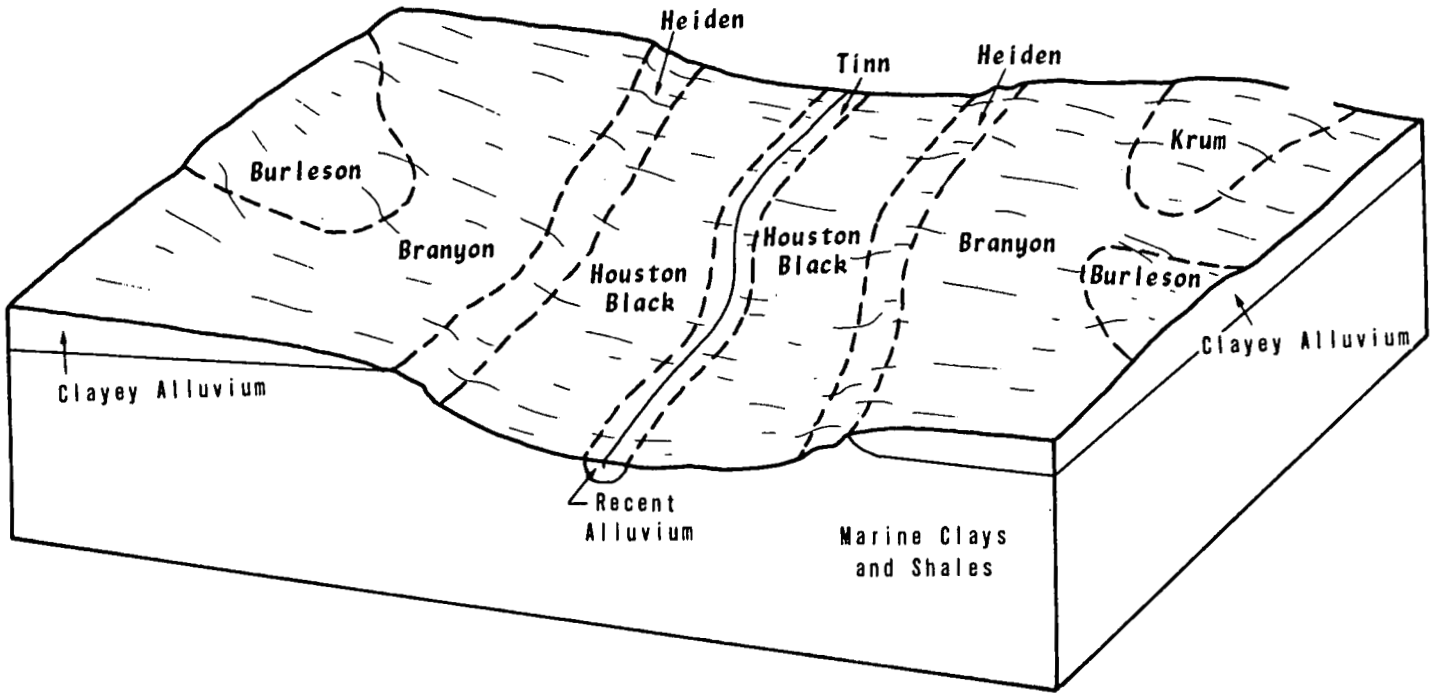


Figure 3.—Typical landscape pattern of the Branyon-Houston Black-Burleson general soil map unit.

percent of this unit are Ferris, Heiden, Krum, Oakalla, Sunev, and Tinn soils.

Typically, the Branyon soils have an upper layer of clay about 44 inches thick. The upper part is dark gray, and the lower part is gray. The layer below that to about 60 inches is light brownish gray clay. The underlying material to 72 inches is light gray silty clay. The soil is calcareous and moderately alkaline throughout.

Typically, the Houston Black soils have an upper layer of dark gray clay about 32 inches thick. The layer below that, to about 54 inches, is dark grayish brown clay. The underlying material to 62 inches is mottled, grayish brown clay. The soil is calcareous and moderately alkaline throughout.

Typically, the Burleson soils have an upper layer of very dark gray clay about 22 inches thick. The layer below that, to 58 inches, is mildly alkaline, dark gray clay. The underlying material to 64 inches is mildly alkaline gray clay. In most places, it is calcareous.

The soils making up this unit are used mainly for cotton and grain sorghum. Some areas of the more sloping soils are in permanent pasture grasses. Crop and pasture yields are generally high. The soils are capable of producing high yields of range forage.

These soils are suited to urban uses; however, they have a high shrink-swell potential and corrosivity to underground steel pipe. Buildings and streets buckle and crack if not properly constructed. The very slow permeability is a problem in septic systems.

The use of these soils for recreation areas is limited because the soils are very sticky and muddy when wet and foot and vehicle traffic are difficult.

2. Denton-Eckrant-Doss

Moderately deep, shallow and very shallow, calcareous, clayey, cobbly and stony soils formed in indurated fractured limestone or limy earths; on uplands

These nearly level to hilly soils are on broad uplands (fig. 4). The Eckrant soils are generally on the steeper hills and ridges. The Doss soils are typically on broad ridges and side slopes. The Denton soils are mainly in valleys. Slopes range from 0 to 30 percent.

This map unit makes up about 21 percent of the county. Denton soils make up about 21 percent of the unit, Eckrant soils about 20 percent, and Doss soils 19 percent. Other soils making up about 40 percent of this unit are Crawford, Brackett, Fairlie, Georgetown, Oakalla, and Sunev soils and Rock outcrop.

Typically, the Denton soils have an upper layer of

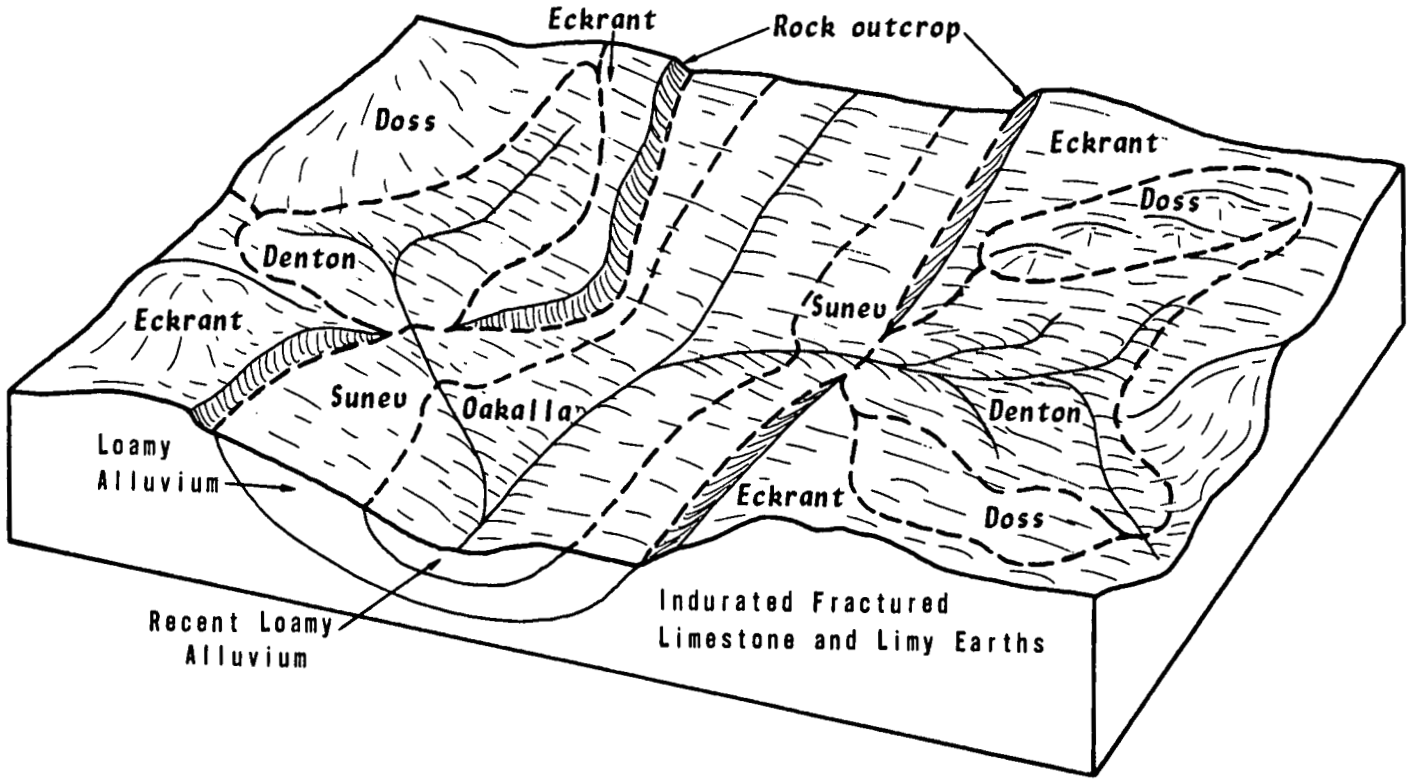


Figure 4.—Typical landscape pattern of the Oakalla-Sunev and the Denton-Eckrant-Doss general soil map units.

calcareous, dark brown silty clay about 33 inches thick. The underlying layer is calcareous, very pale brown silty clay loam about 3 inches thick. It is underlain by fractured limestone and limy material.

Typically, the Eckrant soils have a very dark gray, extremely stony clay surface layer about 11 inches thick. About 25 percent of the surface is covered with limestone fragments. The underlying material is indurated fractured limestone.

Typically, the Doss soils have a calcareous, dark grayish brown, silty clay surface layer about 9 inches thick. The subsoil, to 19 inches, is calcareous, brown silty clay loam. The underlying material is weakly cemented limy earth interbedded with limestone fragments.

Most of the soils making up this unit are used as rangeland. A few areas of Denton, Doss, and Fairlie soils are used for small grains and forage sorghum, and a few are in tame grass pasture.

The Denton soils are well suited to grain sorghum, cotton, and small grains. The Doss soils are well suited to cool-season crops or drought resistant grasses. The high content of lime of the Doss soils may cause chlorosis in sensitive crops such as sorghum or small grains. The Eckrant soils are suited only to use as rangeland.

Most of the soils are suited to urban uses. The underlying strata of the Eckrant and Doss soils provide good foundations for buildings and streets. Live oak, elm, and other trees are in abundance. Disposal of wastes, both solids and liquids, in septic systems is severely limited because of the slow to moderately slow permeability and the depth to the underlying fractured rock. The shrink-swell potential is a hazard on the Denton soils.

Only a few small areas of this unit are well suited to recreation activities. Most areas are too clayey, stony, or sloping. However, many areas provide good habitat for deer, turkey, and other wildlife.

3. Eckrant-Georgetown

Very shallow to moderately deep, calcareous and noncalcareous, stony, cobbly, and loamy soils formed in indurated fractured limestone; on uplands

These nearly level to hilly soils are on broad uplands (fig. 5). The Eckrant soils are generally in the more sloping areas on ridges and hills and along drainageways. The Georgetown soils are mainly on broad ridges and gentle side slopes. Slopes range from 0 to 30 percent.

This map unit makes up about 19 percent of the county. Eckrant soils make up about 58 percent of the unit and Georgetown soils about 24 percent. Other soils making up about 18 percent of the unit are Crawford, Oakalla, and Sunev soils and Rock outcrop.

Typically, the Eckrant soils have an extremely stony, very dark gray clay surface layer about 11 inches thick. About 25 percent of the surface is covered with fragments of limestone. The underlying material is indurated fractured limestone.

Typically, the Georgetown soils have a slightly acid, brown stony clay loam surface layer about 7 inches thick. There are few to common stones on or near the surface. The subsoil, to 35 inches, is neutral, reddish brown clay in the upper part and slightly acid, reddish brown cobbly clay in the lower part. The underlying material is indurated fractured limestone.

Except for a few small areas planted to tame pasture grasses, the soils making up this unit are used mainly as rangeland.

These soils are suited to urban uses. Live oak, elm, and other native trees add beauty and shade that are desirable for residential areas. The limestone substratum provides a good base for foundations and streets but is difficult to excavate for ditches. Some areas are too steep for urban uses.

Because of stones, depth to rock, and steep slope in places, recreational areas, such as parks and playgrounds, are difficult to establish and maintain. However, several camping areas are along North Fork Lake west of Georgetown.

The soils in this unit have good potential for use as wildlife habitat for deer and turkey.

4. Austin-Houston Black-Castephen

Deep to shallow, calcareous clayey soils formed in marine chalk, marl, shale, and clays; on uplands

These nearly level to gently sloping soils are on broad uplands (fig. 6). Typically, the Castephen soils are on ridges, the Austin soils are on the middle slopes, and the Houston Black soils are in the lower areas. Slopes range from 0 to 5 percent.

This map unit makes up about 18 percent of the county. Austin soils make up about 29 percent of the unit, Houston Black soils 23 percent, and Castephen soils make up 10 percent. Other soils making up about 38 percent of the unit are mainly Eddy, Krum, Oakalla, and Whitewright soils.

Typically, the Austin soils have a calcareous, dark grayish brown silty clay surface layer about 13 inches thick. The subsoil extends to a depth of 34 inches. The upper part is calcareous, brown silty clay, and the lower part is yellowish brown silty clay. The underlying material is chalk or chalky marl.

Typically, the Houston Black soils have an upper layer of calcareous, dark gray clay about 32 inches thick. The layer below that, to about 54 inches, is calcareous, dark grayish brown clay. The underlying material to 62 inches is mottled, grayish brown clay.

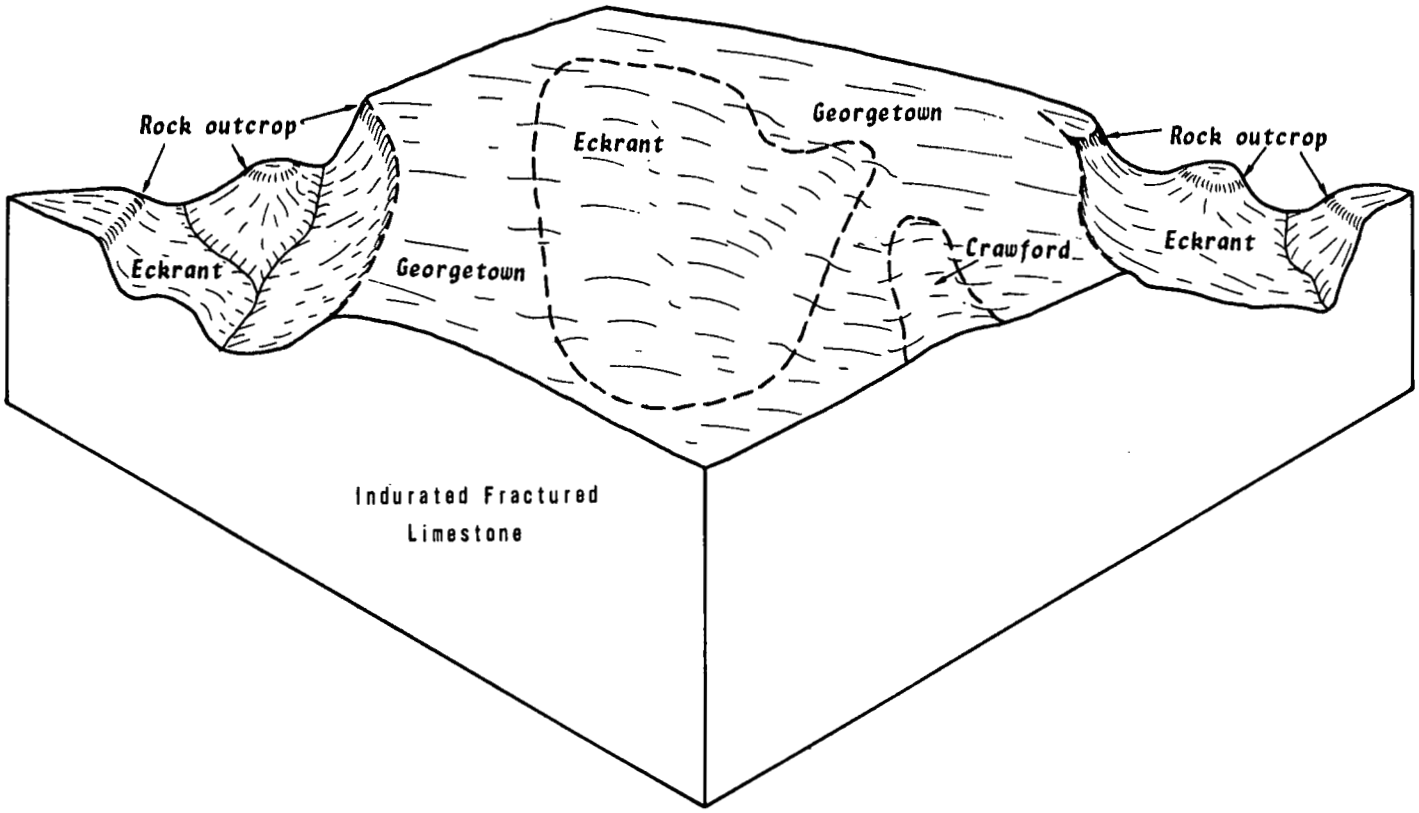


Figure 5.—Typical landscape pattern of the Eckrant-Georgetown general soil map unit.

Typically, the Castephen soils have a surface layer of calcareous, dark brown, silty clay about 16 inches thick. The underlying material is a very pale brown interbedded chalk and loamy marl.

The deep Austin and Houston Black soils are used mainly for cotton and grain sorghum. The Castephen soils are used mainly for small grains and permanent pasture. These soils are capable of producing high yields of range forage.

One of the main problems in using these soils as urban land, particularly the Austin and Castephen soils, is the difficulty in excavating the chalk and marl substrata for utilities, foundations, or trafficways. The possibility of waste water from septic systems or holding lagoons contaminating underground water is also a hazard. The Houston Black soils have a high shrink-swell potential and corrosivity of underground steel pipelines.

The use of the soil for recreation sites is limited by the high lime content, particularly in the Castephen soils, that causes iron chlorosis in many plants. When wet, the clayey surface layer is sticky and muddy. In some places, slope is a limitation.

5. Wilson-Crockett-Behring

Deep, noncalcareous, loamy soils formed in marine clays, marls, and shales; on uplands

These nearly level to gently sloping soils are on broad uplands (fig. 7). Wilson soils are in smooth, nearly level upland flats. Crockett soils are in all parts of the landscape but are less extensive in the valleys. The Behring soils are on ridge crests and upper side slopes. Slopes range from 0 to 5 percent.

This unit makes up about 3 percent of the county. Wilson soils make up about 35 percent of the unit, Crockett soils 27 percent, and Behring soils 23 percent. Other soils making up about 15 percent of this unit are Altoga, Deleon, Ferris, Heiden, and Krum soils.

Typically, the Wilson soils have a surface layer of gray clay loam about 5 inches thick. The subsoil, to 60 inches, is grayish clay. The underlying material to 72 inches is mottled olive and grayish clayey shale. The soils are neutral in the upper part and grade to moderately alkaline in the lower part.

Typically, the Crockett soils have a slightly acid, grayish brown loam surface layer about 4 inches thick.

The upper part of the subsoil, to 18 inches, is a neutral, mottled grayish brown and reddish brown clay. The middle part, to 40 inches, is a mildly alkaline, mottled grayish and brownish clay. The lower part, to 52 inches, is a mildly alkaline, mottled yellowish and brownish clay. The underlying material to 60 inches is moderately alkaline, mottled yellowish and brownish silty clay.

Typically, the Behring soils have a surface layer of dark grayish brown clay loam about 4 inches thick. The layer below that, to 30 inches, is dark grayish brown clay. The subsoil, to about 42 inches, is light olive brown clay. The underlying material to 60 inches is mottled light gray and brownish yellow silty clay. The soils are noncalcareous and mildly alkaline in the upper part and moderately alkaline in the lower part.

The soils making up this unit are used mainly for tame pasture or as rangeland. A few areas are used for cotton or grain sorghum.

If these soils are used for crops and pasture, yields are medium on the Behring and Wilson soils and the less sloping Crockett soils.

Most areas of rangeland have an overstory of brush. The soils produce medium forage yields.

These soils are suited to urban uses. Limitations are a high shrink-swell potential, corrosivity, and the very slow to slow permeability.

The use of these soils as recreation areas is limited by the very slow to slow permeability; when wet, by a sticky, muddy surface; and in some places, by slope.

6. Brackett-Eckrant-Doss

Shallow and very shallow, calcareous, loamy and clayey, gravelly, stony, and cobbly soils formed in indurated limestone and marl; on uplands

These gently sloping to hilly soils are on limestone hills and ridges and side slopes. Dominant slopes range from 12 to 25 percent and minor slopes range from 1 to 30 percent. The Brackett and Eckrant soils are generally in the steeper areas.

This unit makes up about 3 percent of the county. Brackett soils make up about 50 percent of the unit, Eckrant soils make up 30 percent, and Doss soils 10 percent. Other soils making up about 10 percent of the unit are mostly Fairlie, Oakalla, and Sunev soils.

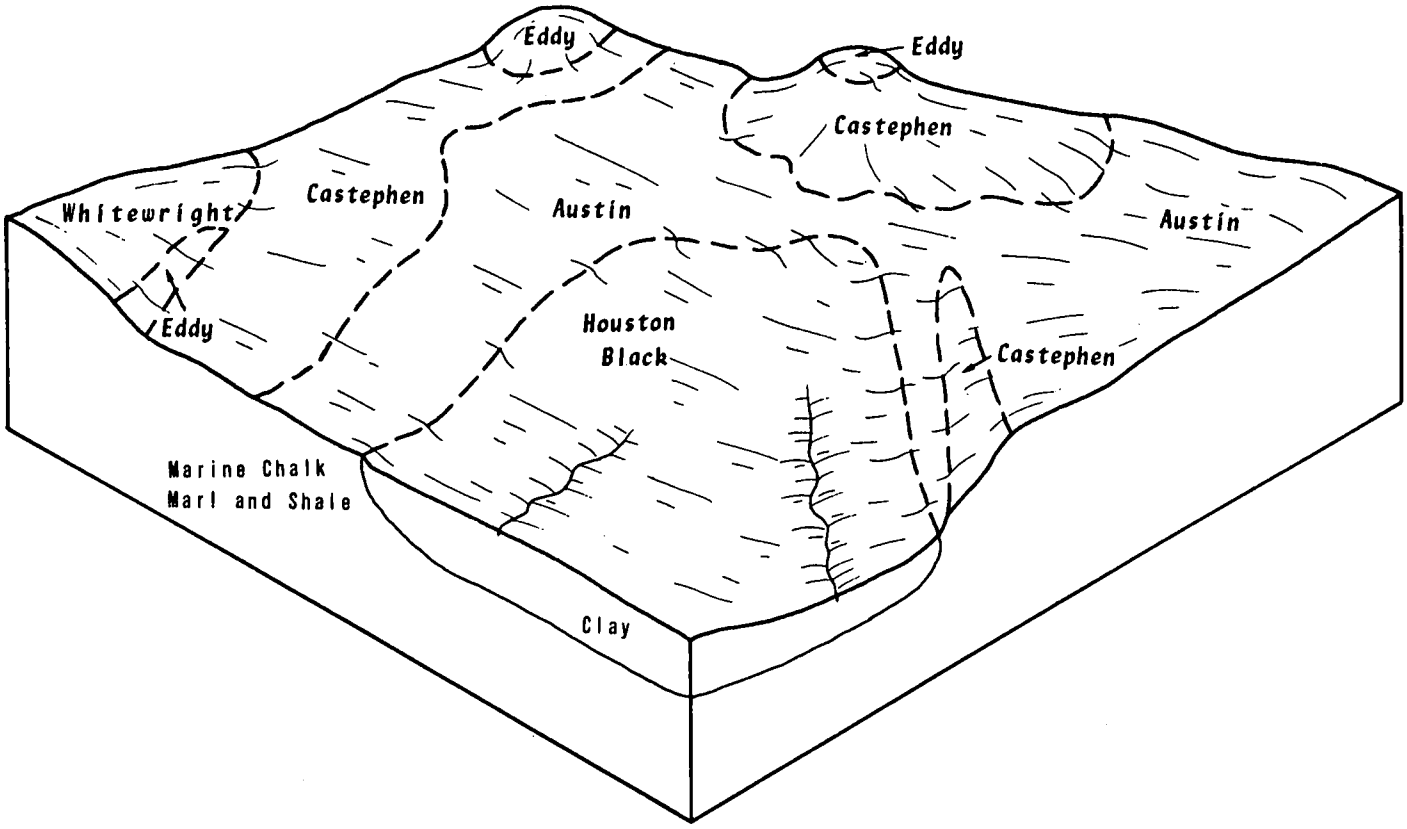


Figure 6.—Typical landscape pattern of the Austin-Houston Black-Castephen general soil map unit.

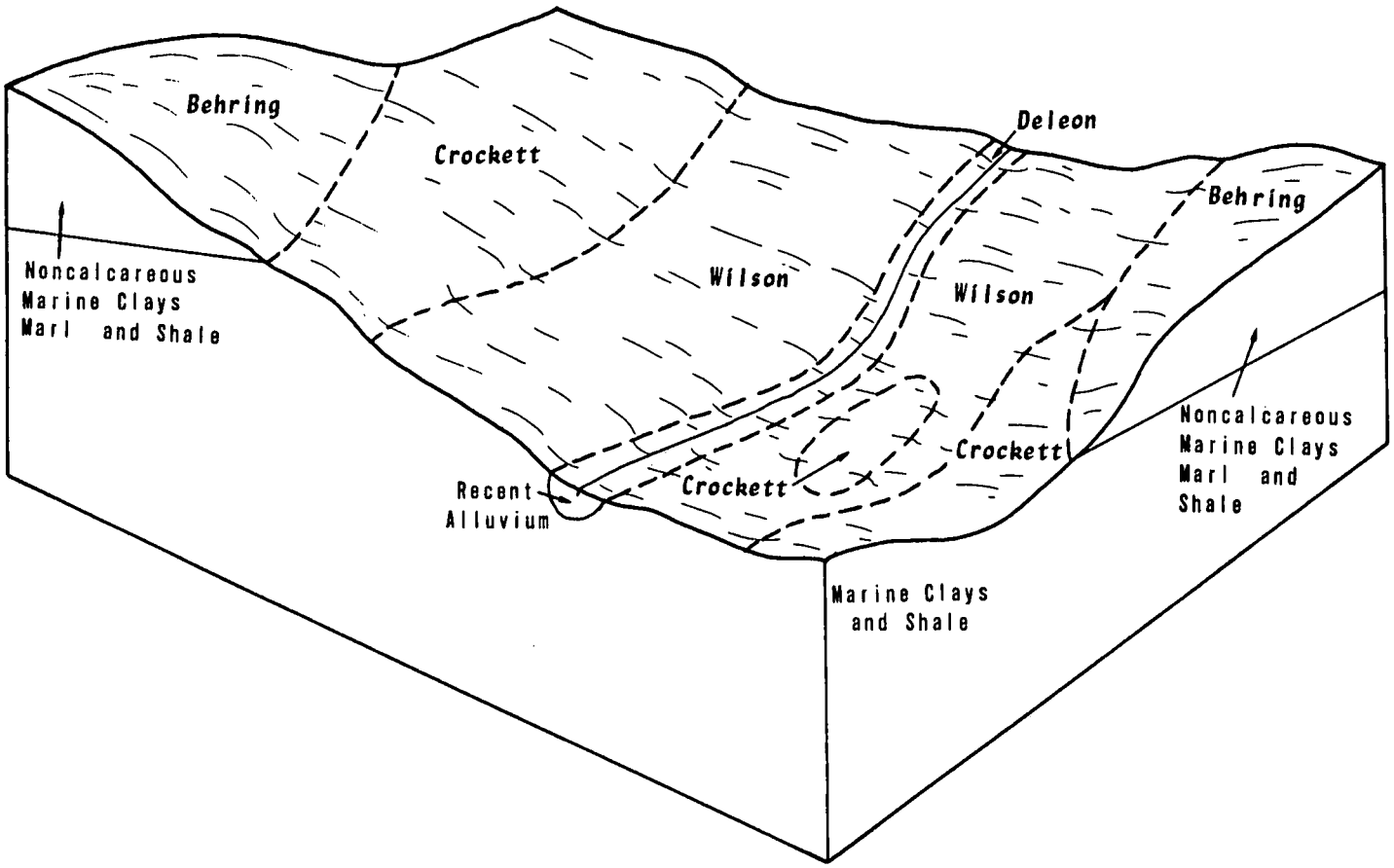


Figure 7.—Typical landscape pattern of the Wilson-Crockett-Behring general soil map unit.

Typically, the Brackett soils have a calcareous, pale brown, gravelly clay loam surface layer about 5 inches thick. About 15 percent of the surface is covered with fragments of limestone. The subsoil, to 16 inches, is calcareous, pale yellow clay loam. The underlying material is interbedded calcareous loam and limestone. In some areas, the surface layer is clay loam.

Typically, the Eckrant soils have a very dark gray, extremely stony clay surface layer about 11 inches thick. About 25 percent of the surface is covered with fragments of limestone. The underlying material is indurated limestone. In some areas, the surface layer is cobbly clay.

Typically, the Doss soils have a calcareous, dark grayish brown silty clay surface layer about 9 inches thick. The subsoil, to 19 inches, is calcareous, brown silty clay loam. The underlying layer is weakly cemented limy earth interbedded with fragments of limestone.

Most of the soils making up this unit are in rangeland. Forage yields are low. A few areas of Doss soils are in pasture or are used for small grains.

The soils in overlook and wooded areas are desirable for use as residential sites. The soils provide excellent foundations for structures and streets, but excavating is difficult in the rock substratum of the shallow soils. Waste disposal in septic systems is a problem because the soils are inadequate for filtering. For gardening and landscaping, limitations are depth to rock and the high lime content of the Brackett soils that causes iron chlorosis in many plants.

The use of the soils as recreation areas, such as parks or playgrounds, is limited by the strong to steep slopes, shallowness to rock, and stones. The potential is high for use as habitat for wildlife, especially deer and turkey.

7. Axtell-Rosanky-Rader

Deep, noncalcareous, loamy and sandy soils formed in marine sands, sandstones, and clays; on uplands

These nearly level to gently sloping soils are on broad uplands (fig. 8). In most places, the Rosanky soils are on

ridges and the Axtell and Rader soils are on the lower slopes. Slopes range from 0 to 5 percent.

This map unit makes up about 3 percent of the county. Axtell soils make up about 45 percent of the unit, Rosanky soils 15 percent, and Rader soils 10 percent. Other soils making up about 30 percent of the unit are Padina and Uhland soils.

Typically, the Axtell soils have a slightly acid, brown, fine sandy loam surface layer about 4 inches thick. The subsoil, to 44 inches, is strongly acid, mottled red clay. The underlying material to 60 inches is mildly alkaline, mottled light gray and brownish yellow silty clay that is stratified with very pale brown sandy loam.

Typically, the Rosanky soils have a surface layer of dark brown, slightly acid sandy loam about 12 inches thick. The upper part of the subsoil, to 39 inches, is red clay. The lower part, to 60 inches, is strongly acid, reddish yellow clay loam. The underlying material is weakly consolidated sandstone. This soil is slightly acid in the upper layers and grades to strongly acid in the lower layers. In some areas, the surface layer is loamy fine sand.

Typically, the Rader soils have a surface layer of yellowish brown fine sandy loam about 6 inches thick. The subsurface layer is light yellowish brown fine sandy loam about 12 inches thick. The upper part of the subsoil, to 28 inches, is mottled yellowish sandy clay and light gray sandy loam. The lower part of the subsoil, to 62 inches, is sandy clay that has grayish, yellowish, and brownish mottles in the upper part and light gray mottles in the lower part. These soils are slightly acid in the upper layers and grade to mildly alkaline in the lower layers.

The soils making up this unit are used mainly for tame pasture or as rangeland. A few areas are used for grain sorghum and cotton. Forage and crop yields are generally medium. Most areas of rangeland are wooded.

These soils are suitable for urban uses. Limitations are the shrink-swell potential, which affects foundations and streets, corrosivity, which affects underground pipes, and the very slow to slow permeability, which affects septic systems. In places, wetness is a seasonal problem.

These soils are suited to recreation uses. Slope is a limitation in some places, and seasonal wetness is a limitation in others.

8. Oakalla-Sunev

Deep, calcareous, loamy soils formed in alluvium; on bottom lands and stream terraces

These nearly level soils are along streams. The Oakalla soils are on bottom lands, and the Sunev soils are on higher stream terraces (see figure 4). Slopes range from 0 to 3 percent.

This map unit makes up about 2 percent of the county. Oakalla soils make up about 60 percent of the unit, and Sunev soils make up about 25 percent. Other soils

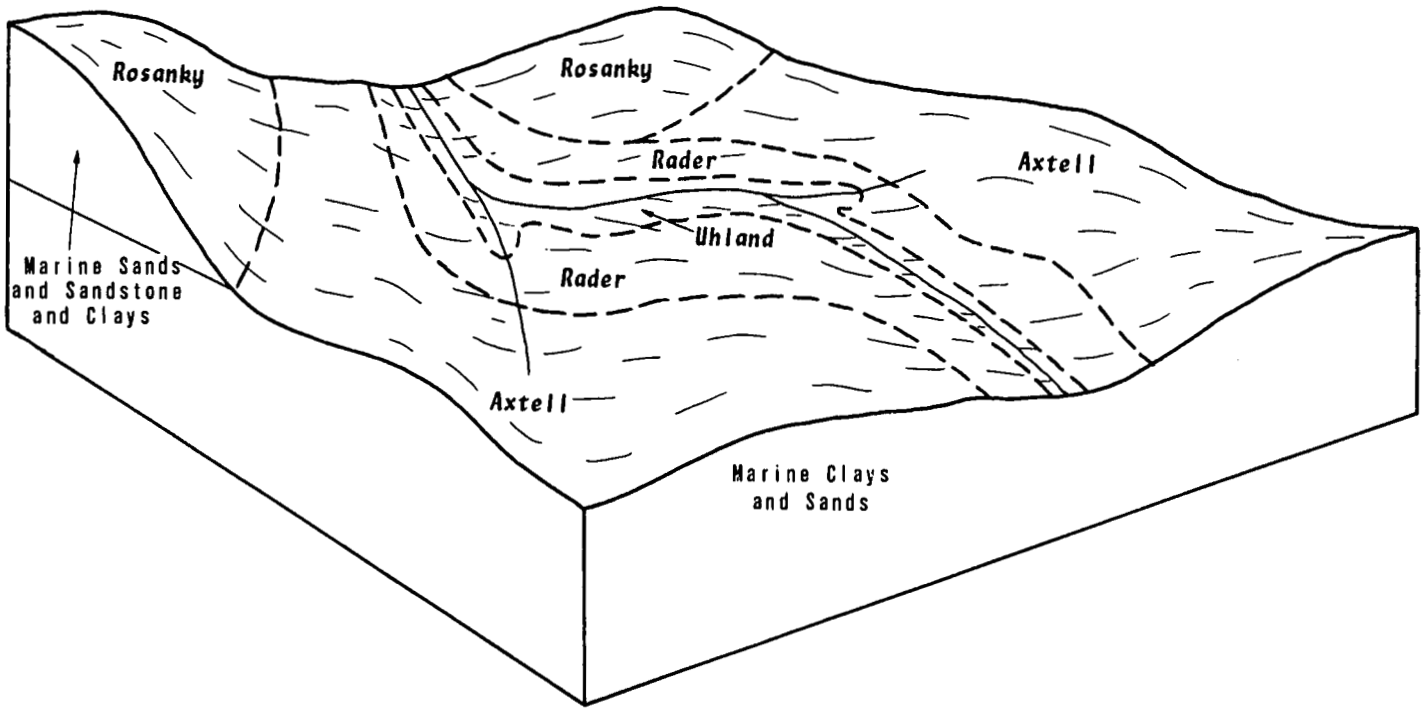


Figure 8.—Typical landscape pattern of the Axtell-Rosanky-Rader general soil map unit.

making up about 15 percent of the unit are Altoga, Krum, Queeny, Tinn, and Branyon soils.

Typically, the Oakalla soils have an upper layer of calcareous silty clay loam about 32 inches thick. The upper part is dark grayish brown, and the lower part is dark brown. The subsoil to 60 inches or more is calcareous, light yellowish brown silty clay loam. This soil is moderately alkaline throughout.

Typically, the Sunev soils have an upper layer of calcareous, dark grayish brown silty clay loam about 18 inches thick. The subsoil, to 52 inches, is calcareous, light yellowish brown clay loam. The underlying material to 60 inches is reddish yellow silty clay loam. This soil is moderately alkaline throughout.

The soils making up this unit are used mainly as rangeland and for crops for temporary grazing and hay crops. Some areas are in pasture. Native pecan trees are commonly managed for improved production. Yields of forage and hay generally are high.

Although the Sunev soils and the occasionally flooded Oakalla soils are arable, most fields are too small for efficient production. The high content of lime causes iron chlorosis in some plants. In most years, the frequently flooded Oakalla soils are inundated several times a year.

These soils are not suited to urban uses because of the hazard of flooding.

These soils are suited to some recreation uses such as paths and trails for hiking. Flooding is a hazard for playgrounds and picnic areas.

9. Tinn

Deep, calcareous, clayey soils formed in recent clayey alluvium; on bottom lands

These nearly level soils are along streams (fig. 9). Slopes are mostly less than 0.5 percent. In some areas, the soils are flooded after each rainstorm; in other areas, flooding is mostly along channels and old sloughs.

This map unit makes up about 2 percent of the county. The Tinn soils make up about 87 percent of the unit. Of minor extent and making up 13 percent of the unit are mainly Krum, Branyon, and Houston Black soils.

Typically, Tinn soils have a calcareous, dark gray clay upper layer about 58 inches thick. The subsoil, to 77 inches, is calcareous, grayish brown clay. The underlying material is a mixture of varicolored clays, gravel, and sand.

The frequently flooded Tinn soils are used mainly for tame pasture and hay. The occasionally flooded Tinn

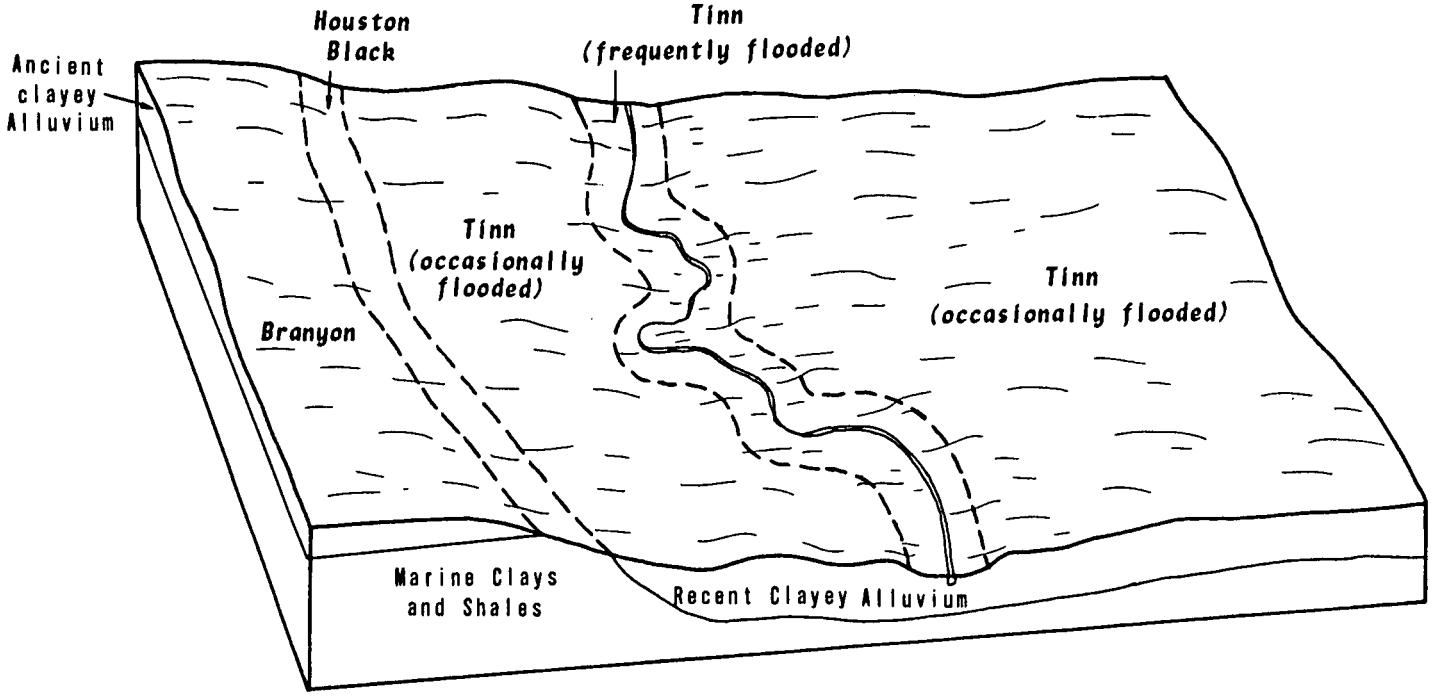


Figure 9.—Typical landscape pattern of the Tinn general soil map unit.

soils are generally planted to grain sorghum and cotton, but some areas of these soils are used for tame pasture and hay.

These soils are not suited to urban uses because of the flood hazard. They are suited to some recreation uses such as campsites and paths and trails. However, flooding is a hazard.

A few areas are in woodland that consists mostly of elm, pecan, and hackberry. Forage yields are generally high.

Detailed soil map units

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil and gives the principal hazards and limitations to be considered in planning for specific uses.

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Branyon clay, 0 to 1 percent slopes, is one of several phases in the Branyon series.

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Austin-Whitewright complex, 1 to 5 percent slopes, eroded, 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 similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can be made up of only one of the major soils, or it can be made up of all of them. Oakalla soils, frequently flooded, is an undifferentiated group in this survey area.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example. Miscellaneous areas are shown on the soil maps. Some areas, for example, gravel pits, are too small to be shown and are identified by a special symbol on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

AgC2—Altoga silty clay loam, 3 to 5 percent slopes, eroded. This soil is in long narrow areas on high terraces that parallel the major streams. Areas are as much as 500 acres in size.

This soil has had extensive sheet and gully erosion. There is sheet erosion near the crests of the ridges where the surface layer is thin, and in places the subsoil is exposed. There is gully erosion in most areas. In pastures, gullies are generally 600 to 800 feet apart and are 3 to 6 feet deep. However, on most terraced cropland, the gullies have been shaped and smoothed.

Typically, this soil has a brown silty clay loam surface layer about 14 inches thick. The upper part of the subsoil, to a depth of 46 inches, is light yellowish brown silty clay loam. The lower part of the subsoil, to 60 inches, is brownish yellow silty clay loam that has accumulations of calcium carbonate. The underlying layer to 72 inches is very pale brown silty clay loam. The soil is calcareous and moderately alkaline throughout.

This soil is friable, granular, and well drained. The available water capacity is high. Permeability is

moderate. Runoff is medium. If this soil is not protected, erosion is a moderate hazard.

Included in mapping are soils that are similar to this Altoga soil except that they have a darker surface layer, or they have a gravel substratum at a depth of less than 20 inches. Also included are small areas of grayish and brownish clayey soils at the head of and along drainageways. These clayey soils are potential pond sites. The included soils make up less than 20 percent of the map unit.

This soil in the western part of the county is used mainly as rangeland; in the eastern part, it is used mainly for crops or tame pasture.

This soil is moderately suited to cotton, grain sorghum, and wheat. Terraces, waterways, and crop residue management help control further erosion, maintain fertility, and improve tilth. Some crops need foliar applications of iron to control chlorosis.

Tame grass pasture management includes controlled grazing, maintaining fertility, and controlling weeds. Forage yields are high with favorable weather and under good management.

Rangeland areas produce medium yields of forage.

This soil has favorable properties for use as building sites. However, the high shrink-swell potential and the moderate permeability are limitations, but these limitations are less severe than those of the deep, clayey included soils. In landscaping and gardening, this soil is easy to work with handtools. Because of the high lime content, ornamental plants develop chlorosis unless soil amendments are added. Fruit trees are susceptible to chlorosis. Native elm and hackberry are reliable trees for shade.

This soil is suited to most recreation uses. Slope is a limitation for playgrounds. When wet, the surface of this soil is sticky and has a relatively low bearing strength; however, the soil dries quickly.

This soil has fair potential for use as habitat for openland and rangeland wildlife. The grass and weeds on this soil provide some food and cover for birds and small animals. In the western part of the county, deer browse the vegetation on this soil; in the eastern part, the game is mostly quail and rabbits. Cover and water are available in woods and from streams that are near most areas of this soil.

This Altoga soil is in capability subclass IIIe and in the Clay Loam range site.

AgD2—Altoga silty clay loam, 5 to 8 percent slopes, eroded. This soil is in long narrow areas on high terraces that parallel the major streams. Areas are 25 to 75 acres.

Most areas have had both sheet and gulley erosion. The surface layer is thinner or completely eroded away at the crests of ridges, and in places the subsoil is exposed. Gullies are about 600 to 800 feet apart and in many places extend 3 to 7 feet into the limy substratum. These eroded soils are used mainly for pasture or as rangeland. Most terraced fields have reverted to native grass and are generally gullied but to a lesser extent than the areas that are used for crops.

Typically, this soil has a light yellowish brown silty clay loam surface layer about 8 inches thick. The upper part of the subsoil, to about 32 inches, is very pale brown silty clay loam. The lower part, to 42 inches, is yellow silty clay loam that has many soft splotches of calcium carbonate. The underlying layer is very pale brown silty clay loam that extends to waterworn gravel at about 80 inches. This moderately alkaline and calcareous soil has a high content of calcium carbonate.

This is a granular, friable, well drained soil. It has moderate permeability and a high available water capacity. If the soil is not adequately protected, erosion is a severe hazard. Some crops need foliar applications of iron to control chlorosis.

Included in mapping are small areas of soils similar to Altoga soils except that they have a darker surface layer or have a gravelly substratum at a depth of less than 20 inches. Also included are small areas of brownish and grayish soils along drainageways. Although these areas are too small to map separately, they are pond sites. The included soils make up less than 20 percent of the map unit.

This soil is used mainly as rangeland. In most places, the vegetation is brush and cool-season grasses. Forage yields are medium under good management and with favorable weather.

This soil is capable of producing high forage yields of tame pasture grasses. Controlled grazing, fertilizer, and weed control are important in management of tame grasses.

This soil is poorly suited to crops because of the severe erosion hazard. Terraces, diversions, and residue management help control erosion.

This soil has favorable properties for use as homesites. Because of its high position, in many places it affords an esthetic view of the valley. The moderate permeability is a limitation to use of this soil for septic systems. The high shrink-swell potential and corrosivity are also limitations. Because of the high lime content, chlorosis is a common problem for fruit trees, ornamentals, and vegetables. The most reliable shade trees are native elm and hackberry.

This soil is limited for use as recreation areas by steep slopes. This soil is somewhat sticky when wet, but it dries quickly. It is suited to use as campsites, picnic areas, and hiking trails.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Songbirds and small animals are fairly plentiful because most areas are in grass, weeds, and brush that provide food and cover. Deer frequent the areas in the western part of the county.

This Altoga soil is in capability subclass IVe and in the Clay Loam range site.

AuA—Austin silty clay, 0 to 1 percent slopes. This nearly level soil is on broad, smooth plains on uplands. Areas are irregular in shape and range from 20 to about 50 acres.

Typically, this soil has a very dark grayish brown silty clay surface layer about 14 inches thick. The subsoil, which extends to about 36 inches, is brown silty clay. The underlying material is very pale brown, laminated chalk that has a few streaks of darker material in the interstices. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. The available water capacity is medium. Runoff is medium. Permeability is moderately slow. The smooth, nearly level surface slows runoff; most rainfall enters the soil. Water erosion is a slight hazard.

Included in mapping are small areas of soils similar to Austin soils except that they are more than 40 inches thick over chalk or have a gray surface layer. Also included are areas of Houston Black soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas are in pasture or rangeland (fig. 10).

This soil is used mainly for grain sorghum, small grains, and cotton. Yields are high under good management and with favorable weather. Regular additions of organic matter and fertilizer help maintain tilth and plant nutrients.

If this soil, in fields that were formerly cultivated, is used for pasture, it produces high yields of improved grasses for grazing or hay. Maintaining fertility, proper grazing, and weed control are needed. This soil produces high yields of native grasses for grazing or hay. The potential for range forage yields is medium.

Because of its high position on the landscape, this soil is desirable for use as homesites. However, the shrink-swell potential and corrosivity of underground pipe are limitations. The moderately slow permeability is a

Figure 10.—A pasture of Coastal bermudagrass on Austin silty clay, 0 to 1 percent slopes, (foreground) and Eddy very gravelly clay loam, 3 to 8 percent slopes (background).

limitation to use of this soil for septic systems. Contamination of local wells is possible if effluent seeps into fractures in the chalk substratum.

Elm and hackberry are native trees well adapted to this soil. Fruit trees produce well, but chlorosis is a problem because of the high content of lime. Gardening with handtools is somewhat difficult because of the clayey surface layer. Moderate alkalinity and chlorosis are also limitations for gardening.

This soil is suited to use as recreation areas; however, if wet and without plant cover, the surface is sticky and muddy, and the bearing strength is insufficient for camping vehicles.

This soil has good potential for use as habitat for openland wildlife. Wildlife species, mainly rabbit, quail, and doves, are uncommon because of insufficient cover and food in cropland areas.

This Austin soil is in capability subclass IIs and in the Clay Loam range site.

AuB—Austin silty clay, 1 to 3 percent slopes. This gently sloping soil is on uplands. Areas are irregular in shape and range from 20 to about 100 acres.

Typically, this soil has a dark grayish brown silty clay surface layer about 13 inches thick. The subsoil extends to a depth of 34 inches. In the upper 12 inches it is brown silty clay, and in the lower part it is yellowish brown silty clay. The underlying material is slightly weathered chalk or chalk interbedded with chalky marl. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. The available water capacity is medium. Permeability is moderately slow. Runoff is medium. Erosion is a slight hazard.

Included in mapping are small areas of Houston Black soils along narrow, intermittent drainageways and a few small areas of Castephen and Eddy soils on some knolls and on breaks in the slope. Also included are a few areas of soils similar to this Austin soil except that they have a grayish surface layer or have chalk at a depth of more than 40 inches. The included soils make up less than 15 percent of the map unit.

Most of this soil is used for crops. A few areas are in pasture or range.

This soil is well suited to crops. High yields of grain sorghum, small grains, and cotton are produced with favorable weather and under good management. Terraces, waterways, and regular additions of organic matter help control erosion.

This soil produces high yields of tame pasture grasses or hay.

This soil is suitable for use as rangeland. The potential for range forage is medium.

Most areas of this soil are in high positions that are esthetically desirable for urban uses. However, the shrink-swell potential and the moderately slow permeability are limitations that affect roads, foundations, and septic tank absorption fields. The chalk substratum absorbs liquids readily, but contamination of local wells is possible if waste water goes directly into fractures in this layer.

Hackberry and elm are the principal trees native to this soil. Fruit trees are adapted; however, growth and yields are somewhat limited by the high lime content and the medium available water capacity. Gardening with handtools is somewhat difficult because of the hard clayey surface layer. The moderate alkalinity causes chlorosis and stunted growth of some plants.

This soil is suited to use as recreation areas; however, foot and vehicle traffic are difficult if the surface is wet and without plant cover.

This soil has fair potential for use as habitat for openland and rangeland wildlife. A few rabbits, quail, and doves inhabit the area. However, this soil has sufficient cover and food for a wide variety of fowl and animals.

This Austin soil is in capability subclass IIe and in the Clay Loam range site.

AwC2—Austin-Whitewright complex, 1 to 5 percent slopes, eroded. This complex consists of gently sloping to gently undulating soils on uplands. Areas are mostly long and narrow and range from 15 to about 50 acres.

These soils have had sheet and gully erosion. Scars of old gullies and other eroded spots are prominent, particularly on terraced cropland. In the eroded areas, the light-colored subsoil is exposed. The gullies are mostly 600 to 800 feet apart and up to 10 feet wide. Heavily grazed pastures have many active gullies that have cut down into the chalky substratum. The surface layer has been thinned between the gullies.

This complex is made up of about 50 percent Austin soils, 35 percent Whitewright soils, and 15 percent other soils. These soils are so intricately mixed that mapping them separately was not practical.

Typically, the Austin soils have a dark grayish brown silty clay surface layer about 12 inches thick. The subsoil, to 32 inches, is grayish brown silty clay in the upper 5 inches and pale brown silty clay in the lower 15 inches. The underlying material to a depth of 60 inches is very pale brown, thinly interbedded chalk and limy earth.

Permeability of the Austin soils is moderately slow, and the available water capacity is medium. Runoff is rapid in unprotected areas. Erosion is a moderate hazard.

Typically, the Whitewright soils have a light brownish gray silty clay loam surface layer about 5 inches thick. The next layer, to a depth of 13 inches, is pale brown silty clay loam. The underlying material is very pale brown, weakly cemented, fractured, platy chalk that has a few dark stains on the outer edge of the fractures in the upper part. These soils are calcareous and moderately alkaline.

Permeability of the Whitewright soils is moderate. The available water capacity is very low because of the

shallowness to chalk. Runoff is rapid in unprotected areas. Erosion is a severe hazard.

Included in mapping are small areas of Castephen and Eddy soils. Also included is a soil similar to Whitewright soils except that it is more than 20 inches thick over chalk and a soil similar to Austin soils except that it has a gray surface layer. Also included are areas of sloping Austin and Whitewright soils. The included soils make up less than 15 percent of the map unit.

The soils making up this complex are used mainly for hay and pasture. Small areas are used for crops or as rangeland.

If these soils are used for pasture or hay, they generally produce medium yields of forage. The main concerns in management are controlling erosion, maintaining fertility, controlled grazing, and weed control.

These soils are poorly suited to crops. Erosion is too severe a hazard, particularly on the Whitewright soils, for cultivated crops other than small grains. Terraces, waterways, and other erosion controls are also necessary if row crops are grown. Iron chlorosis limits plant growth in some places, mainly on the Whitewright soils.

The acreage in rangeland is capable of producing medium yields of forage.

These soils are limited for urban uses by the high shrink-swell potential and the high corrosivity to underground steel pipe of Austin soils. The chalk under the Whitewright soils causes problems in shaping and excavating for building foundations and streets. Septic systems are difficult to install because depth to rock is shallow to moderately deep; contamination of underground water is possible. Trees native to these soils are hackberry and elm. The Whitewright soils have scattered motts of live oak. Gardening is severely limited by the moderate alkalinity, the high lime content, the medium to very low available water capacity, and the difficulty in working the clayey surface layer.

These soils are limited for use as recreation areas because of slope and, when the soil is wet and without plant cover, the sticky surface. However, the surface dries quickly after rain.

These soils have fair potential for use as habitat for openland and rangeland wildlife. Some birds and small animals inhabit grassy and weedy areas. The soils produce food and cover for a large population of wildlife.

These soils are in capability subclass IVe; the Austin soils are in the Clay Loam range site, and the Whitewright soils are in the Chalky Ridge range site.

AxB—Axtell fine sandy loam, 0 to 3 percent slopes. This nearly level to gently sloping soil is on smooth, broad ridgetops on uplands. Areas are irregular in shape and vary from 25 to 50 acres.

Typically, the surface layer is about 14 inches thick. It is slightly acid, fine sandy loam that is yellowish brown in the upper part and light yellowish brown in the lower part. The subsoil extends to a depth of about 46 inches. It is clay that is red in the upper part and brown in the lower part. The subsoil is strongly acid and is mottled in shades of brown and gray. The underlying layer to 60 inches is mildly alkaline, mottled gray and reddish yellow shaly clay loam.

This is moderately well drained soil. Permeability is very slow. Surface runoff is slow to medium depending on the slope. The available water capacity is medium, but this soil is seldom moist to its full depth. Droughtiness and the extreme difficulty of root growth result in less than optimum plant growth and vigor. Water erosion is a moderate hazard in the more sloping areas.

Included in mapping are small areas of Rader soils that are mostly in the valleys. In a few places, small areas of the well drained Rosanky soils are also included. The included soils make up less than 15 percent of the map unit.

This soil is used for pasture and crops.

This soil is well suited to pasture. It can produce high yields of improved grasses for grazing or hay. Maintaining the fertility level and weed control are management needs.

A few areas of this soil are planted to grain sorghum and small grains, but production is generally low because of the very slow permeability, difficulty of root penetration, and the low fertility. Under good management and with favorable weather, yields are only fair.

Rangeland areas produce medium yields of forage.

This soil has severe limitations for urban structures because of the high shrink-swell potential of the subsoil and the very slow permeability. Septic systems function poorly. Corrosivity of underground steel pipe is a serious risk. Wooded areas are popular for homesites. Because most of this soil is on ridges, it has esthetic value. This soil is well suited to landscaping and gardening. The very slow permeability of the subsoil causes the sandy loam surface layer to be waterlogged after heavy rains. Low fertility and the difficulty of roots penetrating the clayey subsoil are limitations, particularly for shrubs and fruit trees. Post oak and blackjack oak are the main trees for shade that are native to this soil.

This soil is well suited to recreation uses. However, the very slow permeability results in a saturated surface layer after heavy rains.

This soil has fair potential for use as habitat for openland wildlife and good for rangeland wildlife. Plants provide sufficient food and cover for wildlife, which consists mostly of doves, quail, other birds, and rabbits as well as other small animals and a few deer.

This Axtell soil is in capability subclass IIIe and in the Claypan Savannah range site.

AxC2—Axtell fine sandy loam, 2 to 5 percent slopes, eroded. This gently sloping soil is in irregularly

shaped areas on ridgetops and side slopes on uplands. Areas range from about 25 to 75 acres.

Gully and sheet erosion have affected most areas of this soil. On the upper 150 to 200 feet of the slopes, most of the surface layer has been eroded away. Most gullies are V-shaped and 6 to 10 feet deep. Individual gullies are mostly 600 to 1,000 feet apart, but there are networks of gullies with closer spacing. In a few places, the deep gullies are less than 100 feet apart. In some areas, the clayey subsoil is exposed. To control further erosion, gullies should be reshaped and ground cover established.

Typically, this soil has a slightly acid, brown fine sandy loam surface layer about 4 inches thick. The subsoil, which extends to a depth of about 44 inches, is strongly acid, mottled, red clay. The underlying layer to 60 inches is mildly alkaline, mottled, light gray and brownish yellow silty clay stratified with very pale brown sandy loam.

This soil is moderately well drained. Permeability is very slow. Runoff is rapid. The available water capacity is medium. Plant growth is hindered by the low fertility and droughtiness of the soil. Plant roots do not easily penetrate the dense clayey subsoil.

Included in mapping are small areas of Crockett soils and some small areas of Rader soils in narrow valleys. The included soils make up less than 15 percent of the map unit.

This soil is used for pasture or crops or as rangeland.

This soil is well suited to pasture or hay. Crops respond well to fertilizer.

This soil is poorly suited to crops. Erosion and the depleted fertility from past cultivation practices are severe problems. Even under good management, the expected yields are low.

Most areas of this soil that are used as rangeland are wooded or brushy. Under good management, this soil produces high yields of range forage. Fertilizing, clearing, seeding, and controlled grazing are necessary.

This soil is suited to urban uses. However, land shaping for foundations, streets, or utilities generally results in a clayey surface layer that increases runoff and erosion. Corrosion and the high shrink-swell properties are severe limitations. Septic systems function poorly in the dense clayey subsoil. Wooded areas are esthetically desirable for building sites; cleared areas have too many erosion scars. For gardening, the low fertility and absence of a loamy surface layer are the main limitations. Post oak and blackjack oak are well adapted native trees.

This soil has slight limitations for recreation use. In eroded areas, the wet, sticky surface layer is a moderate problem; and in uneroded areas, the very slow permeability is a slight problem. In some places, slope has to be modified for playgrounds.

This soil produces sufficient native plants to support the relatively small numbers of wildlife that inhabit areas of this soil. A few deer graze on the native grass and brush, but most of the wildlife consists of songbirds and small game.

This Axtell soil is in capability subclass IVe and in the Claypan Savannah range site.

BeB—Behring clay loam, 1 to 3 percent slopes. This gently sloping soil is on long, narrow crests of ridges on uplands. The areas are about 20 to 50 acres in size.

Typically, the surface layer is dark grayish brown clay loam in the upper 4 inches and dark grayish brown clay to a depth of about 34 inches. The subsoil extends to a depth of about 46 inches; it is light yellowish brown clay. The underlying layer to 60 inches is mottled light gray, grayish brown, and brownish yellow shaly clay. This soil is noncalcareous and moderately alkaline throughout.

This soil is moderately well drained. Water enters the soil slowly. Permeability is slow. Runoff is medium. The available water capacity is medium. Erosion is a moderate hazard.

Included in mapping are small areas of Wilson, Crockett, and Heiden soils. These make up less than 15 percent of the map unit.

This soil is used mainly for crops, although it produces good yields of pasture or range forage. Many acres covered mainly with brush vegetation are managed as rangeland.

In cultivated areas, the moderate erosion hazard can be easily controlled by terraces, waterways, and crop residue management. Maintaining fertility and tilth are also important. Improved grasses are planted for pasture. Maintenance of fertility and weed control are the important concerns in management.

Most areas of this soil are on ridges, and they afford a scenic overlook for urban uses. However, the clayey texture, the high shrink-swell properties, corrosivity of underground pipe, and the severe problems in septic systems are limitations. Problems in landscaping and gardening are mainly the low fertility and the slow permeability. Fruit trees do not grow or produce well. Native elm and hackberry are well adapted trees for shade.

This soil is well suited to use as recreation areas. However, the surface is sticky when wet. In some areas, slope is a problem.

The potential for use as habitat is good for openland wildlife and fair for rangeland wildlife. Grassy and brushy areas in rangeland provide food and shelter for wildlife, mainly quail, doves, and rabbits.

This Behring soil is in capability subclass IIe and in the Blackland range site.

BeC2—Behring clay loam, 3 to 5 percent slopes, eroded. This soil is on side slopes of ridges on uplands. The areas are dominantly long and narrow and range from 40 to 80 acres in size.

Sheet erosion has removed part of the surface layer in the narrow areas below the ridges and redeposited the sediment at the base of the slopes. Most gullies in cropped areas have been smoothed out, leaving wide, light-colored shallow depressions. Plant growth is poor in these depressions because the soil is low in fertility and water is often ponded. Gullies are mostly 4 to 6 feet deep, 10 to 15 feet wide, and 800 to 1,200 feet apart. They seriously hinder the use of farm machinery.

Typically, the surface layer is dark grayish brown clay loam about 4 inches thick. The layer below that, to 30 inches, is dark grayish brown clay. The subsoil extends to a depth of about 42 inches; it is light olive brown clay. The underlying layer to 60 inches is mottled light gray and brownish yellow silty clay. This soil is noncalcareous and mildly alkaline in the upper part and moderately alkaline in the lower part.

This soil is moderately well drained. Permeability is slow. The available water capacity is medium. Runoff is medium. Erosion is a moderate hazard. Fertility is low. Unless the gullies are reshaped, smoothed, and sodded, they are extremely slow to stabilize.

Included in mapping are small areas of Heiden clay and Crockett loam. These soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture and crops. A few areas are used as rangeland.

This soil is well suited to pasture. It is capable of producing high yields of improved grasses under good management and with favorable weather.

This soil is severely limited for use as cropland by the erosion hazard, deterioration of soil structure, and low fertility. Terraces, contouring, and crop residue management are needed to maintain production.

The few areas used as rangeland are mostly in brush and poor grasses. However, this soil is well suited to use as rangeland and can produce high forage yields under proper management.

Hazards and limitations for urban uses are the high shrink-swell properties, severe corrosivity of underground steel pipe, and slow permeability for septic systems. Fruit trees do not produce well. Elm and hackberry are native trees for shade. Landscaping and gardening are difficult mainly because of low fertility.

This soil is limited for use as recreation areas, mainly by drainage and slope. Gullies have to be reshaped or graded if the soil is used for playgrounds or campsites. When the soil is wet, vehicle traffic is difficult because of the sticky surface.

The potential for use as habitat is good for openland wildlife and fair for rangeland wildlife. Pasture and brushy areas of range supply food and cover for wildlife, mainly rabbits, doves, and quail.

This Behring soil is in capability subclass IIIe and in the Blackland range site.

BkC—Brackett clay loam, 1 to 5 percent slopes. This gently sloping soil is mostly on ridges and their upper side slopes on uplands. Areas are irregular in shape and mostly 10 to 30 acres in size.

Typically, this soil has a moderately alkaline, grayish brown silty clay loam surface layer about 10 inches thick. About 20 percent of the surface layer is covered with fragments of limestone that are dominantly about 1 inch thick. The subsoil, to 19 inches, is moderately alkaline, yellowish brown silty clay loam. The underlying layer is pale yellow silty clay loam.

This soil is well drained. Permeability is moderately slow. Runoff is rapid. The available water capacity is very low. The soil has a high lime content that causes chlorosis in some plants. The rooting depth is shallow. Erosion is a moderate hazard.

Included in mapping are small areas of Doss and Denton soils in narrow drainageways. The included soils make up less than 15 percent of the map unit.

Most areas of this soil are used as rangeland. A few areas are used for small grains and forage sorghum. A few areas are in tame pasture. This soil used as rangeland produces medium yields of forage.

This soil has favorable properties for urban uses. Most areas are in high, scenic positions that are desirable for use as homesites. Although construction is generally more expensive than on deep soils, the stable substratum is a long term benefit for foundations and roads. Constructing septic systems is also costly because of the shallow soil depth. Contaminants may pass through the fractured rocks to underground water sources or seep laterally to the surface.

If this soil is used for landscaping and gardening, intensive soil modification is necessary to improve the soil fertility and to raise the available water capacity. Live oak and Spanish oak are good native trees for shade; fruit trees do not produce well on this soil.

This soil is suitable for use as recreation areas. However, fragments of limestone on the surface, shallow depth to rock, and slope are limitations.

This soil has fair potential for use as habitat for openland and rangeland wildlife, including deer, songbirds, and game birds, particularly wild turkey. Food and cover are sufficient to maintain a large wildlife population.

This Brackett soil is in capability class IVe and in the Adobe range site.

BkE—Brackett gravelly clay loam, 3 to 16 percent slopes. This gently sloping soil is in hilly areas on uplands. Most areas are on the side slopes of ridges, but some areas are on the tops of narrow convex ridges. Areas are generally long and narrow and range from 50 to 500 acres.

Typically, this soil has a moderately alkaline, pale brown clay loam surface layer about 5 inches thick. The surface layer has a 15 percent cover of fragments of

limestone, most of which are less than 4 inches in diameter, but a few are as much as 12 inches in diameter. The subsoil, to 16 inches, is moderately alkaline, pale yellow clay loam that has about 5 percent weakly cemented fine fragments of limestone and a few soft masses of calcium carbonate. The underlying layer is very pale brown interbedded calcareous loam and limestone.

This soil is well drained. The available water capacity is very low. Runoff is rapid, and permeability is moderately slow. Plant growth is restricted and yields are low because of the very low available water capacity, fragments of limestone, high lime content, and shallow rooting depth.

Included in mapping are small areas of Sunev soils along narrow valleys. Also included are small areas of soils that are similar to this Brackett soil except that they have a dark surface layer less than 7 inches thick. The included soils make up less than 20 percent of the map unit.

This soil is used mainly as rangeland. Forage yields are generally medium.

This soil has favorable and unfavorable properties for urban uses, especially homesites. On the higher slopes, it provides an esthetic view. Structures have a stable footing on limestone in the underlying layer. Constructing building sites, streets, or buried utilities is limited by the underlying rock and the steepness of slopes. Septic systems are difficult to install because of the stones. Furthermore, the effluent can contaminate ground water or seep laterally to the surface. Spanish oak and juniper are the dominant native trees for shade. Fruit trees do not produce well because of the shallow rooting depth and the high lime content. Intensive soil modification is necessary if this soil is used for gardening and landscaping.

Stones on the surface and shallowness are limitations to use of this soil as recreation areas. Some areas are too steep for use as playing fields or playgrounds.

This soil has fair potential for use as habitat for rangeland wildlife. The main species, deer and turkey, obtain a large part of their food and cover from plants on this soil.

This Brackett soil is in capability subclass VIIs and in the Steep Adobe range site.

BkG—Brackett-Rock outcrop complex, 16 to 30 percent slopes. This complex consists of hilly to steep Brackett soils and Rock outcrop on uplands. Areas are long and narrow and range from 30 to 300 acres.

This complex is made up of about 50 percent Brackett soils, about 25 percent Rock outcrop, and 25 percent other soils.

Typically, the Brackett soils have a moderately alkaline, grayish brown, gravelly silty clay loam surface layer about 4 inches thick. About 60 to 80 percent of the surface is covered with limestone pebbles, cobbles, stones, and a few boulders. The subsoil, which extends to a depth of about 12 inches, is moderately alkaline, light brownish gray gravelly silty clay loam. The underlying material is interbedded limestone and marl.

The Brackett soils are well drained. Runoff is rapid. The available water capacity is very low. Erosion is a moderate to severe hazard. The high content of calcium carbonate causes chlorosis in some plants. The rooting depth is shallow.

Rock outcrop consists of narrow horizontal bands and random areas of marl outcrop. Loose cobbles, stones, and boulders are common on the surface.

Included in mapping are areas of Eckrant soils, a soil similar to Brackett soils except that it has more than 35 percent coarse fragments throughout, and a soil on benches that is more than 20 inches deep to limestone.

This complex is used mainly as rangeland.

For urban uses, there are several limitations. Some areas, because of the view, are desirable as homesites. Steep slopes and shallowness to rock severely limit land shaping for houses and yards and trenching for utilities. Septic systems are not practical because of possible seepage over the closely spaced limestone outcrop. Spanish oak and juniper are the best adapted native trees for shade. Fruit trees do not grow well because of the low available water capacity, shallow rooting depth, and possibility of chlorosis. Intensive soil modification is necessary for gardening and landscaping.

For recreation uses, the limitations imposed by the slope, shallowness to rock, and stoniness are severe, especially for camp areas, picnic areas, and playgrounds. There are no limitations for paths and trails.

This complex has fair potential for use as habitat for rangeland wildlife. Deer and wild turkey are common. In most places, there is sufficient cover and food to maintain a fairly large wildlife population.

This map unit is in capability subclass VIIs and in the Steep Adobe range site.

BrA—Branyon clay, 0 to 1 percent slopes. This nearly level soil is on high, broad, ancient stream terraces that make up an almost treeless plain. Some areas are long and narrow, but most are broad and generally parallel to streams. Areas range in size from 20 to 1,000 acres or more.

Typically, the uppermost layer is clay 44 inches thick. It is dark gray clay in the upper part and gray clay in the lower part. The layer below that, to 60 inches, is light brownish gray clay. The underlying layer to 72 inches is light gray silty clay. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. When dry, the soil has wide, deep cracks that permit rapid infiltration of water; but when the soil is wet and the cracks are sealed, infiltration is very slow. Surface runoff is slow. The available water capacity is high. Root penetration is difficult because of the heavy clay texture throughout.

Some plant roots are severed by soil cracking as it dries. If this soil is undisturbed for about 10 years, it develops a gilgai microrelief that consists of a series of microdepressions and microknolls.

Included in mapping are small areas of Burleson soils and a soil similar to this Branyon soil except that it has a grayish surface layer and a brownish silty clay subsoil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops (fig. 11). A few areas are used for pasture.

This soil is used mainly for row crops. Because of slow surface drainage and the very slow permeability, this soil stays wetter and colder longer than adjoining soils and, as a result, in some years crops are planted later and weed control is difficult. Improvement of tilth and internal drainage are the main concerns in managing this soil for crops. A small acreage is used for improved grass pasture. Forage yields are high.

This soil has severe limitations for urban uses. The high shrink-swell potential causes cracking of foundations and roads unless special reinforcements are installed. The very slow permeability causes septic systems to malfunction. Corrosivity destroys steel underground pipes in a short time unless the pipes are protected.

Improved pecan trees are the primary source of shade in landscaping. Production of nuts is generally good. Fruit trees also produce well. Elm, hackberry, and pecan are native trees that are well suited to this soil. Vegetable gardens are well suited, but the heavy clay surface is difficult to work with handtools.

This soil is moderately suited to recreation uses. If the soil is wet and not protected, the clayey surface is generally too slippery and sticky for foot or vehicle traffic. Cracks in the soil during dry periods restrict some playground activities.

This soil has fair potential for use as habitat for openland and rangeland wildlife. The wildlife is mostly songbirds and game birds and rabbits. Some migratory birds feed on the grain lost during harvesting. Rabbits are common mostly along turn rows and in adjoining pastures where there is cover.

Figure 11.—Harvesting cotton in an area of Branyon clay, 0 to 1 percent slopes.

Figure 12.—Contour farming on Branyon clay, 1 to 3 percent slopes.

This Branyon soil is in capability subclass IIw and in the Blackland range site.

BrB—Branyon clay, 1 to 3 percent slopes. This gently sloping soil is on smooth, high ancient terraces and in narrow valleys. In most places, it is below the nearly level Branyon soil. In valleys, areas of this soil are mostly long and narrow; on high terraces, they are mostly irregularly shaped. Areas range from about 20 to 100 acres.

Typically, this soil has a dark gray clay upper layer about 50 inches thick. The layer below that, which extends to a depth of about 62 inches, is gray clay. The underlying layer to 80 inches is very pale brown silty clay that has yellow mottles. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. When dry, the soil has cracks 2 to 5 feet deep and permeability is rapid. When the soil is wet, the cracks close and permeability is very slow. The cracking of the soil severs some plant roots. Runoff is medium. The available water capacity is high. Erosion is a slight hazard.

Included in mapping are small areas of Krum soils that are on the more sloping breaks below this soil. The included soils make up less than 10 percent of the map unit.

This soil is used mainly for crops. A few areas are rangeland.

The main crops are cotton and grain sorghum. Yields are generally high under good management. Erosion is a slight hazard that can be controlled by terraces, contouring, waterways, and crop residue management (fig. 12).

A few areas are used for tame grass pasture or hay. Yields are generally high.

Most of this soil is on a treeless plain. This soil has severe limitations for urban uses. Because of the high shrink-swell potential, structures shift and foundations break unless they are strongly reinforced. Corrosion of underground steel pipes is rapid unless the pipes are protected. Septic systems frequently malfunction, particularly during extended rainy periods.

Improved pecan trees are the primary source of shade for landscaping. They are well suited to this soil and usually produce a good crop of nuts. Elm and hackberry are trees native to this soil. Fruit trees do well. Vegetables are well suited, but cultivation is difficult with handtools.

This soil can be used as recreation areas. However, during wet weather, the surface without protection is muddy, slippery, and sticky and foot and vehicle traffic are difficult. During dry periods, cracks in the soil restrict playground activities.

This soil has fair potential for use as habitat for openland and rangeland wildlife. The wildlife is migratory and feeds mainly on grain lost during harvesting. Game birds feed in harvested maize fields. Rabbits generally

are common along fence rows or in adjoining pastures where there is grass and cover.

This Branyon soil is in capability subclass IIe and in the Blackland range site.

BuA—Burleson clay, 0 to 1 percent slopes. This nearly level soil is on smooth, high ancient stream terraces.

Typically, this soil has a mildly alkaline, very dark gray clay upper layer about 22 inches thick. The layer below that, to 58 inches, is mildly alkaline, dark gray clay. The underlying layer to 64 inches is mildly alkaline gray clay. In most places, it is calcareous, at least in the lower part.

This soil is moderately well drained. When the soil is dry and cracked, permeability is rapid, but when the soil is wet and the cracks are closed, permeability is very slow. Runoff is slow. In most years, this soil is moist throughout in winter and spring. However, the clayey texture generally slows root development and limits plants that normally have a vigorous and extensive root system. The cracking of the soil during dry periods breaks some of the plant roots.

Included in mapping are small areas of Branyon soils and some areas of Wilson clay loam. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas are in pasture.

This soil generally is well suited to grain sorghum (fig. 13) and cotton. However, this soil is wet and cold in spring during the planting season. During extended rainy periods, weed and insect control are restricted. Yields are high in most years. Improving tilth and soil structure for better internal drainage are concerns in management. Tame pasture forage yields are high.

The clayey surface layer and the shrink-swell potential are severe limitations for foundations, roads, and septic systems. Corrosivity of underground steel pipe is rapid unless the pipe is protected. Septic systems generally malfunction, especially in rainy seasons, because of the very slow permeability.

Hackberry, elm, pecan, and fruit trees are well suited. In many places, improved pecan trees are used for shade and nut production. Vegetable crops are well suited, even though the clayey surface layer is difficult to till with handtools.

This soil is suited to recreation uses. However, if the soil is wet and not protected, the surface becomes slippery and sticky and foot and vehicle traffic are difficult. During dry periods, cracks in the soil limit some playground activities.

This soil has fair potential for use as habitat for openland wildlife and poor for rangeland wildlife. Birds

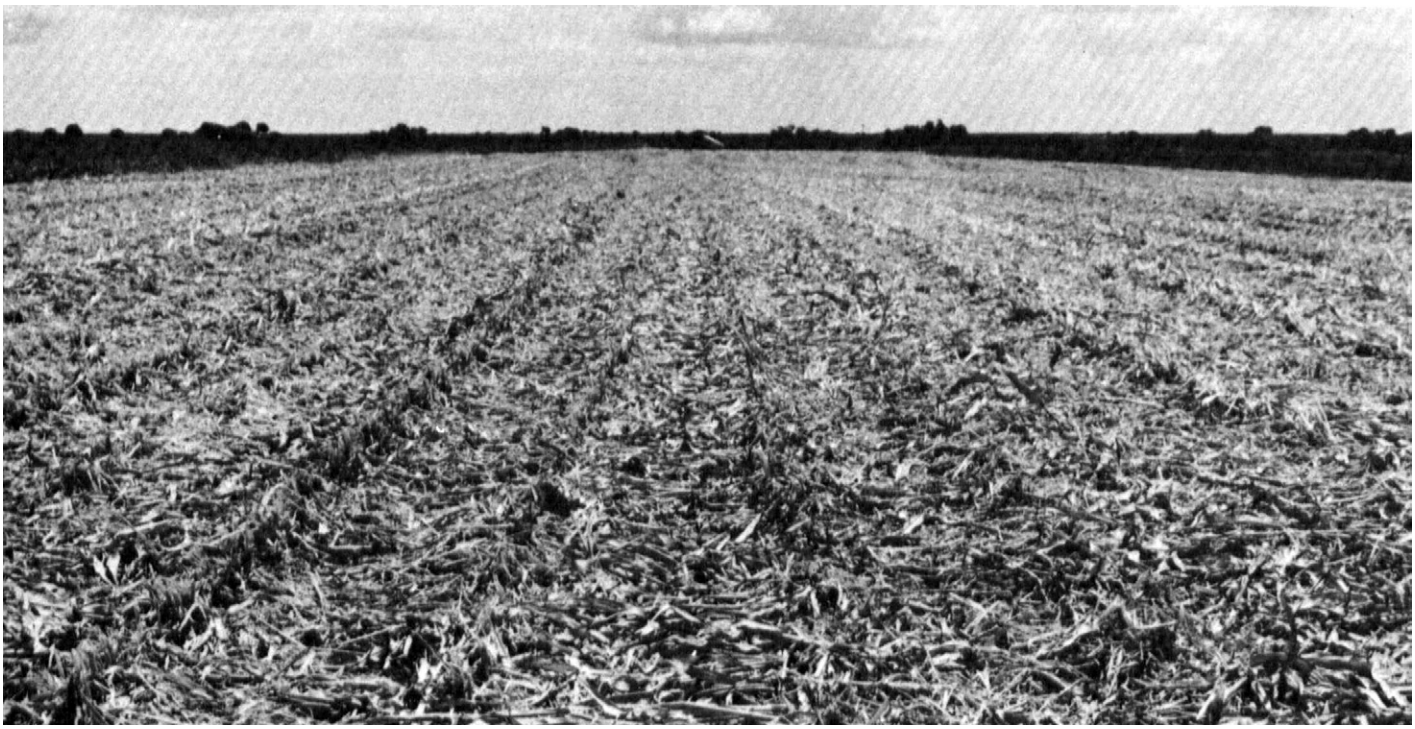


Figure 13.—Grain sorghum residue in an area of Burleson clay, 0 to 1 percent slopes. Incorporating residue into the soil helps maintain tilth.

and small animals are migratory on this soil. The wildlife population, particularly that of birds, peaks when grain is harvested. Small animals, such as rabbits, generally are common along fence rows or in adjoining pastures where there is food and cover.

This Burleson soil is in capability subclass IIw and in the Blackland range site.

BuB—Burleson clay, 1 to 3 percent slopes. This gently sloping soil is on smooth, broad, ancient stream terraces. Slopes are mainly less than 2 percent. Areas are mainly irregular in shape and range from 50 to 100 acres.

Typically, the uppermost layer is mildly alkaline, dark gray clay about 45 inches thick. The underlying layer to 60 inches is moderately alkaline, gray, noncalcareous clay that has very pale brown mottles and common hard concretions of calcium carbonate.

This soil is moderately well drained. The available water capacity is high. When dry, this soil has deep cracks and permeability is rapid. However, when the soil is wet and the cracks close, permeability is very slow. Plant roots do not easily penetrate the heavy clay. During dry periods, the cracking of the soil breaks plant roots. Under wet conditions, most of the rainfall runs off at a low, nonerosional velocity.

Included in mapping are small areas of Branyon and Wilson soils. These soils make up less than 15 percent of the map unit.

This Burleson soil is used mainly for crops. A few areas are in pasture.

This soil is well suited to most crops, but it is used mainly for row crops. Yields of maize and cotton are high in most years. Erosion is a slight hazard that can be controlled by terraces, waterways, and crop residue management. Residue returned to the soil helps improve soil tilth for better movement of water and air.

Yields of pasture forage are high. Fertilizer and controlled grazing help maintain yields.

This soil has several limitations for urban uses. Because of the high shrink-swell potential, structures shift and break. Corrosion of underground steel pipe is rapid unless the pipe is protected. Septic systems do not function well, and during extended rainy periods they generally malfunction. Elm, hackberry, and pecan trees are well suited native trees for shade. In landscaping and gardening, good internal soil drainage is the primary concern. Most garden and landscaping plants grow well. Fruit trees produce well. This soil is difficult to work with handtools.

This soil is suited to recreation uses. However, when the soil is wet and not protected, the surface becomes sticky and slippery and foot and vehicle traffic are difficult. During dry periods, cracks in the soil limit some playground activities.

This soil has fair potential for use as habitat for openland wildlife and poor potential for rangeland wildlife. The wildlife is migratory. The population of birds is highest during grain harvest. Small animals generally travel along turn rows or in adjoining pastures in their search for food and cover.

This Burleson soil is in capability subclass IIe and in the Blackland range site.

CaB—Castephen silty clay, 1 to 3 percent slopes. This gently sloping soil is on uplands. Areas are mainly irregular in shape. Some areas on ridges are long and narrow. Areas range from 10 to about 35 acres.

Typically, the surface layer is dark brown silty clay about 16 inches thick. The underlying material is very pale brown interbedded chalk and loamy marl. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Permeability is moderate. Runoff is medium. The shallow depth, high lime content, and fragments of chalk in this soil cause the available water capacity to be very low. Erosion is a moderate hazard.

Included in mapping are small areas of Eddy, Whitewright, and Austin soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops because the areas are surrounded by the deeper, more productive Austin soils. A few areas are in tame pasture.

Small grains are the main crops. Yields are generally low because of the shallow depth, high lime content, and low available water capacity. Erosion is mainly controlled by maintaining a nearly continuous plant cover and by returning crop residue to the surface. Terraces are not practical on this soil because of the shallow depth to chalk.

This soil has limitations for urban uses. Underground steel pipelines are subject to corrosion. Seepage of effluent from septic systems can contaminate nearby underground water sources or rise laterally to the surface. Landscaping and gardening are difficult because of the shallowness of the soil and the high content of lime. Fruit trees do not produce well. Native elm, hackberry, and live oak are reliable trees for shade.

If this soil is used as recreation areas, maintaining a vigorous grass cover is the main problem. If not protected and wet, the surface layer is sticky and slippery. Wet surfaces do not have the bearing strength necessary for vehicular traffic.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Areas not used for crops are mainly in short grasses and weeds, which offer little protection for birds and small animals.

This Castephen soil is in capability subclass IIIe and in the Chalky Ridge range site.

CaC—Castephen silty clay, 3 to 5 percent slopes. This gently sloping soil is on complex slopes near the crest of knolls and side slopes of ridges on uplands.

Areas are generally long and narrow and range from 10 to 35 acres.

Typically, the surface layer is dark brown silty clay loam about 15 inches thick. The underlying material to a depth of more than 28 inches is platy chalk that is slightly weathered in the upper 12 inches. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. The available water capacity is very low. Permeability is moderate. Runoff is medium. The rooting zone is shallow. Erosion is a severe hazard in unprotected areas.

Included in mapping are small areas of Whitewright, Eddy, and Austin soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture, but a few areas are in small grains. In areas that are used for row crops there are deeper, more productive soils than the Castephen soil.

This soil is limited for use as cropland by its shallowness, the very low available water capacity, high lime content, slope, and the severe hazard of erosion. The most practical way to control erosion is to maintain a plant cover or a mulch on the surface. Terraces are impractical because of the shallowness to chalk. Crop yields are low.

This soil can produce medium amounts of pasture forage. The main concern in management is to maintain fertility and the content of organic matter to help maintain or increase the available water capacity.

Areas in rangeland produce medium yields of forage.

This soil is corrosive to underground steel pipe that is not protected. Septic systems that drain into the chalk substratum can contaminate underground water or seep laterally to the surface. The soil is highly expansive, but damage from shrinking and swelling is limited because the soil is thin. Gardens need soil amendments, fertilizers, and water. Elm, hackberry, and live oak are suitable trees for shade. Fruit trees do not produce well on this soil.

Recreation areas for most activities can be developed easily on this soil. However, a grass cover is needed in areas of foot traffic. Foot or automobile travel is difficult in unprotected areas when they are wet. Also, wet areas do not have the bearing strength needed for vehicle traffic. This soil dries quicker than the adjacent deeper soils.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Because of inadequate cover, only a few songbirds, game birds, and small animals inhabit areas of this soil.

This Castephen soil is in capability subclass IVe and in the Chalky Ridge range site.

CfA—Crawford clay, 0 to 1 percent slopes. This nearly level soil is on tops of mesas, on foot slopes, and in shallow valleys on uplands. Areas are irregular in shape and range from about 20 to 50 acres.

Typically, the surface layer is neutral, dark grayish brown clay about 6 inches thick. The layer below that, to 32 inches, is neutral, dark brown clay. The substratum is fractured whitish limestone.

This soil is well drained. Permeability is very slow. This soil swells when wet and shrinks when dry. Water enters the soil rapidly when the soil is dry and very slowly when the soil is moist. The available water capacity is low. Runoff is slow. The rooting zone is moderately deep. During dry periods, the cracking of the soil breaks some plant roots.

Included with this soil in mapping are small areas of Fairlie and Georgetown soils and a soil that is similar to Crawford soil except that it has a grayish subsoil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as rangeland. A few areas are used for grain sorghum or small grains, and a few areas are used for tame grass pasture or hay.

If this soil used as rangeland, the potential is high for grass forage production.

Most areas are esthetically pleasing as homesites. However, because of the shrink-swell potential, foundations can shift and buckle. Paved roads generally become bumpy and broken and constantly need patching. Underground steel pipe that is not protected is subject to corrosion. Septic systems function poorly in the heavy clay subsoil. Septic drain fields placed in contact with underlying limestone can allow contaminates to leach through fractures into local wells. Native elm and post oak are well suited trees for shade. Fruit trees are moderately well suited. Although soil reaction is favorable for vegetables, gardening with handtools is difficult.

This soil is moderately well suited to use as recreation areas. However, during wet periods the clayey surface is sticky and slippery and foot and vehicle traffic are difficult. Cracks in dry soil limit some playground activities.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Vegetation on this soil provides food and cover for deer, turkey, small animals, songbirds, and game birds.

This Crawford soil is in capability subclass IIIs and in the Deep Redland range site.

CfB—Crawford clay, 1 to 3 percent slopes. This gently sloping soil is on mesas, foot slopes, and at the head of drainageways on uplands. Areas are irregular in shape and range from about 15 to 50 acres.

Typically, the uppermost layer is neutral clay about 27 inches thick. It is brown in the upper 6 inches and dark reddish brown below that. The underlying material is whitish, fractured hard limestone.

This soil is well drained. The available water capacity is low. When the soil is dry and cracked, permeability is rapid; but when the soil is wet and the cracks are closed,

permeability is very slow. Runoff is medium. The rooting depth is moderately deep. Erosion is a medium hazard. During dry periods, cracking of the soil breaks some plant roots.

Included in mapping are small areas of Denton, Georgetown, and Fairlie soils. Also included are soils similar to this Crawford soil except that they are underlain by weakly cemented limy material and are gray in the upper 12 inches. The included soils make up less than 15 percent of the map unit.

The soil is used mainly as rangeland, primarily because of its close association with other soils used for that purpose. Forage yields are high under good management and with favorable weather. In some areas where this soil is associated with arable soils, it is used for crops, hay, or pasture.

Because it is in high positions on the landscape, and generally dotted with post oak, this soil is desirable as homesites. Limitations are the clayey texture and the shrink-swell potential. Foundations are subject to shifting and breaking, and paved roads become bumpy and broken. Underground steel pipe may corrode if not protected. Septic systems function very poorly in the clay subsoil. Contaminants from the absorption field may reach the water table. Soil reaction is favorable for vegetables; however, gardening with handtools is difficult because of the clayey surface layer. Elm and post oak are suitable native trees.

This soil is suited to recreation areas. However, when the clayey surface layer is wet, it becomes sticky, slippery, and muddy and foot and vehicle traffic are difficult. Cracks in dry soil limit some playground activities.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Deer, turkey, and other wildlife obtain much of their food and cover from vegetation on this soil.

This Crawford soil is in capability subclass IIIe and in the Deep Redland range site.

CrB—Crockett loam, 1 to 3 percent slopes. This gently sloping soil is on irregularly shaped narrow ridges on uplands. Areas range mostly from 20 to 50 acres.

Typically, the surface layer is slightly acid, brown sandy loam about 7 inches thick. The upper part of the subsoil, which extends to a depth of about 14 inches, is neutral, mottled, reddish brown clay; and the lower part, to 47 inches, is a mottled, mildly alkaline, brown clay. The underlying layer to 60 inches is moderately alkaline silty clay loam. In the lower part it is calcareous.

This soil is moderately well drained. Permeability is very slow. Runoff is medium. The available water capacity is high, but the soil is seldom wet throughout from rainfall. Roots, particularly those of annuals, do not easily penetrate the dense clay subsoil. Erosion is a moderate hazard.

Included in mapping are small areas of Axtell and Wilson soils. Also included are a few areas of eroded Crockett clay and small areas of Axtell soils. The included soils make up about 15 percent of the map unit.

This soil is mainly in brushy range. A few areas are used for pasture or crops.

Under proper management, areas in range can produce medium yields of forage.

This soil is well suited to tame grass pasture. A concern in management is maintaining the fertility level.

The main cultivated crops are small grains. Fertility management is the main concern. Erosion can be controlled with terraces and by returning crop residue to the soil.

This soil is suitable for urban uses, but the limitations are severe. In the subsoil, the shrink-swell potential is high and corrosivity of underground steel pipe is severe. Septic systems function poorly, and effluent can surface during wet periods. Native elm and hackberry are good shade trees on homesites, but fruit trees grow poorly because of the dense clayey subsoil. Vegetable gardens do well with proper irrigation, fertilizer, and organic mulching, but most ornamentals grow poorly because of the clayey subsoil and wetness after heavy rainfall.

This soil is limited for use as recreation areas, particularly campsites or playgrounds, by the very slow permeability. Because the surface dries quickly, this soil is suitable for trails and picnic areas.

This soil supports a good habitat for openland and rangeland wildlife. An abundance of wild birds and small animals inhabits brushy areas. The habitat is capable of supporting a larger population of wildlife. Generally, wildlife moves into smaller areas as the brushy pastures in the habitat are cleared and the area is planted to improved pasture grasses.

This Crockett soil is in capability subclass IIIe and in Claypan Prairie range site.

CrC2—Crockett loam, 2 to 5 percent slopes, eroded. This gently undulating soil is mainly on side slopes of ridges on uplands. Areas are mainly irregular in shape and are 25 to 75 acres in size.

Most of the loamy surface layer has been removed by water erosion. Some of the sediment from the surface layer is at the base of the slope, but a large part of the sediment has been carried downstream. The gullies formed in cattle paths and other areas where runoff was concentrated. The gullies are 6 to 8 feet deep, 10 to 15 feet wide, and mostly 400 to 800 feet apart. In a few areas, the gullies are less than 100 feet apart.

Typically, this soil has a surface layer of slightly acid, grayish brown, friable loam about 4 inches thick. The subsoil in the upper part, to 18 inches, is neutral, mottled grayish brown and reddish brown very firm clay. In the middle part, to 40 inches, it is mildly alkaline, mottled olive gray and reddish brown, very firm clay. In the lower part, to 52 inches, it is mildly alkaline, mottled brownish

yellow and reddish brown, very firm clay. The underlying layer to 60 inches is moderately alkaline, mottled brownish yellow and reddish brown, very firm silty clay.

This soil is moderately well drained. Permeability is very slow. Runoff is rapid. The available water capacity is high, but the soil is rarely wet throughout. Crop and grass yields are adversely affected because plant roots do not easily penetrate the dense clay subsoil. Further erosion is a severe hazard. Unless smoothed and vegetated, gullies are slow to stabilize.

Included in mapping are small areas of Crockett clay loam and Crockett sandy clay loam that are mostly around gullies and at crests of slopes. In a few areas there are no gullies or the gullies have been graded and smoothed. Also included are narrow areas of Wilson soils along gently sloping drainageways and a few small areas of Axtell soils. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as rangeland or for pasture. A few areas are used for crops.

This soil is well suited to range, although cultivated crops under intensive management are possible. Erosion is a severe hazard if the soil is not protected with vegetation or crop residue. Continuous broadcast crops that protect the surface and produce large amounts of residue help control erosion. Terraces and waterways are also necessary.

Improved tame grasses for pasture or hay need fertilizer and brush control. Forage yields are medium.

In urban uses, the shrink-swell potential of this soil affects foundations and other structures. The clayey subsoil corrodes underground steel pipe unless the pipe is protected. Septic systems work poorly and generally malfunction during rainy periods. Most areas are dominated by mesquite brush and weeds. Elm and hackberry are well suited as shade trees. Fruit trees grow but produce poorly. Fair gardens can be grown in uneroded areas. Fertilizer, water, and organic mulches are needed at regular intervals for good gardening.

This soil is suitable for use as recreation areas. The loamy surface layer dries quickly after rains and holds up well under foot and vehicle traffic. The very slow permeability and slope in some areas are limitations.

This soil provides good habitat for openland and rangeland wildlife. Brushy areas provide food and cover for a variety of songbirds, game birds, and small animals. These areas are gradually shrinking as they are converted to improved pasture.

This Crockett soil is in capability subclass IVe and in the Claypan Prairie range site.

De—Deleon clay loam, occasionally flooded. This nearly level soil is on long and narrow flood plains in slightly higher areas than those of the frequently flooded Deleon soils. Slopes are less than 1 percent. Areas flood once in about 7 to 10 years.

Typically, the uppermost layer of this soil is dark brown sandy clay loam about 22 inches thick. The layer below that, to 34 inches, is pale brown sandy clay. The layer below that, to 54 inches, is dark brown sandy clay. The underlying layer to 62 inches is dark brown clay loam that has thin sandy strata. The soil is noncalcareous and is moderately alkaline throughout.

This soil is moderately well drained. The available water capacity is medium. Runoff is slow. Permeability is slow. This soil is flooded for brief periods 2 to 3 times every 10 years.

Included in mapping are soils that are similar to this Deleon soil except that they have clayey lower layers or are calcareous in the lower part. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops or pasture.

If this soil is used for crops, maintaining fertility and tilth are the main concerns in management. If this soil is used for pasture, fertilizer is needed for plants to produce high yields.

This soil is not suited to urban uses because of the flood hazard.

The use of this soil for recreation areas is limited by the flood hazard. Also, when this soil is wet, the surface is sticky and muddy, and vehicle traffic is difficult.

This soil supports a fair habitat for openland and rangeland wildlife. Because this soil is near creeks and streams that have trees and brush for cover, wild birds and small animals frequently feed in and traverse the area. The habitat provides food and cover for large numbers of wildlife.

This Deleon soil is in capability subclass IIs and in the Loamy Bottomland range site.

Df—Deleon soils, frequently flooded. This soil is on long, narrow flood plains adjacent to stream channels. Slopes are less than 1 percent. Areas are nearly level and are flooded for a few hours to a few days several times in most years. Local roads are frequently covered by floodwaters, causing some damage. The few areas that are used for crops are subject to soil and crop losses.

Typically, this soil has a dark grayish brown, mildly alkaline, clay loam upper layer about 40 inches thick. The underlying layer is light olive brown, moderately alkaline silty clay loam. The soil is noncalcareous throughout.

This soil is moderately well drained. Permeability is slow. This soil receives the runoff of uplands during high intensity rains. Runoff is slow. The available water capacity is high, and roots easily penetrate the soil.

Included in mapping are areas of similar soils except that they are clayey throughout, are clayey in the lower part, or are calcareous throughout. These soils make up as much as 45 percent of the map unit.

This soil is suited only to use as pasture or rangeland because of frequently damaging floods. It can produce

large amounts of forage from the native grasses, but production is generally limited because of shading. Most areas are along wooded creeks.

This soil is not suitable for urban uses mainly because of the hazard of flooding.

Pecan groves are common on this soil and produce well in most years.

This soil is severely limited for use as recreation areas by the flood hazard. It is used mainly for paths and trails for hiking.

This soil provides a fair habitat for rangeland wildlife. It is a natural habitat for wild birds and small animals. Cover, water, and food are plentiful and support a large population of several species.

This Deleon soil is in capability subclass Vw and in the Loamy Bottomland range site.

DmB—Demona loamy fine sand, 1 to 5 percent slopes. This soil is on gently sloping uplands. Areas are irregular in shape and range from 40 to 125 acres.

Typically, the surface layer is neutral, pale brown loamy fine sand about 14 inches thick. The subsurface layer, to a depth of 22 inches, is neutral, very pale brown loamy fine sand. The subsoil, to 54 inches, is neutral, brownish yellow sandy clay mottled with red and gray. The underlying material is neutral, light gray silty clay loam.

This soil is moderately well drained. Permeability is moderately slow. Runoff is slow to medium. The available water capacity is medium. Roots do not easily penetrate the sandy clay subsoil. Water erosion is a moderate hazard. This soil has a slight susceptibility to wind erosion. A perched water table is at a depth of 1 1/2 to 3 1/2 feet below the surface from May to October.

Included in mapping are small areas of Padina and Rosanky soils and a soil that is similar to the Demona soil except it has a sandy surface layer that is 10 to 15 inches thick. Padina soils are mainly in valleys where the sandy surface is thick. The other included soils are in areas mainly near ridges where erosion has thinned the surface and subsurface layers. The included soils make up as much as 15 percent of the map unit.

This soil is used mainly for pasture and hay. A few areas are used for crops, and a few are in rangeland.

This soil produces high yields of improved grasses for hay and pasture if fertility is maintained and weather is favorable. Management of grazing and weed control are needed. Range areas are capable of producing high yields of forage.

A few small areas are used for peanuts, watermelon, tomatoes, or corn.

The wooded areas of this soil offer attractive homesites. However, because of the shrink-swell potential, this soil has limitations for use as building sites unless the foundation is on a sandy clay subsoil, which has a moderate shrink-swell potential. Septic systems work well in the sandy layers but poorly in the underlying sandy clay. Corrosion is a serious limitation for underground steel pipe in the subsoil. Post oak and blackjack oak are native shade trees that are well adapted. Most landscape plants, garden plants, and fruit trees are well suited.

Slope is a problem for some recreation uses. In places, wetness caused by the perched water table is a limitation. With heavy traffic, the sandy surface becomes loose and somewhat dusty.

This soil has good potential for use as habitat for openland and rangeland wildlife. The wooded areas provide food and cover for wild birds and small animals. The wildlife population is decreasing as wooded areas are cleared for pasture.

This Demona soil is in capability subclass IIIe and in the Sandy range site.

DnA—Denton silty clay, 0 to 1 percent slopes. This is a nearly level soil on valley floors where the surface is slightly concave and on ridges where the surface is plane to convex. Areas range from about 15 to 30 acres.

Typically, the upper layer is very dark brown silty clay about 23 inches thick. The subsoil to a depth of 35 inches is dark brown silty clay, and to 38 inches it is yellowish and grayish silty clay loam. The underlying material is weathered nodular limestone and limy earth.

This soil is well drained. Runoff is medium. Permeability is slow. When this soil dries and cracks, water enters the soil rapidly, but when the soil is wet and cracks are closed, water enters it slowly. The rooting zone is moderately deep. The available water capacity is medium.

Included in mapping are small areas of Crawford and Fairlie soils and soils similar to this Denton soil except that they are more than 40 inches thick over limestone or marl or they have a grayish surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas are in pasture or rangeland (fig. 14). Because of the medium available water capacity, crops that are drought resistant or crops of a cool-season variety are most suitable. Concerns in management include maintenance of tilth and fertility.

Areas of this soil that are used for tame grass pasture produce medium yields of improved grasses. Other areas, generally along drainageways and in fields that were formerly cultivated, are used as rangeland.

This soil is suitable for urban uses although the high shrink-swell potential, corrosivity, and the slow permeability are problems. Concrete or asphalt can crack because of the high shrink-swell potential. Corrosion of underground steel pipe is rapid unless protected. Septic systems do not function well in wet soil. If the discharge field is in the rock substratum, contaminants may enter the water table.

Figure 14.—Rangeland on Denton silty clay, 0 to 1 percent slopes. Eckrant extremely stony clay, 0 to 3 percent slopes, is on the low hills in the background. The landscape is typical of the Grand Prairie Land Resource Area.

Landscaping and gardening can be done with fair success. Chlorosis is a problem in some plants. Gardens and fruit trees need supplemental water. Live oak, elm, and Spanish oak are the best native trees for shade.

This soil is suitable for recreation uses. However, when wet, the clayey surface becomes sticky and muddy.

This soil has good potential for use as habitat for openland wildlife. Deer and turkey frequent areas of this soil; the vegetation provides food and cover.

This Denton soil is in capability subclass IIs and in the Clay Loam range site.

DnB—Denton silty clay, 1 to 3 percent slopes. This soil is in shallow valleys and narrow drainageways on uplands. Areas are mostly long and narrow and range from about 20 to 80 acres.

Typically, the upper layer is dark brown silty clay about 33 inches thick. The layer below that, to 36 inches, is very pale brown silty clay loam. The underlying material is fractured limestone and limy material. The soil is calcareous and moderately alkaline throughout.

This is a well drained and slowly permeable soil. Runoff is medium. The available water capacity is medium. This soil cracks when dry. The rooting zone is moderately deep. Erosion is a slight hazard.

Included in mapping are small areas of Fairlie, Georgetown, and Crawford soils. Also included are a few areas of soils similar to this Denton soil except that they are more than 40 inches thick over limestone or have a gray surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas are in pasture or rangeland.

The main crop is small grains. Yields are medium. Some areas are used for tame grass pasture. A large acreage along shallow drainageways and in old fields that were formerly cultivated is used as rangeland with adjoining soils that are not arable.

This soil is suitable for urban uses. However, the shrink-swell potential affects the stability of foundations, paved roads, and buried utility lines. Septic systems are limited by the moderate soil depth, slow permeability, and the possibility of contaminants moving down through fractured limestone. Corrosion of underground steel pipe is rapid unless it is protected. Fruit trees do not do well because of the high lime content; vegetables are also affected but not so seriously. Elm is the best native tree for shade.

This soil is suitable for recreation use. However, when wet, unprotected areas are sticky and muddy and vehicle traffic is difficult.

This soil has good potential for use as habitat for openland wildlife. Range or idle areas such as those along fence rows provide large amounts of food and a good cover for turkey and deer.

This Denton soil is in capability subclass IIe and in the Clay Loam range site.

DnC—Denton silty clay, 3 to 5 percent slopes. This soil is in shallow valleys on short side slopes on uplands. Most areas are long and narrow and range from 15 to 40 acres.

Typically, the upper layer is dark brown silty clay about 18 inches thick. The subsoil, to a depth of about 25 inches, is light brown silty clay. The layer below that, to 32 inches, is pale brown silty clay loam. The underlying material is limestone interbedded with weathered limestone and limy material. The soil is calcareous and moderately alkaline.

This soil is well drained. Runoff is medium. Permeability is slow. When dry, the soil cracks and water enters the soil rapidly, but when the soil is wet, water enters it slowly. The rooting zone is moderately deep. The available water capacity is medium. Erosion is a moderate hazard.

Included in mapping are small areas of Doss, Brackett, and a soil similar to this Denton soil except that it is gray and is less than 20 inches thick over limestone. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas are used for pasture or as rangeland.

The primary crops include forage for temporary grazing, hay, and small grains. This soil has a moderate erosion hazard that can be controlled by terraces, waterways, and crop residue management.

Some areas are in permanent tame grass pastures. Forage yields are medium.

Many areas of this soil along drainageways and in fields that were formerly cultivated are adjacent to soils that are not arable. These areas are used as rangeland and can produce large amounts of high quality forage.

This soil is suitable for urban uses. However, a severe shrink-swell potential affects the stability of foundations, streets, and buried utility lines. Corrosion of underground steel pipes is rapid unless the pipes are protected. Septic systems are seriously limited by the slow permeability and the moderate soil depth. Also, contaminates may move through the fractured limestone into underground water sources. Some fruit trees and vegetables are affected by chlorosis because of the high content of lime. The most reliable native tree for shade is elm.

This soil is suitable for use as recreation areas. Slope is a problem for playgrounds. During wet weather, the surface is sticky and muddy and foot and vehicle traffic are difficult.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Wildlife is bountiful. Deer and turkey frequent areas of this soil. The vegetation furnishes a large part of their food; the wooded areas nearby provide cover.

This Denton soil is in capability subclass IIIe and in the Clay Loam range site.

DoC—Doss silty clay, 1 to 5 percent slopes. This gently sloping soil is on uplands. Areas are generally irregular in shape and range from 10 to 50 acres.

Typically, this soil has a dark grayish brown silty clay surface layer about 9 inches thick. The subsoil, to 19 inches, is brown silty clay loam. The underlying material is weakly cemented limy earth interbedded with fragments of limestone. This soil is calcareous and moderately alkaline.

This soil is well drained. It has a low available water capacity. Permeability is moderately slow. Runoff is medium. The rooting zone is shallow. Erosion is a moderate hazard.

Included in mapping are small areas of Denton and Georgetown soils. Also included are a few areas of a soil similar to Doss soils except that it has gray colors. Denton soils are in narrow valleys; Georgetown soils are on hilltops over harder limestone than that of Doss soils. Also included are small areas of Brackett soils on short side slopes. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as rangeland. A few areas are used for crops. The rangeland produces medium yields of forage.

Small grains are the main crops. Yields are generally low. Erosion is controlled by keeping a plant cover on the surface and by returning crop residue to the soil.

This soil is suitable for urban uses. However, because of shallowness to rock, the construction of foundations and underground utility lines is difficult. Underground

water contamination from sewage systems is possible. Some landscape and garden plants are affected by chlorosis because of the high lime content. Adapted trees for shade include native oak and elm. Fruit trees do not do well. Gardens are successful if watered and mulched regularly.

This soil is well suited to recreation uses. The shallow soil limits the moisture needed for a grass cover. This soil dries out more quickly than adjacent deeper, more clayey soils.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Areas of this soil are used intermittently by wildlife. A fair amount of the food particularly for deer and turkey is provided by vegetation on this soil. Cover is provided by the tall grasses in areas that are used for range and by the nearby wooded areas.

This Doss soil is in capability subclass IVe and in the Shallow range site.

EaD—Eckrant cobbly clay, 1 to 8 percent slopes. This soil is on undulating uplands. Slopes average about 4 percent. Areas are irregular in shape and range from 50 to 500 acres.

Typically, the surface layer is about 13 inches thick. The upper part is dark grayish brown cobbly clay. The lower part is dark brown cobbly clay. The underlying material is coarsely fractured indurated limestone. This soil is calcareous and moderately alkaline. The surface has about a 50 percent cover of fragments of limestone that are mostly 4 to 8 inches across.

This soil is well drained. Permeability is moderately slow, and runoff is rapid. The available water capacity is very low. The rooting zone is very shallow to shallow.

Included in mapping are small areas of Doss soils and Denton soils along narrow drainageways. Also included is a soil similar to Eckrant soil except that it is less than 35 percent limestone fragments and the fine earth is loamy rather than clayey. The included soils make up less than 20 percent of the map unit.

This soil is used as rangeland. The potential plant community is a live oak savannah. Forage yields are low.

This soil is suited to urban uses because of the firm underlying strata. However, site preparation is difficult for foundations, buried utility lines, septic systems, and streets because of the underlying limestone. Underground water sources may become contaminated from septic systems if pollutants pass unfiltered through the fractured bedrock and into the water source. Landscaping and gardening are difficult because of stones and the very shallow to shallow depth to bedrock. Fruit trees do not produce well.

The main limitations to use of this soil as recreation areas are stones and cobbles on the surface. When wet, the surface is sticky and slippery. Maintaining a grass cover is difficult because of the very shallow soil depth and cobbles and stones.

This soil supports a fair habitat for rangeland wildlife. Vegetation on this soil provides most of the necessary food and cover for the large number of wildlife in the area.

This Eckrant soil is in capability subclass VIIs and in the Low Stony Hills range site.

EeB—Eckrant extremely stony clay, 0 to 3 percent slopes. This nearly level to gently sloping soil is on broad ridges and in shallow valleys on uplands. Most of the areas are irregular in shape and range from 50 to 500 acres.

Typically, this soil has an extremely stony, very dark gray clay surface layer about 11 inches thick. The underlying material is indurated limestone. About 25 percent of the surface is covered with fragments of limestone; most are about 6 inches across but range from 3 inches to 3 feet across and are as much as 10 inches thick. The soil is calcareous and moderately alkaline.

This soil is well drained. Permeability is moderately slow, and surface runoff is rapid. The fragments of limestone on the surface help to prevent erosion. The available water capacity is very low because of the shallowness of the soil and stones in the soil. The rooting depth is shallow to very shallow.

Included in mapping are small areas of Doss and Georgetown soils. The included soils make up less than 30 percent of the map unit.

This soil is used mainly as rangeland. The potential plant community is a live oak savannah. Forage yields are low.

The many live oaks in areas of this soil make those areas attractive as homesites. The hard limestone furnishes a stable footing for building foundations; however, considerable cutting and blasting are necessary for construction of underground utility lines, foundations, and roads and streets. Live oak and elm are reliable native trees for shade. Landscaping is difficult because of the very shallow and shallow depth to rock. Gardening is severely limited by stones.

The use of this soil as recreation areas is limited by stones on the surface and the low available moisture capacity. When this soil is wet, the clayey surface is sticky and slippery.

This soil supports a fair habitat for rangeland wildlife. Vegetation on this soil provides the kind and amount of feed and cover required by the large populations of deer and turkey in the area.

This Eckrant soil is in capability subclass VIIs and in the Low Stony Hills range site.

ErE—Eckrant-Rock outcrop complex, rolling. This complex, on uplands, consists of Eckrant soils and Rock outcrop on hills and ridges and on sides of drainageways. The soils and Rock outcrop are so intricately mixed or so small in area, that mapping them

separately was not practical. Slopes range from 5 to 16 percent. Areas are irregular in shape or long and narrow and range from 50 to 500 acres.

This complex is made up of about 70 percent Eckrant soils, 15 percent Rock outcrop, and 15 percent other soils.

Typically, the surface layer of Eckrant soils is calcareous, moderately alkaline, dark grayish brown extremely stony clay about 8 inches thick. The underlying material is fractured indurated limestone. Fragments of limestone from 6 inches to 2 feet across cover about 35 percent of the surface.

Rock outcrop consists of exposed limestone bedrock. It is in narrow horizontal bands and in random areas within areas of the Eckrant soils. Loose cobbles and stones on the surface are common.

The other soils included in mapped areas of this complex are Doss soils on narrow ridgetops, Denton soils at the base of slopes and in narrow drainageways, and Georgetown soils in positions similar to those of Eckrant soils.

Permeability is moderately slow. The rooting depth is very shallow. Runoff is rapid. The available water capacity is very low. Plant and tree growth is severely limited, especially on the limestone ledges that are exposed in narrow bands perpendicular to the slope.

This complex is used mainly as rangeland. Forage yields from the large variety of plants are low.

This complex has an esthetic appeal for use as homesites. However, the hard limestone substratum and the slope are limitations. Live oak and elm are well adapted native trees for shade. Fruit trees do not grow well. Gardening is very difficult because of stones, slope, and the shallow to very shallow depth to bedrock.

This complex has poor suitability for recreation uses because of slope, the clayey surface, large stones, and the shallow to very shallow depth to rock.

This complex supports a fair habitat for rangeland wildlife. Vegetation on this soil provides food and cover needed by deer and turkey. The wildlife population is generally high.

The Eckrant soils are in capability subclass VIIs and in the Steep Rocky range site.

ErG—Eckrant-Rock outcrop complex, hilly. This complex, on uplands, consists of Eckrant soils and Rock outcrop mostly along major streams where geologic erosion has formed sharp hills, ridges, and ravines. The soils and Rock outcrop are so intricately mixed or so small in area that mapping them separately was not practical. Slopes range from 10 to 30 percent. Most areas are long and narrow, are parallel to streams, and range from 10 to 200 acres.

This complex is made up of about 41 percent Eckrant soils, 38 percent Rock outcrop, and 21 percent other soils.

Typically, the Eckrant soils have a calcareous, moderately alkaline, extremely stony silty clay loam surface layer about 11 inches thick. The upper part is very dark grayish brown, and the lower part is dark grayish brown. The underlying material below 11 inches is indurated limestone. About 55 percent of the soil surface is covered with fragments of limestone that are 1 to 6 feet across.

Rock outcrop consists of exposed limestone bedrock. Most areas of Rock outcrop are directly below the crests of hills and ridges. Loose cobbles and stones on the surface are common.

Other soils included in the mapped areas of this complex are Doss soils in small areas on benches or ledges and a soil similar to Eckrant soils except that it is more than 20 inches thick over colluvial limestone fragments and limy material.

Permeability is moderately slow. The soils are well drained. Because of low available water capacity, rapid runoff from the steep slopes, and very shallow to shallow rooting depth, these soils do not have the moisture needed for vigorous plant growth. Droughtiness late in spring and summer affects plants.

This complex is used as rangeland. Forage yields are low.

Most areas of this complex have esthetic appeal for use as homesites. However, most housing developments stop at the edge of the ridges because of the difficulty of building on the steeper side slopes. Streets and utility lines are difficult to construct or install because of bedrock and slope. Most landscaping consists of modifying the existing plants and trees.

This complex is not suitable for recreation uses other than hiking.

This complex supports a fair habitat for rangeland wildlife. Wildlife is plentiful. Most of the areas are heavily wooded and provide food and cover for deer and turkey.

The Eckrant soils are in capability subclass VIIs and in the Steep Rocky range site.

EyB—Eddy very gravelly clay loam, 0 to 3 percent slopes. This is a nearly level to gently sloping soil on ridges on uplands. Areas are mostly long and narrow and range from 20 to 50 acres.

Typically, this soil has a calcareous, moderately alkaline, grayish brown, very gravelly clay loam surface layer about 11 inches thick. In the lower 7 inches the surface layer is approximately 60 percent, by volume, fragments of broken chalk. The underlying material is chalk that is weakly cemented in the upper part and becomes harder with depth.

This soil is well drained. Permeability is moderately slow. Rooting depth is very shallow to shallow. The available water capacity is very low. Runoff is medium.

This is a droughty, limy soil suitable for cool season crops or drought tolerant grasses. Erosion is not a problem because of the nearly level to gentle slopes and

the partial cover of chalk fragments in most places. Live oak is well adapted to this soil and develops an extensive root system in the fractures in the underlying chalk.

Included in mapping are soils similar to this Eddy soil except that they have less than 35 percent fragments of chalk or have a darker colored surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as rangeland. A few areas are used for tame grass pasture. Forage yields are low.

The areas of this soil that have native live oak trees are favorable as homesites. The chalk substratum provides a good foundation for houses and streets. Construction or installation of foundations, streets, septic systems, and utility lines is limited by the hard chalk at shallow to very shallow depths. Live oak and elm are the best native trees for shade. Soil modification is necessary in landscaping and gardening. Fruit trees do not grow well because of chlorosis and shallowness to rock.

Suitability of this soil for recreation uses is limited by fragments of chalk on the surface and by the very low available water capacity.

This soil has poor potential for use as habitat for openland and rangeland wildlife. Areas of this soil are generally not large enough to support a habitat for an extensive population of wildlife; most of the wildlife feeds on vegetation on adjoining soils.

This Eddy soil is in capability subclass IVs and in the Chalky Ridge range site.

EyD—Eddy very gravelly clay loam, 3 to 8 percent slopes. This undulating soil is on uplands in irregularly shaped areas that range from about 50 to 75 acres.

Typically, this soil has a calcareous, moderately alkaline grayish brown, very gravelly clay loam surface layer about 6 inches thick. Fragments of chalk 1 to 3 inches across, mostly brought up by plowing, range from a few in the surface layer to about 50 percent by volume in the lower part of the soil. The underlying layer is hard, white chalk.

This soil is well drained. Permeability is moderately slow. The rooting zone is very shallow. Runoff is rapid. Because of the very shallow to shallow depth, the high content of calcium carbonate, and gravel content, the available water capacity is very low. Erosion is a moderate hazard. In a few places, gullies extend down into the chalk.

Included in mapping are small areas of Castephen and Whitewright soils. These soils make up less than 15 percent of the map unit.

This soil is suited only to use as rangeland. Most of the acreage is used as rangeland. The potential plant community is prairie grass and scattered motts of live oak. Forage yields are low.

This soil in wooded areas has an esthetic appeal for use as homesites. However, foundations and septic systems are limited by the shallowness to the chalk bedrock. Live oak and elm are the best native trees for shade. Landscaping or gardening is difficult because of the high lime content and the shallow to very shallow depth to rock. Fruit trees grow poorly in this soil.

Gravel, slope, and the very low available water capacity for plants are limitations for recreation uses. The gravel on the surface provides an all-weather surface for parking camping vehicles.

This soil has poor potential for use as habitat for openland and rangeland wildlife. The wildlife in this area, mostly rabbits and birds, finds adequate food and cover from vegetation on this soil and adjoining soils.

This Eddy soil is in capability subclass VIe and in the Chalky Ridge range site.

FaA—Fairlie clay, 0 to 1 percent slopes. This nearly level soil is on broad plateaus, slightly depressed areas near the head of drains, and in shallow valleys on uplands. Some areas are long and narrow, but most are irregular in shape. Areas range from 50 to about 200 acres.

Typically, this soil has a dark gray clay upper layer about 36 inches thick. The layer below that, which extends to about 46 inches, is gray clay. The underlying material to a depth of 55 inches is weakly cemented limestone interbedded with limy material. The soil is calcareous and moderately alkaline.

This soil is moderately well drained. When dry, it has wide cracks, and water enters it rapidly. However, when the soil is wet and the cracks are sealed, water enters it very slowly. Surface runoff is slow when the soil is dry and cracked. The available water capacity is high. Erosion is a slight hazard.

Included in mapping is a soil similar to this Fairlie soil except that it has limestone at a depth of less than 40 inches. This soil makes up as much as 15 percent of some mapped areas. Also included are a few small areas of Crawford, Doss, and Denton soils. The included soils make up less than 20 percent of the map unit.

This soil is used mainly for crops. The main crops are grain sorghum, hay, and small grains. Yields are high in years of favorable weather. During dry periods, the cracking of the soil breaks some plant roots and limits the production of warm season crops. Management includes maintaining tilth and fertility.

Some areas of this soil are used for improved tame pasture. High forage yields are possible under good management and with favorable weather.

The few areas of this soil that are used as rangeland are mostly in long narrow valleys surrounded by nonarable soils or abandoned fields. Production of native grass forage is high with favorable weather and under good management.

This soil has severe limitations for urban uses. Because of the high shrink-swell potential, building foundations and streets crack unless they are properly constructed. Corrosivity of underground utility pipes is severe. Septic systems work poorly or may fail during rainy periods. Landscaping and gardening with handtools are difficult because of the clayey texture. Elm and hackberry are the best native trees for shade. Fruit trees do not grow well.

Recreation areas can be developed on this soil. However, when wet, the clayey surface is sticky and muddy and foot and vehicle traffic are difficult. Cracking of the soil during dry periods limits some playground activities.

This soil has good potential for use as habitat for openland wildlife and fair for rangeland wildlife. Deer and turkey intermittently feed on crops or volunteer plants on this soil. However, they seek cover in nearby wooded areas.

This Fairlie soil is in capability subclass IIw and in the Blackland range site.

FaB—Fairlie clay, 1 to 2 percent slopes. This gently sloping soil is along broad flats and on the edges of drainageways on uplands. Most areas are long and narrow and range from 15 to 100 acres or more.

Typically, this soil has a dark gray clay upper layer about 21 inches thick. The layer below that, to 46 inches, is clay that is gray in the upper part and dark grayish brown in the lower part. The underlying material is weakly cemented limestone interbedded with limy material. This soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. When dry, this soil cracks extensively, and water enters it rapidly. When this soil is wet and the cracks are closed, water enters the soil very slowly. Runoff is medium. The available water capacity is high. Erosion is a slight hazard.

Included in mapping are small areas of Crawford, Doss, and Denton soils. Also included is a soil similar to Fairlie soil except that it is less than 40 inches deep to limestone. This soil makes up as much as 30 percent of the map unit. The included soils make up less than 35 percent of the map unit.

This soil is used mainly for crops. A few acres are used for tame pasture in which forage yields are generally high.

With good management, this soil can produce high yields of grain sorghum or small grains. Erosion is a slight hazard that can be controlled by terraces, waterways, and crop residue management. Cracking of the soil during dry periods breaks some plant roots and limits production of some warm season crops. Control of erosion and improvement of tilth are the main concerns in management.

This soil is suitable for urban uses. Excavations for foundation sites, utility lines, and other urban structures are easily prepared. However, the clayey texture and the very slow permeability affect the absorption fields of septic systems. Because of the high shrink-swell potential, foundations and paved streets crack. The hazard of corrosivity is severe to underground steel utility pipes. Landscaping and gardening are difficult with handtools because of the clayey texture. Fruit trees do not grow well. Elm and hackberry are well adapted native trees for shade.

Recreation areas can be developed easily on this soil. When wet, this soil is muddy and sticky and foot and vehicle traffic are difficult. Cracking of the soil during dry periods limits some playground activities.

This soil has a good potential for use as habitat for openland wildlife and fair for rangeland wildlife. Deer and turkey feed on the vegetation on this soil, but they find cover in nearby wooded areas. This soil can produce the food and cover needed, but most areas are small and used for crops.

This Fairlie soil is in capability subclass IIe and in the Blackland range site.

FhE—Ferris-Heiden complex, 5 to 20 percent slopes, severely eroded. This complex consists of sloping to moderately steep Ferris and Heiden soils on sharp slopes between the higher, smooth uplands and the lower, less sloping valleys. The Ferris soils generally are on the upper slopes and in the steep areas, and the Heiden soils are on the lower slopes. These soils are so intricately mixed that mapping them separately was not practical. Areas are long and narrow and parallel the valleys. They range from 10 to 300 acres.

This complex has had extensive gully and sheet erosion. Most gullies are approximately 10 feet wide and 150 to 300 feet apart and have cut into the lower soil layers. Areas of this soil between gullies are moderately steep. The surface layer is of normal thickness at about the midpoint between gullies and thins out progressively toward the gullies.

This complex consists of about 55 percent Ferris clay, 30 percent Heiden clay, 5 percent other soils, and 10 percent gullied areas.

Typically, the Ferris soil has a surface layer of grayish brown clay about 8 inches thick. The next layer, to 34 inches, is mottled grayish brown and olive yellow clay. The underlying layer to 60 inches is light brownish gray shaly clay. This soil is calcareous and moderately alkaline throughout.

Typically, the Heiden soil has an upper layer of dark grayish brown clay about 22 inches thick. The layer below that, to 44 inches, is grayish brown clay that has olive mottles. The underlying layer to 60 inches is pale olive shaly clay.

Included in mapping are a few areas of Ferris and Heiden soils that are not eroded and other areas where the gullies have been smoothed. Also included are areas

of Altoga soils near the crests of slopes. The included soils make up less than 15 percent of the map unit.

The soils making up this map unit are well drained. Permeability is very slow. When dry, these soils crack extensively, and water enters the soils rapidly. When the soils are wet, the cracks close, and water enters the soil very slowly. Runoff is rapid. In most years, the soils are wet throughout at least once a year. The available water capacity is high. Erosion is a severe hazard.

The soils are used mainly as rangeland. They are too gullied and low in fertility for economical reclamation for crop use. At best, they could be used only for continuous close-spaced crops. Machinery can be used between gullies to plant tame pasture grasses. Gullies can be reshaped, sodded, seeded, and developed into suitable pasture. The low fertility and slope are the main limitations.

Some areas of these soils are suitable homesites. However, the high shrink-swell potential affects foundations and streets, corrosivity is rapid to underground steel pipelines, and the very slow permeability affects septic systems. Landscaping and gardening with handtools are difficult because of the clayey texture. Many ornamentals as well as fruit trees do not grow well. Cracking of the soil during dry periods breaks some plant roots and limits production of some warm season crops. Native elm and hackberry are well adapted trees for shade.

These soils are limited for use as recreation areas by slope, gullies, and the clayey texture. When wet, the surface is sticky and muddy and foot and vehicle traffic are difficult.

These soils support a fair habitat for openland and rangeland wildlife. Wildlife consists mostly of wild birds and rabbits.

This complex is in capability subclass VIe and in the Eroded Blackland range site.

GeB—Georgetown clay loam, 0 to 2 percent slopes. This nearly level to gently sloping soil is on uplands. Most areas are irregular in shape and range from 10 to 50 acres.

Typically, the surface layer is slightly acid, brown clay loam about 7 inches thick. The subsoil extends to about 35 inches; it is neutral to slightly acid, reddish brown clay in the upper part and cobbly clay in the lower part. The underlying material is indurated limestone that has limy earth imbedded in the crevices.

This soil is well drained. Permeability is slow. Surface runoff is medium. The available water capacity is low. Plant growth may be restricted because of the moderate depth of the soil, but cool-season crops make good yields in most years. Erosion is a slight hazard.

Included in mapping are small areas of soils similar to this Georgetown soil except that they are less than 20 inches deep to limestone or are more than 35 percent gravel and cobbles throughout. The included soils make up less than 15 percent of the map unit.

This soil is used as rangeland. It is capable of producing medium yields of vigorous grasses.

This soil is suitable for urban uses. However, the areas are mostly in savannahs and have few trees, other flora, or landscape features usually desirable for homesites. Septic systems are difficult to install because of shallowness to fractured limestone. The risk of corrosion is high for unprotected steel pipe. Soil reaction is favorable, and landscaping and gardening with supplemental watering can be successful. Fruit trees require consistent watering during the growing season.

This soil is easily adapted to recreation uses. However, establishing a grass cover is difficult because of the very low available water capacity. Without a grass cover, the surface is sticky when wet and dusty when dry.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Vegetation on this soil sometimes provides food for turkey and deer in the area. Some fields are planted to small grains for deer to graze. Cover is available in nearby wooded areas.

This Georgetown soil is in capability subclass IIIe and in the Redland range site.

GsB—Georgetown stony clay loam, 1 to 3 percent slopes. This gently sloping soil is mostly on the higher parts of uplands. Areas are irregular in shape and range from 40 to 500 acres.

Typically, this soil has a slightly acid, brown stony clay loam surface layer about 7 inches thick and few to common stones on or near the surface. The subsoil, which extends down to a depth of about 35 inches, is neutral, reddish brown clay in the upper part and slightly acid, reddish brown cobbly clay in the lower part. The underlying material is indurated fractured limestone that has clay loam in crevices and fractures.

This soil is well drained. Permeability is slow, and surface runoff is medium. The available water capacity is low. Reaction is neutral to slightly acid. The erosion hazard ranges to slight.

Included in mapping are small areas of soils similar to this Georgetown soil except that they do not have cobbles and stones in the surface layer or stones on the surface or are less than 20 inches deep to hard limestone. Also included are a few areas of Fairlie soils in slightly depressed areas and a few areas of Eckrant soils on knolls or ridges. The included soils make up less than 15 percent of the map unit.

This soil is used as rangeland. It is capable of producing moderate yields of palatable grasses.

Most areas of this soil are desirable for use as homesites because they are in a high position on the landscape and are generally dotted with native elm and post oak. However, the clayey subsoil is corrosive to buried pipelines. Because of the limited soil depth,

Figure 15.—The indurated limestone bedrock, in an area of Georgetown stony clay loam, 1 to 3 percent slopes, is difficult to excavate. The sand base protects the pipe against damage by rock fragments.

construction and installation of foundations and underground utilities in the rock substratum are difficult and costly (fig.15). However, the limestone provides a stable base for foundations and streets. Septic systems do not function well in the clay subsoil, and if placed in the fractured bedrock, they can contaminate local water supplies. Stones on the surface can be removed to improve the areas for gardening and landscaping. Vegetables, landscape plants, and some fruit trees do well with irrigation. Elm and post oak are well adapted native trees for shade.

This soil is well suited to recreation areas. Stones on the surface and slow permeability are the main limitations. The stones can be removed manually. When the soil is wet, an unprotected surface is sticky and muddy and vehicle traffic is difficult. However, the surface dries more quickly than the adjoining, more clayey soils.

This soil has poor potential as habitat for openland wildlife and fair potential for rangeland wildlife. Deer and turkey generally inhabit the areas.

The Georgetown soil is in capability subclass VIs and in the Redland range site.

HeB—Heiden clay, 1 to 3 percent slopes. This gently sloping soil is in valleys and on ridges on uplands. Areas are long and narrow and range mostly from 30 to 60 acres.

Typically, this soil has a dark grayish brown clay upper layer about 30 inches thick. The layer below that, which extends to a depth of about 50 inches, is grayish brown clay streaked with dark grayish brown. The underlying layer to 60 inches is light yellowish brown clay that has a

few soft masses of calcium carbonate. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Permeability is very slow. When the soil is dry and cracked, water enters it rapidly; but when the soil is wet, water enters it very slowly. The available water capacity is high. Roots easily penetrate this soil. During the dry periods, the cracking soil breaks plant roots and limits production of some crops. Management includes maintenance of tilth. Erosion is a moderate hazard.

Included in mapping on many foot slopes are soils that have a brownish surface layer and grayish lower layers but otherwise are similar to this Heiden soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas of this soil are used for pasture or as rangeland.

Grain sorghum and small grains are the main crops. Erosion control includes terraces, waterways, and crop residue management.

If this soil is used for tame grass pasture and hay, it produces high yields of grasses. Grazing control and maintenance of fertility are the main concerns in management.

Most areas of this soil in rangeland are on narrow ridges surrounded by strongly sloping to moderately steep, eroded Ferris and Heiden soils. Forage yields are medium.

The areas of this soil are basically a treeless plain with little natural beauty for use as homesites. Limitations are the high shrink-swell potential that affects foundations and streets, the very slow permeability that affects septic systems, and a high risk of corrosion that affects unprotected underground steel pipes. Most of these limitations can be overcome with proper design and installation. Landscaping and gardening are difficult with handtools. Soil reaction is too alkaline for optimum growth. Fruit trees do not grow well. Native elm and hackberry are well adapted trees for shade.

This soil is suitable for recreation uses (fig. 16), but the clayey texture causes severe problems. When the soil is wet and unprotected, foot and vehicle traffic are difficult. The very slow permeability is also a limitation. Cracks in the soil during dry periods limit some playground activities.

This soil has good potential as habitat for openland wildlife and fair for rangeland wildlife. Game birds, songbirds, and rabbits frequent weedy pastures in this area.

This Heiden soil is in capability subclass IIe and in the Blackland range site.

HeC2—Heiden clay, 3 to 5 percent slopes, eroded. This is a gently undulating soil on uplands. Areas are generally long and narrow and range from 30 to 60 acres.

Water erosion, mostly from rains of high intensity, has created gullies from 1 to 4 feet deep and 800 to 1,000 feet apart. Also, the surface layer has been thinned by soil removal; the thinnest areas are near the gullies. Generally, one-fourth to one-half of the original surface layer has been removed. Most gullies are crossable with farm equipment.

Typically, the upper layer is dark grayish brown clay about 16 inches thick. The next layer, which extends down to about 42 inches, is olive clay. The underlying layer to 60 inches is mottled, pale olive clay. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Permeability is very slow. Runoff is rapid. When this soil is dry, deep cracks form; when wet, the soil swells and the cracks close. The available water capacity is high. Fertility is low in many places. Erosion is a severe hazard.

Included in mapping are small areas of sloping to strongly sloping areas of Heiden clay. Also included is a soil similar to this Heiden soil except that it has a grayish surface layer about 14 to 16 inches thick. Some areas of Wilson soils are also included. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas of this soil are in pasture.

This soil produces medium yields of cotton and grain sorghum. Control of erosion, maintaining fertility, and improving tilth are the major concerns in management. Cracking of the soil during dry periods breaks plant roots and limits production of some crops. Erosion control includes terraces, waterways, and crop residue management.

Large acreages are used for pasture that produces high yields of improved grasses for grazing or hay. Maintenance of fertility and grazing control are concerns in management.

This soil is suited to urban uses but has several limitations. Because of the shrink-swell potential, foundations and streets crack, shift, and buckle. Because of the very slow permeability and extended rainy periods, septic systems can fail. The risk of corrosion is high for underground steel pipelines unless they are well protected. Landscaping and gardening are difficult with handtools. Fruit trees do not do well. Native elm and hackberry are suitable trees for shade.

Most of this soil is suitable for recreation areas. The slope in some places is a limitation. When wet, the soil is sticky and muddy and foot and vehicle traffic are difficult.

This soil has fair potential as habitat for openland and rangeland wildlife. Wild birds and small animals in the area frequent the grassy and brushy areas of this soil.

This Heiden soil is in capability subclass IIIe and in the Blackland range site.

HeD2—Heiden clay, 5 to 8 percent slopes, eroded. This undulating soil is mainly in long and narrow areas on uplands. A few areas are broad and irregular in shape. Areas range from about 20 to 100 acres.

Figure 16.—A farm pond in an area of Heiden clay, 1 to 3 percent slopes.

Water erosion from rains of high intensity has created gullies from 2 to 6 feet deep and 400 to 800 feet apart. The surface layer has been thinned by soil removal; the thinnest areas are near the gullies. Generally, one-fourth to one-half of the original surface layer has been removed. Most gullies are crossable with regular farm equipment. The areas of this soil that are used for crops have a striped appearance because of the alternating darker intergully areas and the lighter areas where the lower soil layers have been exposed by gully erosion.)

Typically, this soil has a dark grayish brown clay upper layer about 22 inches thick. The next layer, to about 44 inches, is grayish brown clay. The underlying layer to 60 inches is pale olive shaly clay. This soil is calcareous and moderately alkaline throughout.

This soil is well drained. When the soil is dry, deep cracks form; when the soil is wet, it swells and the cracks close. Permeability is very slow. Runoff is rapid. The available water capacity is high. Fertility is low in many places. Erosion is a severe hazard.

Included in mapping are small areas of Ferris soils and a few areas of a soil similar to Heiden soils except that it has a grayish surface layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture. A few areas are used for crops.

This soil produces medium to high yields of improved pasture grasses for grazing or hay. Grazing control, maintenance of fertility, and weed control are concerns in managing pasture.

This soil is poorly suited to crops. Water erosion is difficult to control. Even if this soil is terraced, close-

spaced high residue crops are needed to prevent further erosion.

This soil is capable of producing medium yields of range forage.

This soil is suitable for urban uses. However, the shrink-swell potential is high, and the risk of corrosion of underground steel utility pipes is severe. Septic systems are subject to malfunction. Also, landscaping and gardening are difficult with handtools. Fruit tree production is only fair. Elm and hackberry are suitable trees for shade.

Slope and clayey texture are limitations for use of the soil as recreation areas. When the soil is wet and not protected, the surface is muddy and slippery and foot and vehicle traffic are difficult.

This soil has fair potential as habitat for openland and rangeland wildlife. Quail, doves, songbirds, and small animals frequent the grassy areas of this soil.

This Heiden soil is in capability subclass IVe and in the Blackland range site.

HsE—Heiden extremely stony clay, 3 to 12 percent slopes. This is a gently sloping to strongly sloping soil on uplands. It is in long and narrow areas between the limestone soils in the western part of the county and the chalk and marl soils in the eastern part. Most of the acreage is in one continuous area of 600 acres.

Typically, this soil has a surface layer of very dark grayish brown extremely stony clay about 18 inches thick. About 20 percent of the surface is covered with fragments of gray limestone. Below the surface layer, to a depth of 40 inches, there is light olive brown clay that has streaks of the overlying darker material in old cracks. The underlying layer to 60 inches is a mixture of olive yellow and gray clay or shaly clay containing common, soft lumps of calcium carbonate. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Permeability is very slow. When dry, the soil is deeply and widely cracked, and water enters it rapidly. When the soil is wet, water enters it very slowly and most of the water runs off rapidly. The available water capacity is high. Roots penetrate the soil but are somewhat restricted by the clayey texture. The fragments of limestone cover about 10 to 20 percent of the surface. Most of the fragments are on the upper slopes.

Included in mapping are small areas of Heiden clay and Houston Black clay. Also included are narrow areas of nearly level Heiden clay. The included soils make up less than 15 percent of the map unit.

This soil is used mainly as rangeland. Because of the high available moisture capacity, this soil is capable of producing high yields of native grasses. Because of stones and slope, this soil is not suited to crops and is poorly suited to pasture.

Some areas provide scenic views and are desirable as homesites. Limitations for urban uses are slope, the high shrink-swell potential, the very slow permeability, and the high risk of corrosion. These affect building foundations, streets, septic systems, and underground utility pipes. Landscaping and gardening with handtools are difficult because of the clayey soil. The large fragments of limestone on the surface are also a limitation. During dry periods, cracking of the soil breaks plant roots and restricts growth of some plants. Fruit trees do not grow well. Native elm and hackberry are suitable trees for shade.

This soil is too sloping and stony for recreation uses such as playgrounds. Its suitability for other types of recreation is limited. When the soil is wet, the surface is sticky and muddy and foot and vehicle traffic are difficult.

This soil has poor potential for use as habitat for openland wildlife and fair potential for rangeland wildlife. Most areas of this soil are in grass and weeds. The wildlife that inhabits those areas is mainly doves, quail, songbirds, and small animals.

This Heiden soil is in capability subclass VIe and in the Blackland range site.

HuA—Houston Black clay, 0 to 1 percent slopes. This nearly level soil is on high ridges and in valleys on uplands. Areas are mostly irregular in shape and range mostly from 20 to 40 acres.

Typically, this soil has a dark gray clay upper layer about 26 inches thick. The layer below that extends to a depth of about 52 inches; it is dark grayish brown clay that has mottles of light yellowish brown. The underlying layer to 62 inches is mottled reddish yellow and strong brown shaly clay. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. Permeability is very slow. When the soil is dry and cracked, water enters it rapidly. When the soil is wet, water enters it very slowly. Runoff is very slow because of the nearly level slope. Erosion is a slight hazard. The available water capacity is high.

Included in mapping are small areas of Branyon soils that make up less than 20 percent of the map unit.

This soil is used mostly for cotton, grain sorghum, and wheat. Some areas are used for corn. A few areas are in pasture.

This soil produces high yields of crops in most years. Maintenance of tilth and fertility are necessary.

This soil produces high yields of range forage.

This soil is suitable for urban uses. However, the clayey texture imposes several limitations. Because of the high shrink-swell potential, building foundations and streets buckle and crack if they are not properly designed. The risk of corrosivity of underground steel pipe is high. Septic systems frequently fail during rainy periods. Landscaping and gardening are difficult with handtools, but growth of plants is good if the surface layer is mulched with organic material. The mulch helps maintain a satisfactory moisture level and helps prevent

cracking of the soil. The native elm and hackberry are the most reliable trees for shade.

This soil is easily adapted to use as recreation areas. However, when this soil is wet, the surface is muddy and slippery and foot and vehicle traffic are difficult. Cracking of the soil during dry periods limits some playground activities.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Wildlife uses areas of this soil intermittently. Wild birds feed on insects and worms during spring planting and on wasted sorghum seeds during the fall harvest. Other food and some cover are available along the fence rows.

This Houston Black soil is in capability subclass IIw and in the Blackland range site.

HuB—Houston Black clay, 1 to 3 percent slopes. This gently sloping soil is on smooth uplands. The areas are irregular in shape and range from 50 to 250 acres.

Typically, the upper layer is dark gray clay about 32 inches thick. The layer below that is dark grayish brown clay to about 54 inches. The underlying layer to about 62 inches is mottled, grayish brown clay. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. Permeability is very slow. When the soil is dry and cracked, water enters it rapidly. When the soil is wet and the cracks are closed, infiltration is very slow. Runoff is medium. The available water capacity is high. Erosion is a moderate hazard.

Included in mapping are small areas of soils that have brownish colors or are noncalcareous in the upper layer but are otherwise similar to the Houston Black soil. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops; however, many acres are in pasture.

This soil, in most years, produces high yields of cotton and grain sorghum. Erosion control includes terracing, grassed waterways, and good crop residue management. Maintenance of tilth and the fertility level are concerns in management.

Many areas of this soil are used for improved grass pasture or hay. Yields are high. Management includes controlled grazing, weed control, and maintenance of a high level of fertility.

The use of this soil as rangeland has potential for high forage yields. However, this soil is not used as rangeland.

This soil has several limitations to urban uses because of the clayey texture. Because of the high shrink-swell potential, building foundations and streets crack and buckle if they are not properly designed and constructed (fig. 17). The risk of corrosion of steel underground pipe is high. Septic systems function poorly during rainy seasons. Landscaping and gardening are difficult unless organic mulches are applied. The mulch helps maintain a sufficient moisture level to prevent cracking of the soil. Growth and production of fruit trees is fair. The most reliable trees for shade are native elm and hackberry.

This soil is suited to use as recreation areas. However, when the soil is wet and not protected, the surface is muddy and sticky, and foot and vehicle traffic are difficult. In some places, slope is a limitation. Cracking of the soil in dry periods may limit playground activities.

This soil has fair potential for use as habitat for openland and rangeland wildlife. Birds and small animals find food and cover in pastures and weedy areas along fence rows. Birds frequent this habitat mainly during the spring planting season and during the fall grain harvest season.

This Houston Black soil is in capability subclass IIe and in the Blackland range site.

HuC2—Houston Black clay, 3 to 5 percent slopes, eroded. This gently sloping soil is on smooth uplands. Areas are long and narrow to irregular in shape and range from about 20 to 50 acres.

Gullies in areas of this soil are 1 to 4 feet deep and 800 to 1,000 feet apart. Sheet erosion has removed a few inches of the surface layer, which is thinnest in areas near gullies. Most gullies are crossable with farm equipment. In some places, soils on the lower slopes have several inches of sediment from soils in higher positions.

Typically, this soil has a dark gray clay upper layer about 22 inches thick. The layer below that extends to a depth of about 38 inches. It is gray clay that has medium and coarse olive yellow mottles. The underlying layer to 60 inches is mottled, yellow and light brownish gray silty clay. The soil is calcareous and moderately alkaline throughout.

This soil is moderately well drained. The available water capacity is high. Permeability is very slow. When this soil is dry and deeply cracked, water enters it rapidly; however, water enters very slowly when the soil is wet. Runoff is rapid. Erosion is a severe hazard. Gullies form rapidly if this soil is not protected. In areas where this soil was formerly used for crops, gullies form that in some places cut into the lower underlying layer. If this soil is continuously used for crops, the gullies are partly obliterated with each plowing. The land appears to sink around each gully, and a series of swales forms perpendicular to the slope. In such areas, the surface becomes alternating bands of grays and browns.

Included in mapping are small areas of uneroded Houston Black soils and a soil that is similar to this Houston Black soil except that it has a brownish upper layer. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. However, many acres are used for pasture.

Grain sorghum and cotton are the main crops. Yields are generally high. Erosion is a moderate hazard. It can

Figure 17.—The shrinking and swelling of the soil caused the cracking of this asphalt road on Houston Black clay, 1 to 3 percent slopes.

be controlled by terraces, grassed waterways, and crop residue management.

Many acres are in improved grass pasture or hay. High forage yields can be obtained by controlling grazing and maintaining high fertility.

This soil, if used as rangeland, has potential for high forage yields of range plants.

This soil has limitations for urban uses. Because of the high shrink-swell potential, buildings and streets crack and buckle. The risk of corrosion to underground steel pipelines is high. Septic systems often fail during rainy periods. Landscaping and gardening with handtools are difficult because of the clayey texture. However, if soil amendments and organic material are added, plant growth is generally satisfactory. Cracking of the soil during dry periods is minimized by mulch. Growth and production of fruit trees are fair. The most reliable trees for shade include native hackberry and elm.

This soil is suitable for most recreation uses. However, when the soil is wet, the surface is sticky and muddy, and foot and vehicle traffic are difficult. Slope is also a limitation for some uses. Cracking of the soil during dry periods limits some playground activities.

This soil provides fair habitat for wildlife. Some wild birds and small game stay in grassy and weedy areas. Also, birds forage the cultivated fields during spring planting and again during fall grain harvest.

This Houston Black soil is in capability subclass IIIe and in the Blackland range site.

KsA—Krum silty clay, 0 to 1 percent slopes. This nearly level soil is on high terraces. Areas are generally long and narrow and lie parallel to streams; however, some are wide and irregular in shape. Areas range mostly from 40 to 100 acres.

Typically, this soil has a surface layer of dark grayish brown silty clay about 6 inches thick. The subsurface

layer, to 26 inches, is very dark grayish brown silty clay. The subsoil, to about 44 inches, is brown silty clay. The underlying layer to 72 inches is reddish yellow silty clay that has a few concretions and soft masses of calcium carbonate. This soil is calcareous and moderately alkaline.

This soil is well drained. Runoff is slow, and permeability is moderately slow. The available water capacity is high. Plant roots easily penetrate the soil. Erosion is a slight hazard.

Included in mapping are small areas of soils that are in small, shallow depressions and have a grayish surface layer but are otherwise similar to the Krum soil. Also included are small areas of Branyon soils that are in narrow, shallow depressions. The included soils make up less than 10 percent of the map unit.

This soil is used mainly for row crops. A few areas are used for pasture.

Cotton and grain sorghum yields are high. Maintaining tilth is the main concern in management.

A few areas of this soil are in tame grass pasture. High yields of forage are produced. Controlled grazing and weed control are the main concerns in management.

This soil is not used as rangeland. However, it has the potential for high forage yields from range plants.

This soil is easily adapted to urban uses. However, because of the high shrink-swell potential, foundations or streets can break or shift. Corrosivity of underground steel pipe is high. Because of the moderately slow permeability, septic systems may not function properly during wet periods. Landscaping and gardening with handtools are somewhat difficult, and chlorosis is a slight problem. Fruit trees grow and produce well. Pecan, native elm, and hackberry are reliable trees for shade.

This soil is suitable for use as recreation areas. However, because of the clayey texture, the surface is sticky and muddy when wet, and foot and vehicle traffic are difficult.

This soil has good potential for use as habitat for openland wildlife and fair for rangeland wildlife. Game birds visit these areas after the grain harvest season to seek food and cover in the sorghum stubble.

This Krum soil is in capability class I and in the Clay Loam range site.

KsB—Krum silty clay, 1 to 3 percent slopes. This gently sloping soil is on ancient high stream terraces. In most places, it is on long, gentle slopes below areas of nearly level Krum soils. Areas are mostly long and narrow and range from 25 to about 75 acres.

Typically, this soil has a surface layer of dark grayish brown silty clay about 22 inches thick. The upper part of the subsoil extends to a depth of about 48 inches; it is dark brown silty clay. The lower part extends to a depth of 60 inches; it is mottled, reddish yellow and dark brown silty clay and has many fine and medium hard concretions and some soft masses of calcium carbonate. The soil is calcareous and moderately alkaline throughout.

Permeability is moderately slow. There is some runoff during heavy rainstorms. However, erosion damage is slight. The available water capacity is high. Roots easily penetrate this well drained soil.

Included in mapping are small areas of Sunev soils, which are similar to the Krum soil except that they have a thinner surface layer and moderate shrink-swell potential. Small areas of Branyon soils are included in some places. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for crops. A few areas are in pasture.

This soil generally produces high yields of grain sorghum and cotton. Erosion control and maintenance of tilth are primary concerns in management. Erosion control includes terraces, waterways, and crop residue management.

Areas of this soil in pasture generally produce high yields of forage. Maintaining fertility is the main concern in management.

This soil produces high yields of range forage.

This soil is suited to urban uses. Limitations include the high shrink-swell potential and the rapid corrosion of underground steel pipes. The moderately slow permeability affects septic systems. Because of the clayey texture, landscaping and gardening with handtools are difficult when the soil is too dry or too wet. The high content of carbonates can cause chlorosis in some plants. Fruit trees and pecan trees generally grow and produce well. The most reliable trees for shade are native elm and hackberry.

This soil is suited to recreation uses. However, when this soil is wet, the surface is sticky and muddy, and foot and vehicle traffic are difficult. In some places, slope is a limitation for some uses.

This soil has good potential for use as habitat for openland wildlife and fair for rangeland wildlife. Birds congregate in this habitat during the grain harvest season. At other times, there are very few birds and small animals in these areas.

This Krum soil is in capability subclass IIe and in the Clay Loam range site.

Oa—Oakalla silty clay loam, occasionally flooded. This nearly level soil is on smooth, bottom lands. Areas are long and narrow and lie parallel to streams. This soil is flooded at intervals of about 2 to 8 years. Areas range from 50 to 200 acres.

Typically, the uppermost layer is silty clay loam about 32 inches thick. It is dark grayish brown in the upper part and dark brown in the lower part. The subsoil, to 60 inches, is light yellowish brown silty clay loam. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. The available water capacity is high. Runoff is slow, and permeability is moderate. Roots generally penetrate this soil easily.

Included in mapping are small areas of Oakalla soils that are frequently flooded in most years and Tinn soils in narrow areas along streams or in depressions. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for row crops. A few areas are used for pasture or as rangeland. Generally, yields of grain sorghum, cotton, and small grains are high. Management includes maintaining tilth and the fertility level.

This soil produces high forage yields if it is used for tame pasture or hay or as rangeland.

This soil is not suited to urban uses because of the risk of flooding.

This soil can be used for some kinds of recreation areas. Flooding is a limitation. The surface is sticky when wet, impeding foot and vehicle traffic.

This Oakalla soil is in capability class I and in the Loamy Bottomland range site.

Oc—Oakalla soils, channeled. These soils are on bottom lands in narrow stream valleys. The bottom lands are dissected by numerous channels that are 2 to 6 feet deep, 10 to 30 feet wide, and 50 to 500 feet apart. The side slopes of the channels range from about 8 percent in gradient to nearly vertical. Slope is 0 to 1 percent. Areas of this soil are long and narrow and range up to several acres. These soils are not in a regular pattern.

Typically, the surface layer is dark brown loam about 7 inches thick. The layer below that is dark brown clay loam about 16 inches thick. The underlying layer to 66 inches is dark brown sandy clay loam. The soil is calcareous and moderately alkaline.

These soils are flooded for very brief to brief periods in most years.

In most places, a network of small channels feeds into the main stream channel. These channels are the result of the scouring action of floodwater that overflows from the main channel. Soil and gravel have been deposited in many spots, and soil removal is apparently balanced somewhat by soil deposition. The available water capacity is high.

Included in mapping are soils that are 10 to 25 percent fragments of limestone, have strata of sand and clay, are lighter colored, or are 20 to 40 inches thick over limestone; otherwise they are similar to these Oakalla soils. The included soils make up less than 15 percent of the map unit.

Oakalla soils are used as rangeland. The channeled topography is too rough for farm equipment. Range forage yields are high under good management.

These soils are flooded too frequently for urban uses.

The use of the soils for recreation areas, such as hiking and riding trails, is feasible, but after flooding, brush deposits and water scours across the trails create maintenance problems.

These soils have poor potential for use as habitat for openland wildlife and fair for rangeland wildlife. In their natural state, they provide food and cover for deer, turkey, and other game.

These Oakalla soils are in capability subclass Vw and in the Loamy Bottomland range site.

Of—Oakalla soils, frequently flooded. These nearly level soils are on long, narrow bottom lands that are flooded several times annually after heavy rains. In the few areas where these soils are cultivated, flooding causes soil erosion and damage to crops. Areas vary from about 50 to 150 acres. These soils are not in a regular pattern.

Typically, the upper layer to 34 inches is silty clay loam that is dark grayish brown in the upper part and dark brown in the lower part. The material in the lower part is sandier than that in the upper part. The subsoil, to 60 inches, is grayish brown silty clay loam alternating with silty clay; it has few to many seams of very pale brown sandier material. The soil is calcareous and moderately alkaline throughout.

These soils are well drained. Permeability is moderate. Floodwater produces scour marks and a constantly changing network of channels. In general, soil removal is balanced by soil deposition. The available water capacity is high.

Included in mapping are small areas of Oakalla soils that are only occasionally flooded and some areas of Tinn soils on the bottom lands of some sloughs. The included soils make up less than 15 percent of the map unit.

Most areas of these soils are used for pasture. The soils are well suited to this use. The soils are well suited to pecan production in association with grazing. Grazing management and weed control are concerns in management.

In rangeland areas, these soils produce high yields of forage.

These soils are not suitable for urban uses because of flooding. Local roads and bridges are sometimes damaged by brush and trees being swept downstream.

Suitability of these soils for recreation uses such as playgrounds, trails, and campsites is poor because of the frequent flooding.

These soils have poor potential for use as habitat for openland wildlife. The soils provide a fair amount of food and cover for rangeland wildlife.

These Oakalla soils are in capability subclass Vw and in the Loamy Bottomland range site.

PaD—Padina fine sand, 1 to 8 percent slopes. This undulating soil is mostly on ridges and side slopes on uplands. Areas are irregular in shape and range from 30 to 60 acres.

Typically, the upper layer is very pale brown, slightly acid loamy fine sand about 22 inches thick. The subsurface layer, to 65 inches, is medium acid, very pale brown fine sand. The subsoil extends to a depth of about 78 inches; it is medium acid, mottled, reddish yellow, light reddish brown, and white sandy clay loam.

This soil is well drained. Permeability is rapid in the sandy surface layer and moderately slow in the subsoil. Runoff is slow or minimal except during wet periods. Wind and water erosion are slight hazards. The rooting zone is deep, and the soil is easily penetrated by roots; however, plant growth is limited by the low available water capacity.

Included in mapping are small, narrow areas of Demona soils, which are mainly in the valleys, and small, narrow areas of Rosanky soils on ridges. The included soils make up less than 15 percent of the map unit.

This soil is used mostly for pasture. Many areas have been planted to improved pasture grasses, but yields are generally low unless large amounts of fertilizer are used.

Many areas of this soil are used as rangeland. Forage yields are high under proper management and with favorable weather. This soil mainly supports tall grasses.

A few areas are used for crops. The main crop is peanuts (fig. 18).

This soil is well suited to homesites, particularly in areas of post oak and blackjack oak. Irrigation and fertilizer are necessary to maintain lawns and shrubbery. The risk of corrosion to underground steel pipe is a moderate problem. Fruit trees generally do not grow well, but gardening is successful if irrigation and fertilizer are used.

This soil is generally too droughty to support the kind of grass cover needed for recreation areas. Irrigation is necessary for growth of grass. Foot traffic on unprotected soil is somewhat difficult because of the sandy surface, which is dry and loose most of the year. Ordinary vehicle movement is difficult on the dry surface, and it is only slightly better when the surface is wet.

This soil has fair potential for use as habitat for openland and rangeland wildlife, but there is little food

Figure 18.—Peanuts in an area of Padina fine sand, 1 to 8 percent slopes.

available for small wild animals and birds that frequent the area. Wooded areas provide cover and protection in winter.

This Padina soil is in capability subclass IVe and in the Deep Sand range site.

QuC—Queeny clay loam, 1 to 5 percent slopes. This gently sloping soil is along the edge of ancient stream terraces. The areas are generally long and narrow; however, some areas are irregular in shape. Areas are mostly 10 to 40 acres.

Typically, the surface layer is calcareous, moderately alkaline clay loam about 13 inches thick that is dark grayish brown in the upper part and brown in the lower part. The underlying layer from 13 to 32 inches is bedded gravel, sand, and fine earth. The upper part of the gravel layer is strongly cemented by caliche.

This soil is well drained. Permeability is moderate. The rooting depth is very shallow to shallow. This soil has a very low available water capacity and is droughty.

Included in mapping are small areas of Altoga and Sunev soils and a few areas of strongly sloping Queeny soils. The included soils make up less than 15 percent of the map unit.

This soil is used mostly for pasture. A few areas are used as rangeland, and some areas are mined for sand and gravel. If mining trends continue, most of the areas of this soil will be altered by the mining operations. Generally, pasture grass yields are low. Yields can be increased by controlled grazing and fertilizer.

Most of the acreage of this soil in the western part of the county is used as rangeland. Forage yields are generally low.

Most areas of this soil are in high positions on the landscape, which have scenic overlook qualities. The shrink-swell potential and risk of corrosivity to unprotected steel are moderate. Septic systems generally work well in the gravel substratum, but leachate may contaminate local water wells. With irrigation, landscaping and gardening are generally successful; chlorosis and stunted growth are minor problems. Fruit trees produce well. Elm and hackberry are the most reliable native trees for shade.

The slope of this soil is excessive for some kinds of recreation facilities. The main problem is the very low available water capacity, which affects the growth of grass. Where the soil is bare, the surface is somewhat sticky when wet, but it dries out quickly.

This soil has poor potential for use as habitat for wildlife. It does not provide the necessary food and cover.

This Queeny soil is in capability subclass IVs and in the Chalky Ridge range site.

RaB—Rader fine sandy loam, 0 to 2 percent slopes. This is a nearly level to gently sloping soil on smooth uplands. The areas are irregular in shape and range from about 20 to 40 acres. There are some areas in long, narrow valleys; those areas are as much as 150 acres in size.

Typically, the surface layer is yellowish brown fine sandy loam about 6 inches thick. The subsurface layer is light yellowish brown fine sandy loam about 12 inches thick. The upper part of the subsoil, to 28 inches, is mottled, yellowish sandy clay and light gray fine sandy loam. The lower part of the subsoil, to 62 inches, is sandy clay. It is mottled and grayish, yellowish, and brownish in the upper part and light gray in the lower part. This soil is slightly acid in the upper part and grades to mildly alkaline in the lower part.

This soil is very slowly permeable. A perched water table is between depths of 2 and 5 feet in winter and spring in most years. Surface runoff is slow. The soil is moderately well drained. The available water capacity is medium. Plant roots easily penetrate this soil. Erosion is a slight hazard.

Included in mapping are small areas of Axtell and Rosanky soils. Also included, generally near the crest of the slope, are small areas of Rader soils that have eroded to sandy clay. The included soils make up less than 15 percent of the map unit.

Most of this soil is used as rangeland and for pasture and hay. A few acres are used for crops. The soil is also well suited to truck crops if fertilizer is used.

This soil produces medium yields of grain sorghum, cotton, and small grains. The main concerns are to maintain fertility and tilth, especially in the upper part of the subsoil. This soil is well suited to truck crops.

Areas of this soil that are used as rangeland produce medium yields of forage.

This soil is suited to urban uses. However, the sandy clay subsoil has a moderate shrink-swell potential. Risk of corrosion to underground steel pipe is high. Septic systems work poorly in the very slowly permeable subsoil. Post oak is the best native tree for shade. Fruit trees generally need better internal drainage than this soil provides. Vegetable gardens do well with irrigation and fertilizer.

Recreation areas are easily developed on this soil. However, the very slow permeability results in a wet surface during rainy periods.

This soil has good potential for use as habitat for openland and rangeland wildlife. Wildlife consists mainly of songbirds and small animals. Weed seeds and grasses are plentiful, but shelter and cover generally are not available.

This Rader soil is in capability subclass IIIe and in the Sandy Loam range site.

RkD—Rosanky loamy fine sand, 1 to 8 percent slopes. This undulating soil is mostly on long and narrow ridges. A few areas are in irregularly shaped broad ridges. Slopes range from about 1 percent on the ridge

crests to 8 percent on the side slopes immediately below the ridges. Areas range from about 20 to 50 acres.

Typically, the surface layer consists of about 6 inches of slightly acid, pale brown loamy fine sand. The subsurface layer, to 14 inches, is slightly acid, light brown loamy fine sand. The subsoil, to 46 inches, is red, strongly acid sandy clay. The lower part has yellowish and brownish mottles. The underlying layer is strongly acid, light red, structureless, hard-packed loamy fine sand that has many seams and discrete balls of sandy clay.

This soil is well drained. Permeability is moderately slow. Surface runoff is medium. Erosion is a slight to moderate hazard. The available water capacity is medium. The rooting zone is deep. In most areas the sandy surface layer is low in fertility.

Included in mapping are small areas of Padina and Demona soils and small areas of eroded soils that have the sandy clay loam subsoil at the surface. Also included are some areas of soils that have accumulations of loamy fine sand; their surface layer is about 26 inches thick. The included soils make up less than 15 percent of the map unit.

This soil is used mostly for pasture and as rangeland. The soil produces high yields of forage. Good management includes maintaining or building up fertility in the sandy surface layer.

This soil is suitable for crops. Maintaining fertility and controlling erosion are the main concerns in management. Close-growing, high residue crops help with both concerns.

This soil has favorable areas for homesites. The areas are high on the landscape, and in most places there is a scattering of post oak. The shrink-swell potential is low, and the risk of corrosion to underground pipe is high. Septic systems work well in most places. With regular additions of water and fertilizer, landscaping and gardening are successful.

This soil is well suited to development of recreation areas. However, most areas are too sloping for large playgrounds. On unprotected dry surfaces, dust and poor traction are problems, but not serious ones.

This soil has good potential for use as habitat for openland wildlife and fair for rangeland wildlife. Many areas are wooded. Grasses and seed-producing forbs in small clearings provide food and cover for the few wild birds and animals in these areas.

This Rosanky soil is in capability subclass IVe and in the Sandy range site.

RoC—Rosanky fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on uplands. Areas range from about 30 to 100 acres.

Typically, the surface layer is brown, slightly acid fine sandy loam about 12 inches thick. The lower part of this layer is slightly lighter in color. The upper part of the subsoil, to a depth of about 39 inches, is red clay. The lower subsoil to 60 inches is strongly acid, reddish yellow clay loam. The underlying layer to more than 80 inches is stratified reddish and yellowish, hard packed, weakly consolidated sandstone. This soil is slightly acid in the upper part and grades to strongly acid in the lower part.

This soil is well drained and has moderately slow permeability. In most places, runoff is medium, but it is rapid in the more sloping soils. The rooting zone is deep and easily penetrated by roots. The available water capacity is medium. Erosion is a moderate hazard.

Included in mapping are small areas of Axtell and Demona soils and some areas of eroded soils that have the sandy clay subsoil at the surface. The eroded areas are mainly immediately below the crest of ridges. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture or as rangeland. A few areas are used for crops.

The use of this soil for pasture produces high yields of forage and hay under good management and with favorable weather. Fertilizer and controlled grazing are necessary. Range forage yields are potentially high.

This soil is suited to small grains, cotton, and grain sorghum. Under good management, truck crops such as tomatoes and watermelons do well. Management includes maintaining fertility and controlling erosion. Returning crop residue to the soil and terracing help.

This soil is suitable for use as homesites. Most areas are in high positions on the landscape, have good drainage, and have a scattering of post oak. Limitations include the moderate shrink-swell potential and the high corrosivity of the subsoil to underground pipes. Septic systems generally work well. Landscaping and gardening, particularly with the aid of water and fertilizer, are successful.

Most areas of this soil are well suited to use as recreation areas. Some areas may need leveling.

This soil has good potential for use as habitat for openland wildlife and fair for rangeland wildlife. However, most areas have been cleared of trees and brush and provide little food or cover. The idle fields provide some food from seed-producing plants.

This Rosanky soil is in capability subclass IIIe and in the Sandy Loam range site.

SuA—Sunev silty clay loam, 0 to 1 percent slopes. This nearly level soil is on smooth stream terraces. This soil is mainly on high terraces, but in some places, it is on terraces only slightly higher than the nearby stream channel. Soil areas are generally long and narrow and range from 25 to 75 acres.

Typically, this soil has a dark grayish brown silty clay loam upper layer about 18 inches thick. The subsoil is silty clay loam and extends to a depth of more than 60 inches. It is light yellowish brown in the upper part and reddish yellow in the lower part. Large amounts of

calcium carbonate are in the lower part. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Permeability is moderate. The available water capacity is moderate, and because there is very little runoff, plant moisture needs are supplied during most years. Plant roots easily penetrate this soil.

Included in some mapped areas are small areas of Krum and Queeny soils. The included soils make up less than 15 percent of the map unit.

This soil is used for crops or pasture or as rangeland.

This soil is used mainly for crops that provide temporary pasture and hay crops such as small grains and sorghum. Forage yields are generally high.

In places, this soil is well suited to permanent tame grass pasture. Maintaining fertility is the main concern in management.

This soil, if used as rangeland, produces high yields of forage.

Most areas of this soil are near streams and are attractive for use as homesites. The soil is suited to urban uses. The shrink-swell potential is moderate, and the risk of corrosion of underground steel pipes is moderate. The malfunctioning of septic systems is a slight hazard. Landscaping and gardening are easily done on this friable soil but the soil dries rapidly, and some plants develop chlorosis because of the high content of lime. Fruit trees do well on this soil. The most reliable tree for shade is native elm.

This soil is well suited to use as recreation areas. When the surface is wet and not protected, it is somewhat sticky and slippery. It dries quickly. This soil supports a dense grass cover.

This soil has good potential for use as habitat for openland and rangeland wildlife. Deer browse in these areas and take cover in nearby woods and brush. The weedy plants produce seed for birds.

This Sunev soil is in capability subclass IIs and in the Clay Loam range site.

SuB—Sunev silty clay loam, 1 to 3 percent slopes. This gently sloping soil is on stream terraces below areas of the nearly level Sunev soil. Areas are generally long and narrow and lie along streams. Areas range from about 20 to 50 acres.

Typically, the upper layer is dark grayish brown silty clay loam about 18 inches thick. The subsoil, to 52 inches, is light yellowish brown silty clay loam. The underlying layer, which extends to 60 inches, is reddish yellow silty clay loam and has many soft masses and concretions of calcium carbonate. This soil is calcareous and moderately alkaline throughout.

This soil is well drained. Permeability is moderate. Runoff is medium. The available water capacity is moderate. Roots easily penetrate this soil. Erosion is a slight hazard.

Included in mapping are small areas of Altoga and Krum soils, which make up less than 15 percent of the map unit.

This soil is used for crops or pasture or as rangeland.

This soil is well suited to crops. Grain sorghum, wheat, and cotton are commonly grown. Yields are high under good management and with favorable weather. Management includes maintaining tilth and fertility. In places, terraces are needed to help control erosion; elsewhere, close-growing, high-residue crops are adequate.

This soil is well suited to pasture and rangeland. Forage yields are generally high.

Because this soil is near streams, most areas are desirable as homesites. For urban uses, corrosion of underground pipe is a moderate limitation that can easily be controlled. Septic systems function if properly designed. Landscaping and gardening are easily done, but the soil dries rapidly and some plants develop chlorosis because of the high lime content. Fruit trees do fairly well. Native elm is the most reliable tree for shade.

This soil is well suited to recreation uses. It dries out quickly after rains. When this soil is wet and not protected, the surface becomes sticky. The soil can support a dense cover of sod grasses.

This soil has good potential for use as habitat for openland and rangeland wildlife. It provides abundant food for the wild game and birds of the area. Deer commonly graze forage in areas of this soil, but they seek cover in nearby woods.

This Sunev soil is in capability subclass IIe and in the Clay Loam range site.

Tc—Tinn clay, occasionally flooded. This nearly level soil is on bottom lands. This soil is flooded once in 7 to 10 years; however, flooding may occur several years in succession. Areas are long and narrow and range from about 35 to 1,500 acres.

Typically, the upper layer, to about 44 inches, is dark gray clay that has fine, light brownish gray mottles in the lower part. The layer below that, to 60 inches or more, is grayish brown clay. This soil is calcareous and moderately alkaline throughout.

This soil is somewhat poorly drained. Water enters this soil very slowly. Runoff is very slow. The seasonal high water table ranges from the surface to 3 feet below the surface late in winter and spring. The prolonged wetness in spring keeps the air content of the soil and the soil temperature low. This condition severly hinders early plant growth. The available water capacity is high. Roots easily penetrate this soil.

Included in mapping are long, narrow sloughs that carry floodwaters when the main stream overflows. Also included is a soil that is similar to this Tinn soil except that it has a brownish surface layer. The included areas make up less than 15 percent of the map unit.

This soil is used mainly for crops, pasture, or hay. It is not used as rangeland.

This soil is well suited to crops; however, flooding is a hazard. The main crops are small grains and grain sorghum.

This soil is well suited to pasture and hay. Forage yields are high. This soil is capable of producing high yields of range forage.

This soil is not suited to urban uses because of the hazard of flooding. Pecan trees are well adapted to this soil, and yields are high; however, drainage may be a problem in some areas, especially in wet years.

The use of this soil for recreation areas is limited by the hazards of flooding and wetness. The areas can be used for picnic areas and for paths and trails for hiking. However, when the soil is wet, the surface is sticky and muddy.

This soil has fair potential for use as habitat for openland wildlife and good for rangeland wildlife. Most areas are used for crops, and little food and cover are available for wildlife. Quail and doves are common during grain harvesting.

This Tinn soil is in capability subclass IIw and in the Clayey Bottomland range site.

Tn—Tinn clay, frequently flooded. This nearly level soil is on bottom lands. This soil is flooded several times each year for very brief periods. Areas are long and narrow and adjacent to streams. Areas range from 500 to 2,000 acres.

Typically, the upper layer is dark gray, calcareous, moderately alkaline clay about 58 inches thick. The layer below that to 77 inches is grayish brown, calcareous, moderately alkaline clay. The underlying layer to 80 inches is a mixture of gravel, sand, and clay.

This soil is very slowly permeable and somewhat poorly drained. An apparent water table ranges from the surface to 3 feet below the surface late in winter and spring. The available water capacity is high. Root development, especially that of annual plants, is slow early in spring because of wetness and coldness. Floodwaters cause some scouring near the channel, but these soil losses are offset by deposits on other parts of the flood plain.

Included in mapping are small areas of a soil that is similar to this Tinn soil except that it has a brownish surface layer. Also included are a few areas of a soil that is only occasionally flooded and areas of a soil on narrow slough banks where the slope is 2 to 3 percent. The included soils make up less than 15 percent of the map unit.

This soil is used mainly for pasture or as rangeland. It is capable of producing high yields of forage.

This soil is not suited to urban uses because of the flood hazard. Local roads and bridges are occasionally damaged by floodwater. This soil is well adapted to pecan trees; however, drainage may be a problem in wet years.

This soil is not suited to recreation uses other than paths and trails for hiking.

This soil has fair potential for use as habitat for openland wildlife and good for rangeland wildlife. Small wild animals and birds inhabit the areas except during periods of flooding. The plant cover produces large quantities of seeds for food.

This Tinn soil is in capability subclass Vw and in the Clayey Bottomland range site.

Uh—Uhland soils, frequently flooded. These nearly level soils are on bottom lands and in drainageways of uplands. These soils are flooded for very brief periods several times in most years. Slopes range from 0 to 1 percent. Areas are up to 3 miles long and narrow and adjacent to streams. Areas are about 100 to 400 acres. These soils are not in a regular pattern.

Typically, the surface layer is brown clay loam about 7 inches thick. The layer below that, to about 44 inches, is yellowish brown fine sandy loam. Below that, to about 56 inches, there is brown sandy loam that has thin loamy and clayey strata. The underlying layer to 67 inches is yellow fine sandy loam. The soil is noncalcareous and mildly alkaline throughout.

Permeability is moderately slow. The available water capacity is medium. These soils are somewhat poorly drained. A high water table is 1 1/2 to 3 feet below the surface during the spring. Both scouring and deposition take place during most floods.

Included in mapping are small areas of Deleon soils, a few areas of soils that are not flooded annually, and areas of a soil that is similar to Uhland soils except that it has clayey underlying material. The included soils make up less than 15 percent of the map unit.

These soils are used for improved pasture or as rangeland. The soils produce high yields of forage with good management. Maintaining fences damaged by floods is a major problem.

These soils are well suited to the combined use of pecan trees and improved grass pasture. However, drainage may be a limitation to pecan trees, especially in wet years.

These soils are not suitable for urban uses because of the hazard of flooding. Local roads are often covered by floodwater during heavy rainfall, and damage to bridges is common.

The use of these soils as recreation areas is severely limited by flooding. However, some areas are used for hiking trails and picnic areas.

The potential of these soils for use as habitat for wildlife is fair. Except during floods, small wild animals and birds inhabit the areas. The vegetation on these soils provides sufficient food for large populations of wildlife.

These Uhland soils are in capability subclass Vw and in the Loamy Bottomland range site.

WhC—Whitewright silty clay loam, 1 to 5 percent slopes. This gently sloping soil is on uplands. Areas on side slopes of low ridges are irregular in shape; those on crests of ridges are long and narrow. The areas range from 10 to 30 acres.

Typically, the surface layer is light brownish gray silty clay loam about 5 inches thick. The subsoil, which extends to a depth of about 15 inches, is very pale brown silty clay loam. The underlying layer is strongly weathered chalk. The soil is calcareous and moderately alkaline.

This soil is well drained. Permeability is moderate. The available water capacity is very low. The rooting depth is shallow. Runoff is rapid. Erosion is a moderate hazard.

Included in mapping are small areas of Castephen and Eddy soils and Whitewright gravelly loam. The included soils make up less than 15 percent of the map unit.

This soil is used for crops or pasture.

The use of this soil for crops is limited. The very low available water capacity, the high content of calcium carbonate, and accelerated erosion are the main concerns in management. Erosion control includes maintaining close-growing plant cover or mulch on the soil surface. Terracing is impractical because of the shallow depth to chalk.

This soil is suited to pasture although yields are low.

The areas of this soil are too small to manage as rangeland.

The soil has good bearing strength for use as foundations for homesites, but it has several limitations for urban uses. The chalk substratum is difficult to shape or excavate. Landscaping and gardening are difficult because of the very low available water capacity and the high content of calcium carbonate. Fruit and nut trees do poorly. Elm and live oak are reliable trees for shade.

The use of this soil for recreation areas is limited by the very low available water capacity, which prevents vigorous grass growth. The unprotected surface is slightly sticky when wet and dusty when dry.

The potential of this soil for use as habitat for wildlife is fair. The vegetation does not provide adequate food or cover; wildlife populations, mostly of birds and small animals, fluctuate throughout the year.

This Whitewright soil is in capability subclass IVe and in the Chalky Ridge range site.

WnA—Wilson clay loam, 0 to 1 percent slopes. This nearly level soil is on broad ridges and in long, narrow and shallow valleys on uplands. Areas range from 20 to 50 acres.

Typically, the surface layer is gray clay loam about 5 inches thick. The subsoil, to 60 inches, is clay that is very dark gray in the upper part, gray in the middle part, and light brownish gray in the lower part. The underlying layer from 60 to 72 inches is mottled olive and grayish clayey shale. This soil is neutral in the upper part and grades to moderately alkaline in the lower part.

This soil is very slowly permeable and is somewhat poorly drained. Runoff is very slow. This soil usually has a perched water table about 1 foot below the surface during the spring. The available water capacity is medium. The heavy clayey subsoil is difficult for roots to penetrate. This soil is droughty during the summer months. Erosion is a slight hazard.

Included in mapping are small areas of Burleson and Crockett soils, which make up less than 15 percent of the map unit.

Most of this soil is used for row crops; some areas are used for improved pasture; and a few acres are in rangeland. Cotton and grain sorghum are the main crops. Yields are generally fair. The main concern is keeping the soil in good tilth.

The choice of grasses is limited to drought-resistant species. Crops and tame grasses are subject to moisture stress during most summers. Controlled grazing is important for good forage yields.

Rangeland areas are brushy and produce medium yields of forage.

This soil is poorly suited to urban uses. Limitations are wetness, the high shrink-swell potential, which affects foundations and streets, the high risk of corrosion of underground steel pipes, and the very slow permeability, which adversely affects septic systems. In landscaping and gardening, conditioning the soil with mulches, residue, or manure helps the penetration of roots, water, and air. Fruit trees and pecan trees grow poorly. Native elm and hackberry are the best trees for shade.

This soil is easily adapted to recreation uses. The main problem is maintaining a grass cover in areas of heavy traffic. Wetness is a problem during rainy seasons.

The potential of this soil for use as habitat for wildlife is fair. Wildlife consists mainly of quail, doves, and songbirds. Small animals sometimes frequent the grassy areas.

This Wilson soil is in capability subclass IIIw and in the Claypan Prairie range site.

WnB—Wilson clay loam, 1 to 3 percent slopes. This gently sloping soil is on uplands dominantly on side slopes of ridges, but it is also on ridgetops and in valleys. Areas are long and narrow or irregular in shape. They are 50 to 150 acres.

Typically, the surface layer is gray clay loam about 5 inches thick. The subsoil, which extends to a depth of about 60 inches, is clay that is very dark gray in the upper part, gray in the middle part, and light brownish gray in the lower part. The underlying layer from 60 to 72 inches is mottled olive and grayish clayey shale. This soil is neutral in the upper part and grades to moderately alkaline in the lower part.

This soil is somewhat poorly drained. Permeability is very slow. This soil has a perched water table about 1 foot below the surface during wet seasons. Runoff is medium. This soil is droughty during the summer. Erosion is a moderate hazard.

Included in mapping are small areas of Crockett and Burleson soils, which make up less than 15 percent of the map unit.

This soil is mainly used for crops. A few areas are used for pasture or as rangeland.

Grain sorghum and cotton are the main crops. Yields are fair under good management and with favorable weather. The dense clay subsoil severely restricts most root penetration, soil aeration, and water infiltration. In most years, this soil is too waterlogged and cold for winter crops. The main concerns in management are preventing erosion and maintaining tilth.

This soil produces medium yields of pasture grass forage. Droughtiness and low fertility are the main limitations.

This soil produces medium yields of range forage. Control of mesquite brush and controlled grazing are necessary.

This soil is suited to urban uses. However, the high shrink-swell potential, the high risk of corrosion of underground steel pipe, and the very slow permeability are the main limitations. Internal drainage is generally too poor for most landscape plants. Shallow-rooted vegetables generally grow well. Fruit trees or pecan trees do not grow satisfactorily. Elm and hackberry are reliable native trees for shade.

The use of this soil for recreation areas is limited by wetness during rainy seasons. In some places, slope is a limitation.

The potential of this soil for use as habitat for wildlife is fair. Birds and small animals inhabit areas of brushy rangeland; the fields and pastures are not much used by wildlife.

This Wilson soil is in capability subclass IIIe and in the Claypan Prairie range site.

Prime farmland

In this section, prime farmland is defined and discussed and the prime farmland soils in Williamson County are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in providing the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, must encourage and facilitate the wise use of our nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to producing food, feed, forage, fiber, and oilseed crops. They have the quality, growing season, and moisture supply needed to economically produce a sustained high yield of crops when treated and managed using acceptable farming methods. Prime farmland soils produce the highest yields with minimal inputs of energy and economic resources, and farming these soils results in the least damage to the environment.

Prime farmland soils may now be in crops, pasture, or other land uses. They either are used for producing food or fiber or are available for these uses. Urban or built-up land and water areas cannot be considered prime farmland.

Prime farmland soils usually get an adequate and dependable supply of moisture from precipitation. They also have favorable temperature and growing season and have acceptable acidity or alkalinity. They have few or no rocks and are permeable to water and air. Prime farmland soils are not excessively erodible or saturated with water for long periods and are not flooded during the growing season. Slope ranges mainly from 0 to 5 percent.

About 314,000 acres, or 44 percent of the land area in Williamson County, is prime farmland. Areas are scattered throughout the county, but the largest areas are in general soil map units 1, 2, 4, and 7. Map unit 1 has the most prime farmland, followed by units 2 and 4. Most of the prime farmland soils are used for cultivated crops. Crops grown on these soils, mainly grain sorghum, cotton, corn, wheat, and oats, account for an estimated two-thirds of the county's total agricultural income each year.

A recent trend in land use has been the conversion of prime farmland to urban and industrial uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, or difficult to cultivate and less productive than prime farmland.

The following map units, or soils, make up prime farmland in Williamson County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed soil map units." This list does not constitute a recommendation for a particular land use.

AuA	Austin silty clay, 0 to 1 percent slopes
AuB	Austin silty clay, 1 to 3 percent slopes
BeB	Behring clay loam, 1 to 3 percent slopes
BrA	Branyon clay, 0 to 1 percent slopes
BrB	Branyon clay, 1 to 3 percent slopes
BuA	Burleson clay, 0 to 1 percent slopes
BuB	Burleson clay, 1 to 3 percent slopes
CfA	Crawford clay, 0 to 1 percent slopes
CfB	Crawford clay, 1 to 3 percent slopes
De	Deleon clay loam, occasionally flooded
DnA	Denton silty clay, 0 to 1 percent slopes
DnB	Denton silty clay, 1 to 3 percent slopes
DnC	Denton silty clay, 3 to 5 percent slopes
FaA	Fairlie clay, 0 to 1 percent slopes
FaB	Fairlie clay, 1 to 2 percent slopes
GeB	Georgetown clay loam, 0 to 2 percent slopes
HeB	Heiden clay, 1 to 3 percent slopes
HuA	Houston Black clay, 0 to 1 percent slopes
HuB	Houston Black clay, 1 to 3 percent slopes
KsA	Krum silty clay, 0 to 1 percent slopes
KsB	Krum silty clay, 1 to 3 percent slopes
Oa	Oakalla silty clay loam, occasionally flooded
RaB	Rader fine sandy loam, 0 to 2 percent slopes
RoC	Rosanky fine sandy loam, 1 to 5 percent slopes
SuA	Sunev silty clay loam, 0 to 1 percent slopes
SuB	Sunev silty clay loam, 1 to 3 percent slopes
Tc	Tinn clay, occasionally flooded

Some areas of the prime farmland soils in Williamson County are urban or built-up land, which is defined as any contiguous unit of land 10 acres or more in size that is used for nonfarm uses including housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water control structures.

Use and management of the soils

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

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

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

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

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

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

Crops and pasture

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

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

In Williamson County in 1979, 372,000 acres was used as cropland, 62,000 acres as pasture, and 246,000 acres as rangeland according to the local office of the Soil Conservation Service. Cotton, grain sorghum, small grains, corn, and hay are the most commonly grown crops. Production is steadily increasing. Farmers are planting seed of high-yielding strains and are using more efficient equipment, fertilizers, insecticides, and herbicides.

Erosion and declining fertility are major concerns in agricultural land use. Most soils used for crops and pasture are fertilized regularly. Laboratory soil analyses and custom mixing of fertilizer are commonly used in cropping. Rangeland is not fertilized.

Most sloping fields have been terraced and contoured, and grassed waterways have been established. Some level fields have only diversions above them for erosion control.

All soils that are cultivated benefit from crops that produce bulky residue. Residue helps improve tilth, infiltration, and fertility and helps reduce erosion.

Terraces and diversions are used mainly to help control runoff.

Grasses commonly used for pastures are kleingrass, Coastal bermudagrass, King Ranch bluestem, and Kleberg bluestem. To a lesser extent weeping lovegrass is used. Fertilizer applied to pastures increases production and improves the quality of the forage. Weed control and proper grazing heights help maintain plant vigor and healthy grass stands.

A planned sequence of grazing and resting pasture improves forage quality and production. Pastures are sometimes used together with range or crops to balance yearlong forage needs. Forage produced in excess of that needed for grazing animals can be cut for hay. Some pastures are left ungrazed and saved for hay.

Special crops, such as peanuts, watermelons, tomatoes, fruit, and pecans, are grown on a limited scale. Peanuts, watermelons, and tomatoes are grown mainly in areas of sandy soils; fruit trees are grown

throughout the county. Pecan groves are mainly on bottom lands along the river and the major creeks.

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 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops (*7*). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

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

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

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

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

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

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

Rangeland

Dalton Merz, range conservationist, Soil Conservation Service, helped prepare this section.

On rangeland, the native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. The plants are generally suitable for grazing, and the plant cover is sufficiently dense to justify grazing use. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition and production of the plant community is determined by soil,

climate, topography, overstory canopy, and grazing management.

In 1979, about 246,000 acres in Williamsom County was used as rangeland. About 167,000 acres in the county is suited only to use as rangeland or as habitat for wildlife.

Most of Williamsori County was once an open prairie, where trees grew only along streams and in a few scattered motts on adjacent uplands. The southeastern part of the county was a savannah characterized by tall grasses, forbs, post oak, and blackjack oak.

The rangeland plant community in the county has changed drastically over the past 50 years. Heavy grazing has resulted in the deterioration of most of the grassland to the point where much of the higher quality vegetation has been grazed out. Tall grasses flourish only in a few places. In their place is a mixture of short and mid grasses and poor-quality forbs. However, remnants of the original plant community still grow in protected areas. In most places, good grazing management will allow the high-quality plants to re-establish themselves.

Most of the ranches and livestock farms are cow-calf operations. However, there are some stocker calf enterprises, and many ranches supplement their cow herds with stockers. This practice permits greater flexibility in adjusting livestock numbers in periods of drought and times of grazing stress.

Most livestock operations supplement grazing of rangeland with improved pastures and forage crops. Improved bermudagrass, kleingrass, Kleberg bluestem, and King Ranch bluestem are commonly used as improved pasture grasses; hay and small grains are generally grown in cultivated areas.

Most production of range forage takes place in two distinct growth periods. Approximately 70 percent of the annual growth is produced in April, May, and June, when spring rains and moderate temperatures are favorable for the growth of warm-season plants. A secondary growth period is in September and October, when fall rains coincide with gradually cooling temperatures.

Droughts of varying duration are frequent in this area. Short midsummer droughts are normal, but droughts that last for many months also occur.

In line with the trend toward urbanization, many of the old established ranches have been sold for urban development.

Range sites and condition classes

Soils vary in their capacity for producing grasses and other plants for grazing. Soils that produce about the same kinds, amounts, and proportions of forage make up a range site.

The plant community in an area that is characterized by at least 75 percent climax vegetation is relatively stable and is indicative of what the site is capable of producing. Climax vegetation reproduces itself and changes in composition very little as long as the environment remains unchanged. On the prairie and the plains, the climax vegetation consists of the plants that grew there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site generally is the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close, continuous grazing. They generally are the tallest and most productive perennial grasses and forbs as well as the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable plants are reduced by close grazing. They generally are shorter than decreasers and less palatable to livestock.

Invaders are plants that cannot compete with the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by heavy continuous grazing. Invaders generally have little value for grazing.

Range condition is judged according to standards that apply to the particular range site. Four range condition classes are used to indicate the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand; in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is 25 or less.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during the growing season.

Table 6 shows, for each soil, the range site and the potential annual production of vegetation in favorable, normal, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. Explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply 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 annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It includes all vegetation,

whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. 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 make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Good range management maintains range in excellent or good condition. Water is conserved, yields are improved, and the soils are protected. The main concern in management is recognizing the changes in plant cover that take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for a short period may have a degraded appearance that temporarily obscures its quality and ability to recover.

After years of prolonged overuse of rangeland, seed sources of desirable vegetation may have been eliminated. In such instances, vegetation can be re-established by applying one or more of the following practices: brush control, range seeding, fencing, water development, or other mechanical treatment to revitalize stands of native plants. Thereafter, deferred grazing, proper grazing use, and planned grazing systems must be applied to maintain or improve the range.

The range sites in the survey area are the Adobe, Blackland, Chalky Ridge, Clayey Bottomland, Clay Loam, Claypan Prairie, Claypan Savannah, Deep Redland, Deep Sand, Eroded Blackland, Loamy Bottomland, Low Stony Hills, Redland, Sandy, Sandy Loam, Shallow, Steep Adobe, and Steep Rocky range sites.

Adobe range site. The Brackett soil in map unit BkC makes up this site (fig. 19).

The potential plant community is primarily tall grasses and includes scattered clumps of Spanish oak and live oak. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 5 percent; sideoats grama and tall grama, 15 percent; and mid grasses, such as muhlys, green sprangletop, dropseeds, hairy grama, perennial threeawn, tridens, and sedges, 15 percent. Woody plants such as live oak and Spanish oak make up about 10 percent. Forbs such as orange zexmenia, prairie clover, dalea, and vetch make up about 5 percent.

Under continuous heavy grazing, little bluestem, indiangrass, and sideoats grama are grazed out of the plant community. These plants are replaced by hairy grama, green sprangletop, tridens, perennial threeawn, and orange zexmenia. If heavy grazing continues for many years, woody plants such as blueberry juniper and agarita increase significantly. If the site deteriorates further, Texas grama, red grama, hairy tridens, tumblegrass, poverty dropseed, and queensdelight may grow in the area.

This site produces low-quality forage mainly because of the high lime content that limits the iron and phosphate available to growing plants. If grazing is not properly controlled, grasses are quickly replaced by Ashe juniper, which effectively excludes all other vegetation because of shading and chemical effects. Brush control and rotation grazing are necessary on this site.

Blackland range site. The Branyon soils in map units BrA and BrB; Behring soils in BeB and BeC2; Burleson soils in BuA and BuB; Fairlie soils in FaA and FaB; Heiden soils in HeB, HeC2, HeD2, and HsE; and Houston Black soils in HuA, HuB, HuC2 are in this site.

The potential plant community is a tall grass prairie. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass and big bluestem, 25 percent; and eastern gamagrass, switchgrass, Texas cupgrass, sideoats grama, wildrye, Texas wintergrass, and vine-mesquite, 10 percent. Woody plants such as live oak, elm, and hackberry make up 5 percent. Forbs such as Maximilian sunflower, Engelmann-daisy, gayfeather, bundleflower, snoutbean, wildbean, and western indigo make up 10 percent.

Under continuous heavy grazing, big bluestem and little bluestem, indiangrass, eastern gamagrass, switchgrass, Maximilian sunflower, and Engelmann-daisy are grazed out of the plant community. These plants are replaced by silver bluestem, Texas wintergrass, tall dropseed, sideoats grama, and less palatable forbs. If heavy grazing continues for many years, buffalograss, Texas wintergrass, mesquite, elm, Texas grama, croton, and broomweed increase significantly.

If the site deteriorates further, mesquite and desert willow encroach in most places. Cool-season grasses such as Texas wintergrass and rescuegrass fill the void left when shade and competition for moisture drive out the tall-growing warm-season grasses. Generally, in areas that have been cropped, there is no natural seed source; therefore, the reseeding of desirable range grasses is the primary concern in management.

Chalky Ridge range site. The Castephen soils in map units CaB and CaC, Eddy soils in EyB and EyD, Queeny soil in QuC, and Whitewright soil in WhC make up this site.

The potential plant community is a mid-grass prairie. Typically, the dominant grasses are little bluestem, which

Figure 19.—The rangeland to the left of the fence is in poor condition, and that to the right of the fence is in good condition. The soil is Brackett clay loam, 1 to 5 percent slopes, on the Adobe range site.

makes up 50 percent of the vegetation; indiangrass, big bluestem, and wildrye, 20 percent; sideoats grama, silver bluestem, and dropseeds, 15 percent; and threeawn, slim tridens, fall witchgrass, and low panicum, 5 percent. Forbs such as gayfeather, bundleflower, penstemon, sensitivebrier, prairie clover, vetch, and wildbean make up 10 percent.

Under continuous heavy grazing, little bluestem, big bluestem, indiangrass, and palatable forbs are grazed out of the plant community first. These plants are replaced by sideoats grama, silver bluestem, threeawn, and less palatable forbs. If heavy grazing continues for many years, hairy grama, red grama, Texas grama, broomweed, baccharis, queensdelight, red threeawn, and hairy tridens increase significantly. In most places, there are scattered motts of live oak.

This site is more easily and quickly abused than most associated range sites. Continuous overgrazing quickly results in changes in composition that favor low-producing, coarse forbs and grasses. Conversely, range condition is quick to improve under proper grazing management. In most places, recovery is so rapid that this site provides a seed source for adjoining sites. Rotation grazing improves the range condition.

Clayey Bottomland range site. The Tinn soils in map units Tc and Tn are in this site.

The potential plant community is a savannah. Typically, the dominant grasses are switchgrass, indiangrass, big bluestem, and little bluestem, which make up 30 percent of the vegetation; meadow dropseed, sideoats grama, vine-mesquite, and silver bluestem, 20 percent; wildrye, sedges, and Texas wintergrass, 20 percent; and buffalograss, white tridens, Scribner panicum, and eastern gamagrass, 10 percent. Woody plants such as live oak, elm, hackberry, pecan, willows, and western soapberry make up 15 percent. Forbs such as Maximilian sunflower, bundleflower, snoutbean, tickclover, and wildbean make up 5 percent.

Under continuous heavy grazing, eastern gamagrass, indiangrass, switchgrass, big bluestem, little bluestem, and Maximilian sunflower are grazed out of the plant community. These plants are replaced by meadow dropseed, sideoats grama, silver bluestem, Texas wintergrass, vine-mesquite, buffalograss, and less palatable forbs. If heavy grazing continues for many years, the overstory canopy thickens and shade-tolerant species such as wildrye, sedges, and low panicum increase. If the site deteriorates further, these plants may grow in the area: buffalograss, common bermudagrass, Texas grama, ragweed, sumpweeds, annual sunflower, cocklebur, broomweed, beebalm, iceweed, and croton.

Most areas have some common bermudagrass and weeds along with desirable tall grasses and forbs. Continuous, close grazing results in an increase of bermudagrass and other low-growing plants but a decrease in desirable, tall-growing wild grasses.

Controlled grazing helps tall range grasses to reseed and crowd out the less desirable bermudagrass.

Clay Loam range site. The Altoga soils in map units AgC2 and AgD2; Austin soils in AuA, AuB, and AwC2; Denton soils in DnA, DnB, and DnC; Krum soils in KsA and KsB; and Sunev soils in SuA and SuB are in this site.

The potential plant community is a true prairie. Typically, the dominant grasses are little bluestem, which makes up 30 percent of the vegetation; indiangrass, 10 percent; big bluestem, 5 percent; and tall dropseed, silver bluestem, sideoats grama, buffalograss, perennial threeawn, and Texas wintergrass, 50 percent. Forbs such as Engelmann-daisy, bundleflower, sensitivebrier, and bushsunflower make up 5 percent.

Under continuous heavy grazing, little bluestem, indiangrass, big bluestem, and Engelmann-daisy are grazed out of the plant community. These plants are replaced mainly by sideoats grama and buffalograss. If heavy grazing continues for several years, plants such as silver bluestem, perennial threeawn, and Texas wintergrass increase significantly. If the site deteriorates further, woody invaders such as blueberry juniper, Ashe juniper, agarita, and persimmon and annual weeds such as broomweed encroach and may become dominant.

Most areas of this range site are in the western part of the county. Domestic animals apparently prefer grazing this range site. For this reason, extra emphasis needs to be placed on deferred grazing as a means of controlling brush and improving composition of the plant population.

Claypan Prairie range site. The Crockett soils in map units CrB and CrC2 and Wilson soils in WnA and WnB make up this range site.

The potential plant community is a tall grass prairie. There are a few oaks, elms, and hackberry trees along watercourses or in widely scattered motts. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 15 percent; Florida paspalum, wildrye, sideoats grama, silver bluestem, meadow dropseed, and Texas wintergrass, 15 percent; and purpletop, brownseed paspalum, and buffalograss, 5 percent. Woody plants such as oak, elm, hackberry, and bumelia make up 5 percent. Forbs such as Maximilian sunflower, Engelmann-daisy, partridgepea, guava, and vetch make up 10 percent.

Under continuous heavy grazing, big bluestem, little bluestem, indiangrass, Florida paspalum, and Maximilian sunflower are grazed out of the plant community. These plants are replaced by silver bluestem, meadow dropseed, Texas wintergrass, sideoats grama, and less palatable forbs. If the site is in a deteriorated condition, Texas wintergrass, buffalograss, mesquite, post oak, osageorange, desert willow, yaupon, and other woody plants dominate the area.

Brush control is the main concern in range management.

Claypan Savannah range site. The Axtell soils in map units AxB and AxC2 make up this site (fig. 20).

The potential plant community is a post oak-blackjack oak savannah. The trees shade 15 to 20 percent of the ground. Typically, the dominant grasses are little bluestem and indiangrass, which make up 50 percent of the vegetation; brownseed paspalum, 10 percent; Florida paspalum, switchgrass, and purpletop, 10 percent; and sideoats grama, arrowfeather threeawn, silver bluestem, and Texas wintergrass, 10 percent. Woody plants such as post oak and blackjack oak make up 10 percent. Other woody plants such as blackberry, American beautyberry, greenbrier, grape, and Alabama supplejack make up 5 percent. Forbs such as Engelmann-daisy, gayfeather, bundleflower, and wildbean make up 5 percent.

Under continuous heavy grazing, little bluestem, indiangrass, Florida paspalum, switchgrass, and purpletop are grazed out of the plant community. These plants are replaced by brownseed paspalum and woody species such as post oak, blackjack oak, elm, yaupon, American beautyberry, and other thicket-forming plants. In addition to climax woody species, the following plants

Figure 20.—The dominant grass in this area of Axtell fine sandy loam is little bluestem. The range site is the Claypan Savannah.

are likely to dominate the site in its deteriorated condition: mesquite, broomsedge bluestem, red lovegrass, bitter sneezeweed, eastern redcedar, and baccharis.

Brush encroachment and low fertility are particular problems of this site. Yaupon, American beautyberry, and hawthorn form dense stands under a scattered canopy of post oak and blackjack oak. A management system that favors an increase in legumes and forbs as well as brush control is important in managing this site.

Deep Redland range site. The Crawford soils in map units CfA and CfB make up this site.

The potential plant community is a tall grass-post oak savannah that is 90 percent grasses, 5 percent forbs, and 5 percent woody plants. Typically, the dominant grasses are big bluestem and little bluestem, which make up 30 percent of the vegetation; switchgrass and indiangrass, 15 percent; sideoats grama, 10 percent; other mid grasses such as Texas cupgrass, pinhole bluestem, tall dropseed, vine-mesquite, curlymesquite, and buffalograss, 25 percent; and Texas wintergrass and Canada wildrye, 10 percent. Woody plants such as post oak, blackjack oak, live oak, and elbowbush make up 5 percent. Forbs such as Engelmann-daisy, bushsunflower, and sensitivebrier make up 5 percent.

Under continuous heavy grazing, big bluestem, indiangrass, switchgrass, and Engelmann-daisy are grazed out of the community. These plants are replaced by plants such as sideoats grama, pinhole bluestem, buffalograss, and post oak. If heavy grazing continues for many years, the oaks increase to a dense stand that has an understory of plants such as threeawn, Texas wintergrass, Ashe juniper, Texas persimmon, pricklypear, and mesquite.

Deep Sand range site. The Padina soil in map unit PaD makes up this site.

The potential plant community is an open savannah. Post oak and blackjack oak shade 20 to 25 percent of the ground. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 10 percent; switchgrass, crinkleawn, purpletop, and brownseed paspalum, 10 percent; and fringeleaf paspalum, mourning lovegrass, splitbeard bluestem, broomsedge bluestem, and low panicums, 10 percent. Woody plants such as post oak and blackjack oak make up 10 percent; other woody plants such as American beautyberry, yaupon, and grape make up 5 percent. Forbs such as snoutbean, sensitivebrier, spiderwort, and dayflower make up 5 percent.

Under continuous heavy grazing, little bluestem, indiangrass, switchgrass, and palatable forbs are grazed out of the plant community. These plants are replaced by trees such as post oak and blackjack oak and by an understory that consists mainly of yaupon and American beautyberry. If the site is in a deteriorated condition, red lovegrass, sandbur, yankeeweed, bullnettle, threeawn, snakecotton, and croton dominate the area.

Soil fertility, reaction, and the sandy texture favor the growth of brushy vegetation such as hawthorn, yaupon, and American beautyberry to the extent that grasses are readily crowded out. Historically, grasses were probably maintained by controlled fires that produced temporary clearings. Brush control and rotation grazing help in range management.

Eroded Blackland range site. The Ferris and Heiden soils in map unit FhE make up this site.

The potential plant community is a tall grass prairie. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass and big bluestem, 20 percent; and sideoats grama, wildrye, tall dropseed, silver bluestem, Texas wintergrass, and vine-mesquite, 15 percent. Woody plants such as live oak, hackberry, and elm make up 5 percent. Forbs such as Engelmann-daisy, Maximilian sunflower, gayfeather, snoutbean, and wildbean make up 10 percent.

Under continuous heavy grazing, little bluestem, indiangrass, big bluestem, and Maximilian sunflower are grazed out of the plant community. These plants are replaced by vine-mesquite, silver bluestem, and tall dropseed. If heavy grazing continues for many years, buffalograss, Texas wintergrass, and mesquite dominate the soils.

A particular problem in improving this site is the inadequacy of seed sources in most places. Also, recovery is slow because fertility in the gullied areas is very low. Brush is a minor problem; most areas have only a scattering of desert willow and mesquite. Management generally includes reseeding, proper grazing, and deferred grazing.

Loamy Bottomland range site. The Deleon soils in map units De and Df, Oakalla soils in map units Oa and Oc, and Uhland soils in map unit Uh are in this site.

The potential plant community is a savannah. Oak, pecan, hackberry, elm, cottonwood, sycamore, and other woody plants shade about 30 percent of the ground. Typically, the grasses are Virginia wildrye and sedges, which make up 25 percent of the vegetation; rustyseed paspalum and beaked panicum, 15 percent; switchgrass, indiangrass, big bluestem, and little bluestem, 15 percent; white tridens and knotroot bristlegrass, 10 percent; eastern gamagrass, 5 percent; and uniola, 5 percent. Woody plants such as pecan, oak, hackberry, elm, cottonwood, sycamore, greenbrier, and Alabama supplejack make up 25 percent.

Under continuous heavy grazing, big bluestem, little bluestem, eastern gamagrass, and other palatable forage plants are grazed out of the plant community. These plants are replaced by trees, shrubs, and woody vines. As the overstory continues to close in, production of grasses and forbs is reduced proportionately. If the site is in a deteriorated condition, broomsedge bluestem, bushy bluestem, vaseygrass, cocklebur, sumpweed, osageorange, and woody plants dominate the soils.

One problem in managing this site is extensive shading by trees and thicket-forming plants such as greenbrier and sapling elm, ash, and sycamore. Brush control and deferred grazing are necessary in many places to improve the stand of grasses.

Low Stony Hills range site. The Eckrant soils in map units EaD and EeB make up this site.

The potential plant community is a live oak savannah. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass and big bluestem, 20 percent; and other mid grasses such as wildrye, sideoats grama, Texas cupgrass, plains lovegrass, green sprangletop, dropseeds, silver bluestem, vine-mesquite, buffalograss, Texas sedges, Texas wintergrass, and perennial threeawn, 15 percent. Woody plants such as live oak, elm, and hackberry make up 10 percent. Forbs such as orange zexmenia, bushsunflower, bundleflower, prairie clover, milkpea, snapbean, and Engelmann-daisy make up 5 percent.

Under continuous heavy grazing by livestock and wild animals, little bluestem, indiangrass, and big bluestem are grazed out of the plant community. These plants are replaced by sideoats grama, Texas wintergrass, buffalograss, and silver bluestem. If heavy grazing continues, these also disappear. Texas wintergrass and buffalograss can tolerate overgrazing and are usually the last to disappear. If the site is in a deteriorated condition, any or all of the following plants may dominate the soils: Ashe juniper, agarita, mesquite, Texas persimmon, pricklypear, tasajillo, prairie coneflower, broomweed, burclover, plantains, hairy tridens, Texas grama, and annual grasses and forbs.

Brush invades areas of this site quickly if the range is not properly managed. Agarita, Texas persimmon, and some Ashe juniper and elm form thickets that are so dense that large animals cannot easily penetrate them. Brush control and rotation grazing are necessary on this site.

Redland range site. The Georgetown soils in map units GeB and GsB are in this site.

About 90 percent of the potential plant population on this site is tall and mid grasses. The remainder is mainly trees and forbs. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 15 percent; big bluestem and wildrye, 15 percent; and other mid grasses such as sideoats grama, dropseeds, silver bluestem, Texas cupgrass, Texas wintergrass, wildrye, buffalograss, vine-mesquite and perennial threeawn, 10 percent. Woody species such as post oak, live oak, and elm make up about 5 percent. Forbs such as wildbean, Engelmann-daisy, gayfeather, bundleflower, sensitivebrier, and vetch make up 5 percent.

Under continuous heavy grazing, little bluestem, big bluestem, indiangrass, wildrye, and Engelmann-daisy are grazed out of the plant community. These plants are replaced by sideoats grama, buffalograss, Texas wintergrass, and vine-mesquite. If heavy grazing continues for many years, woody plants such as live oak, post oak, and elm increase significantly as well as an understory of plants such as dropseeds, sedges, and perennial threeawn. If the site deteriorates further, invader plants such as coneflower, broomweed, blueberry juniper, and mesquite begin growing in the area.

Domestic animals prefer grazing the more palatable forage on this site. Management includes deferred grazing and brush control to help control invading mesquite, persimmon, and agarita brush and to maintain quality and quantity of forage on the site.

Sandy range site. The Demona soil in map unit DmB and the Rosanky soil in map unit RkD are in this site.

The potential plant community is an open savannah that has scattered post oak and blackjack oak trees. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 10 percent; switchgrass, crinkleawn, purpletop, brownseed paspalum, and sand lovegrass, 10 percent; and balsamscale, mourning lovegrass, splitbeard and broomsedge bluestem, and low panicums, 10 percent. Woody plants such as post oak and blackjack oak make up 10 percent; other woody plants such as American beautyberry, greenbrier, and yaupon make up 5 percent. Forbs such as partridgepea, western indigo, snoutbean, and sensitivebrier make up 5 percent.

Under continuous heavy grazing, indiangrass, little bluestem, switchgrass, and crinkleawn are grazed out of the plant community. These plants are replaced mostly by brownseed paspalum, fringeleaf paspalum, threeawns, splitbeard and broomsedge bluestem, and low panicums. If the site has deteriorated, any or all of the following may be on the soils: red lovegrass, yankeeweed, bullnettle, snakecotton, and croton. If retrogression continues, oak, yaupon, hawthorns, greenbrier, American beautyberry, and persimmon form dense thickets.

The sandy texture, reaction, and low fertility of the soils in this site favor woody plants over grasses. The trees and brush are mainly yaupon, greenbrier, and American beautyberry. Historically, this site was probably maintained as a savannah by occasional fires that cleared areas of brush and trees so that grasses could grow. Practices that improve the kinds and amount of desirable range grasses and forbs are mechanical brush control and rotation grazing.

Sandy Loam range site. The Rader soil in map unit RaB and the Rosanky soil in RoC are in the site.

The potential plant community is a post oak and blackjack oak savannah. Typically, the dominant grasses are little bluestem, which makes up 50 percent of the vegetation; indiangrass, 10 percent; switchgrass, big bluestem, eastern gamagrass, purpletop, and brownseed paspalum, 10 percent; and sideoats grama, tall dropseeds, silver bluestem, low paspalums, low panicums, mourning lovegrass, arrowfeather threeawn, knotroot bristlegrass, sedges, and fall witchgrass, 10 percent. Woody plants such as post oak and blackjack oak make up 10 percent; other woody plants such as elm, hackberry, American beautyberry, and greenbrier make up 5 percent. Forbs such as Engelmann-daisy, sensitivebrier, bundleflower, wildbean, and snoutbean make up 5 percent.

Under continuous heavy grazing, indiangrass, big and little bluestem, and eastern gamagrass are grazed out of the plant community. These plants are replaced by brownseed paspalum and woody plants such as oak, elm, hackberry, and American beautyberry until the site resembles a scrub forest. Shade-tolerant plants such as longleaf uniola, sedges, and low panicums generally increase along with the canopy until the shade becomes too dense for them. In addition to the climax woody plants, any or all of the following may be seen if the site has deteriorated: broomsedge bluestem, red lovegrass, yankeeweed, eastern redcedar, persimmon, sesbania, and winged elm.

Much of this range site was formerly in cultivated crops; thus, seed sources are seriously lacking. Other problems in developing rangeland from idle cropland include surface crusting, low fertility, and encroachment of hawthorn, yaupon, and other brush. All of these problems make recovery slow and difficult. Historically, occasional brush fires probably helped maintain this site

as a savannah. Management includes mechanical brush control and rotation grazing.

Shallow range site. The Doss soil in map unit DoC makes up this site.

The potential plant community is grassland that has scattered live oak motts. Typically, the dominant grasses are little bluestem, which makes up 25 percent of the vegetation; sideoats grama, 30 percent; and other mid grasses, such as silver bluestem, green sprangletop, Texas wintergrass, wildrye, curlymesquite, buffalograss, and perennial threeawns, 35 percent. Woody plants such as live oak, kidneywood, and elbowbush make up 5 percent. Forbs such as Engelmann-daisy, bundleflower, neptunia, bushsunflower, and gayfeather make up 5 percent.

Under continuous heavy grazing, little bluestem and sideoats grama are grazed out of the plant community. These plants are replaced by curlymesquite, buffalograss, Texas wintergrass, silver bluestem, and green sprangletop. Woody plants such as live oak and blueberry juniper increase if heavy grazing continues. Broomweed, threeawn, annual grasses, and forbs continue to invade in deteriorated areas.

One particular problem is encroachment of Ashe juniper, Texas persimmon, agarita, condalia, and mesquite. Management includes brush control and rotation grazing.

Steep Adobe range site. The Brackett soils in map units BkE and BkG make up this site.

The potential plant community is about 75 percent grasses. The remainder is woody plants and forbs. The dominant grasses are little bluestem, which makes up 40 percent of the vegetation; indiangrass, 5 percent; sideoats grama and tall grama, 15 percent; and other mid grasses such as muhlys, green sprangletop, dropseed, hairy grama, perennial threeawn, tridens, and sedges, 15 percent. Woody plants such as live oak and Spanish oak make up about 15 percent. Forbs such as orange zexmenia, prairie clover, dalea, and vetch make up about 10 percent.

With continuous heavy grazing by livestock, little bluestem, indiangrass, and sideoats grama are grazed out of the plant community. These plants are replaced by hairy grama, green sprangletop, tridens, perennial threeawn, and orange zexmenia. If heavy grazing continues for many years, woody plants such as Ashe juniper increase significantly. If the site is in a deteriorated condition, several or all of these plants may dominate the area: Texas grama, red grama, hairy tridens, tumblegrass, poverty dropseed, and queensdelight.

Most areas of this site are in Ashe juniper and other brush. Even where cleared, the quality and quantity of forage are low because of the slopes, rock outcrop, gravel, and low fertility.

Steep Rocky range site. The Eckrant soils in map units ErE and ErG make up this site.

The potential plant community is a live oak and Texas oak savannah that is 75 percent grasses, 15 percent woody plants, and 10 percent forbs. Typically, the dominant grasses are little bluestem, which makes up 40 percent of the vegetation; sideoats grama, 10 percent; and other grasses such as indiangrass, big bluestem, Texas cupgrass, cane and pinhole bluestem, tall grama, purple threeawn, plains lovegrass, and green sprangletop, 25 percent. Woody plants such as live oak, Texas oak, sumac, and Texas madrone make up 15 percent. Forbs such as Engelmann-daisy, bushflower, and bundleflower make up 10 percent.

With continuous heavy grazing by livestock, little bluestem, indiangrass, and Engelmann-daisy are grazed out of the plant community. These plants are replaced by sideoats grama, pinhole bluestem, and live oak. If heavy grazing continues for many years, woody plants such as oaks increase to a dense stand in which grows an understory of plants such as threeawn, Texas wintergrass, slim tridens, Ashe juniper, and Texas persimmon.

Most areas of this site are dominated by invaders such as Ashe juniper, Mexican buckeye, persimmon, and agarita under scattered live oak and Spanish oak. Most areas will remain in brush because of the cost of brush removal.

Environmental plantings

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, which are mainly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

One important purpose of environmental plantings is to provide protection against the burning sun of summer and the chilling winds of winter. The temperature in houses and farmstead structures can be significantly changed by tree shade in the summer and shrub windbreaks in the winter. Physical conditions for livestock are generally better, and production generally rises.

Environmental plantings of shrubs and trees have significant value around the home. Energy needs for cooling are less in summer where houses are shaded by trees. Likewise, less fuel is needed for heating in winter where a barrier of trees and shrubs deflects the cold north winds. Woody plants help reduce environmental noise in homes near highways and airports.

A large number of introduced trees and shrubs are available for environmental plantings. Many native shrubs and trees also can be used. The native plants have the advantage of being adapted to the local

environment and may have resistance to diseases and insects. Along with native shrubs and trees, there are a large number of small flowering plants that add beauty to the environment. Local garden clubs and plant nurseries are good sources of information on which plants to use.

Game birds, songbirds, and most wild animals use trees and shrubs for food and cover. Selecting woody plants that provide food for wildlife generally insures an increase in wildlife.

In the sandy southeastern part of the county, adapted shade trees include post oak, hickory, blackjack oak, and black walnut. Redcedar, dewberry, birdeye bush, and mustang grape are recommended for windbreaks and wildlife habitat. Native flowering plants for beauty include American beautyberry, hawthorn, wild honeysuckle, wild vetch, greenbrier, and wild plum.

On the calcareous clayey soils in central Williamson County, elm, hackberry, and pecan are reliable shade trees. Also, cottonwood, sycamore, and water oak grow well, especially on the bottom lands. Georgia cane is well adapted and provides a good windbreak, but it can become a pest. Lotebush, retama, and juniper are adapted bushes, particularly on the fringes of this area. Flowering plants include bluebonnet, indian paintbush, annual sunflower, dotted gayfeather, and queensdelight.

On the shallow and very shallow soils in the western part of the county, live oak, pin oak, and Spanish oak are reliable native shade trees. On the reddish, noncalcareous clayey soils, post oak trees are also adapted. Redbud, sumac, juniper, and agarita are good shrubs for windbreaks and wildlife habitat. Sumac and elbowbush generally are better adapted to the deeper soils. Flowering plants include orange zexmenia, prairie coneflower, Maximilian sunflower, Engelmann-daisy, and rosering gaillardia.

Recreation

The soils of the survey area are rated in table 7 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 9.

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

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

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife habitat

The kinds of wildlife and population densities in Williamson County are variable because of the wide range in soils, landforms, and vegetation. Most of the rangeland is managed for wildlife habitat as a secondary land use; however, in some areas wildlife habitat is the primary land use. Most of the game birds and mammals are of economic importance.

The major wildlife species in the county are white-tailed deer, wild turkey, fox squirrel, jackrabbit, cottontail, bobwhite quail, mourning dove, and other non-game birds and mammals.

Primary furbearers in the area are beaver, bobcat, coyote, fox, nutria, opossum, raccoon, ring-tailed cat (cacomistle), and skunk.

Fish and waterfowl are also an important economic resource. The numerous farm and ranch ponds and small watershed flood control structures provide a habitat for migrating waterfowl. In addition, most of the ponds and lakes are stocked with fish, mainly black bass, channel catfish, and various kinds of sunfish.

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

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, johnsongrass, and kleingrass.

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

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are agarita, pricklypear, and greenbrier.

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

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

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

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

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, shore birds, nutria, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, dove, bobwhite quail, wild turkey, field sparrow, cottontail, and jackrabbit.

Engineering

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

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

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

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

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

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

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

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

Building site development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, and shrink-swell potential can cause the movement of footings. A high water table,

depth to bedrock, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet are not considered.

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, depth to bedrock, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock, flooding, large stones, and content of organic matter.

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

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

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground

water pollution. Ease of excavation and revegetation needs to be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

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

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

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

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

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

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

Water management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas and embankments, dikes, and levees. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

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

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

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

Parallel terrace systems, in which the terraces are the same distance apart throughout their length, are the most popular type. Many old systems are being upgraded to parallel terraces because of the ease of farming with multi-row equipment.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large

stones, wetness, slope, and depth to bedrock affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil properties

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

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 16.

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

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

Engineering index properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

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

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

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

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

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 16.

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

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

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The

estimates are based on test data from the survey area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and chemical properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

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

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

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

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

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

In table 14, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and water features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

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

The four hydrologic soil groups are:

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

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

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

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

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

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely.

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

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 15.

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

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

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class,

total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

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

Engineering index test data

Table 16 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series. The soil samples were tested by the Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (particle index)—T 100 (AASHTO), D-653 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*8*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

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

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

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

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

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

Soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*6*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*8*). Unless otherwise stated, colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

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

Altoga series

The Altoga series consists of deep, well drained, loamy soils on the breaks of high terraces. The soils formed in calcareous ancient alluvium. In most places, the soils parallel contemporary streams; but in some places, they parallel ancient streams. Slope ranges from 3 to 8 percent.

Typical pedon of Altoga silty clay loam, 3 to 5 percent slopes, eroded; from the intersection of Farm Roads 973 and 1660, at Rices Crossing (south of Taylor), 500 feet south on Farm Road 973, and 100 feet east, in a field:

Ap—0 to 6 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; strong fine granular structure; hard, friable; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 14 inches; brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; moderate fine granular structure; hard, friable; calcareous; moderately alkaline; gradual smooth boundary.

B2—14 to 46 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium granular and subangular blocky structure; hard, friable; few films and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3a—46 to 60 inches; brownish yellow (10YR 6/6) silty clay loam, yellowish brown (10YR 5/6) moist; weak fine granular structure; hard, friable; common coarse masses and few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—60 to 72 inches; very pale brown (10YR 7/4) silty clay loam, light yellowish brown (10YR 6/4) moist; structureless; hard, friable; large soft masses and few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges in thickness from 40 to 60 inches or more. Clay content decreases with depth. Calcium carbonate equivalent in the 10- to 40-inch control section is 40 to 60 percent.

The A horizon is 6 to 14 inches thick. It is very dark grayish brown, dark brown, brown, grayish brown, light brownish gray, pale brown, or light yellowish brown. If the A horizon is very dark grayish brown or dark brown, it is less than 10 inches thick.

The B horizon is brown, yellowish brown, light yellowish brown, light brownish gray, pale brown, brownish yellow, very pale brown, or yellow. It is silty clay, silty clay loam, or clay loam.

The C horizon is very pale brown or yellow. Layers of waterworn gravel and sand of limestone begin at a depth of 8 to 10 feet. These layers commonly are 8 to 12 feet thick. They rest on marine marl.

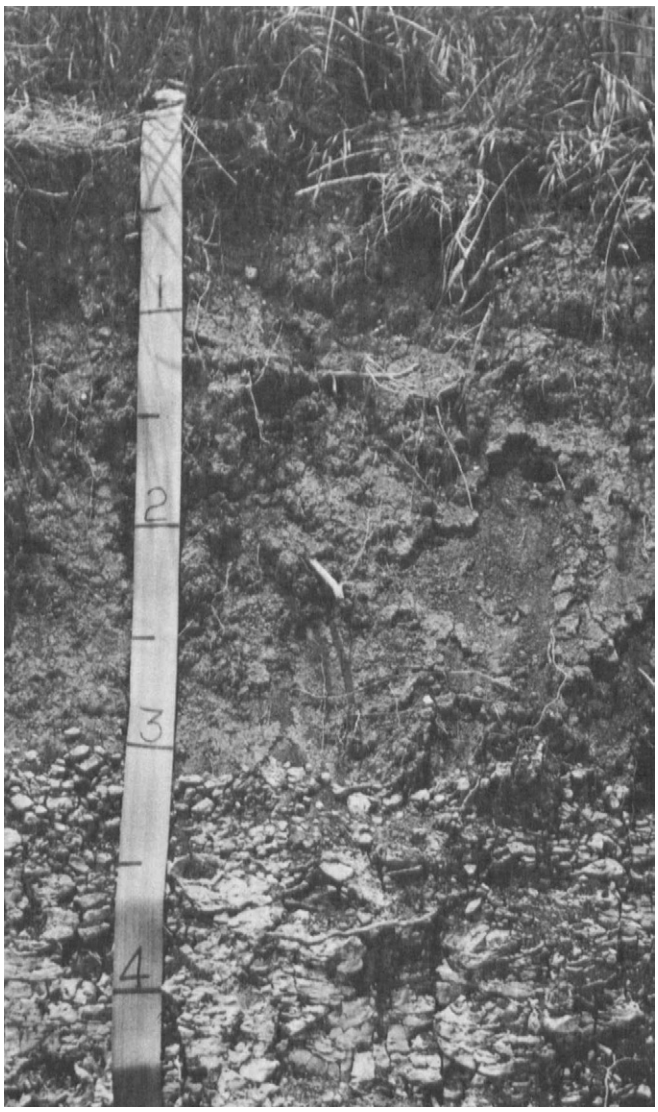


Figure 21.—Profile of Austin silty clay, 0 to 1 percent slopes, showing the underlying weakly cemented chalk and marl.

Austin series

This series consists of moderately deep, well drained, clayey soils on uplands. The soils formed in chalk and interbedded marl (fig. 21). Slopes are smooth and range from 0 to 5 percent.

Typical pedon of Austin silty clay, 1 to 3 percent slopes; from the junction of U.S. Business Highway 81 and Farm Road 971 in Georgetown, 1.5 miles east on Farm Road 971, 3.3 miles northeast on county road, and 100 feet south, in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; weak fine granular structure and subangular blocky; hard, firm; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 13 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, firm; few wormcasts; moderately alkaline; clear smooth boundary.

B21—13 to 25 inches; brown (10YR 5/3) silty clay, dark brown (10YR 4/3) moist; moderate fine subangular blocky structure; hard, firm; few fine fragments of

chalk; calcareous; moderately alkaline; clear smooth boundary.
B22—25 to 35 inches; yellowish brown (10YR 5/4) silty clay, dark yellowish brown (10YR 4/4) moist; moderate fine subangular blocky structure; hard, firm; few fragments of chalk from 1/8 to 1/4 inch across; calcareous; moderately alkaline; clear irregular boundary.
Cr—34 to 48 inches; white (10YR 8/2) chalk and marl, light gray (10YR 7/2) moist; dark colored loamy material in interstices.

The solum ranges from 20 to 40 inches in thickness.

The A horizon is very dark grayish brown, dark grayish brown, dark brown, or brown. It ranges from 10 to 19 inches in thickness.

The B horizon is brown, yellowish brown, or pale brown. It is silty clay or clay. It is 40 to 70 percent by weight calcium carbonate.

The Cr horizon is white, light gray, very pale brown, or brownish yellow.

Axtell series

The Axtell series consists of deep, moderately well drained, loamy soils on uplands. The soils formed in clayey marine sediment (fig. 22). Slopes range from 0 to 5 percent.

Typical pedon of Axtell fine sandy loam, 2 to 5 percent slopes, eroded; from the intersection of Farm Road 112 and county road at Shiloh (southeast of Taylor), 25 miles south on county road, and 50 feet east, in a pasture:

A1—0 to 4 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; moderate fine granular structure; very hard, friable; slightly acid; abrupt wavy boundary.
B21t—4 to 12 inches; red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; few fine yellowish brown mottles; moderate medium blocky structure; prominent clay skins; extremely hard, very firm; strongly acid; gradual wavy boundary.
B22t—12 to 44 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; common fine and medium gray and reddish yellow mottles; weak medium and coarse blocky structure; extremely hard, very firm; strongly acid; gradual wavy boundary.
C—44 to 60 inches; mottled light gray (10YR 7/2) and brownish yellow (10YR 6/6) silty clay, stratified at irregular intervals with very pale brown (10YR 7/4) sandy loam; massive; extremely hard, very firm; mildly alkaline.

The solum ranges from 40 to 60 inches in thickness. When dry, these soils have cracks 0.4 inch or more wide in the upper part of the subsoil.

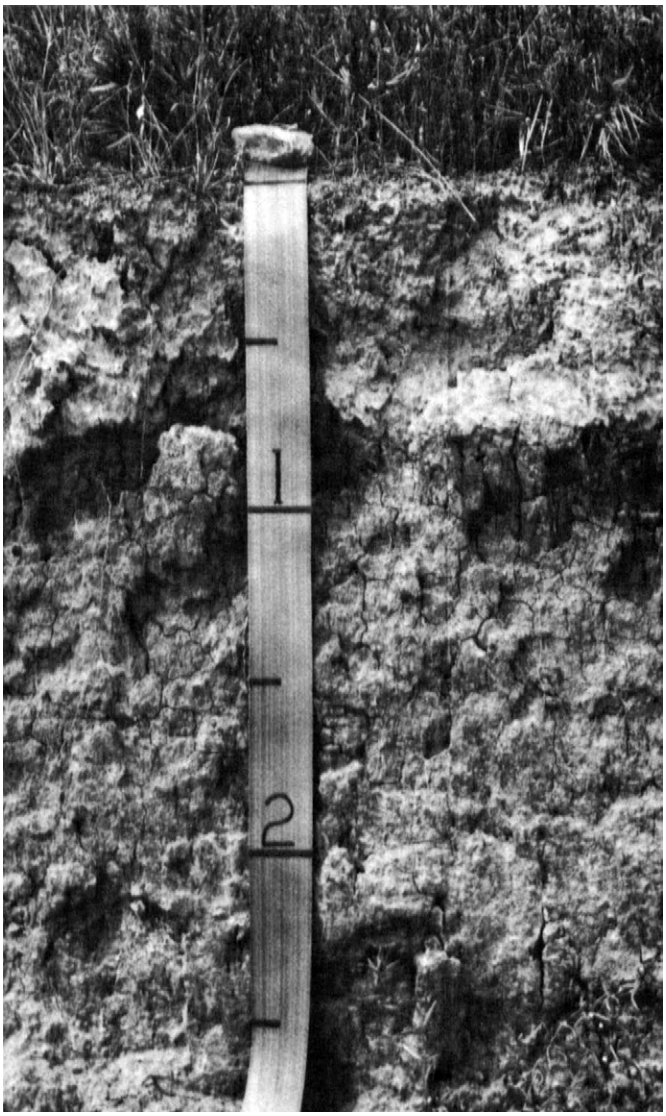


Figure 22.—Profile of Axtell fine sandy loam, 0 to 3 percent slopes. This soil has a light-colored, loamy surface layer and a blocky clayey subsoil.

The A horizon is brown, grayish brown, or very pale brown. The A2 horizon, where present, is slightly lighter colored than the A1 horizon. The plow layer in eroded areas is reddish and yellowish as a result of the mixing of the A and Bt horizons. Reaction ranges from slightly acid to strongly acid. Thickness ranges from 4 to 15 inches. The surface layer is thin mainly on slopes of 3 percent or more in areas that have been cultivated.

The Bt horizon is red, reddish brown, yellowish red, light reddish brown, or reddish brown. Texture is clay or

sandy clay. The horizon is mottled in shades of red, brown, and yellow in some pedons. Reaction is very strongly acid or strongly acid in the upper part and strongly acid to neutral in the lower part.

The C horizon is sandy clay loam, silty clay, or weakly consolidated sandstone interbedded with partially weathered shale. The horizon is mottled in shades of red, brown, gray, and yellow. Reaction ranges from neutral to moderately alkaline.

Behring series

The Behring series consists of deep, moderately well drained, loamy soils on uplands. The soils formed in shaly clay. Slopes range from 1 to 5 percent.

Typical pedon of Behring clay loam, 3 to 5 percent slopes, eroded; from the intersection of Texas Highway 95 and Farm Road 1466 in Coupland, 2 miles east on Farm Road 1466, 3.9 miles southeast on county road, and 100 feet north, in a pasture:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; noncalcareous; mildly alkaline; clear smooth boundary.

A12—4 to 30 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm; noncalcareous; mildly alkaline; clear wavy boundary.

B2—30 to 42 inches; light olive brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; weak coarse blocky structure; extremely hard, very firm; few fine concretions of calcium carbonate; noncalcareous; moderately alkaline; clear wavy boundary.

C—42 to 60 inches; mottled light gray (10YR 7/2) and brownish yellow (10YR 6/6) shaly clay; massive; extremely hard, very firm; few fine concretions of calcium carbonate and gypsum crystals; noncalcareous; moderately alkaline.

The solum ranges in thickness from 35 to 45 inches. When dry these soils have cracks 0.4 inch or more wide in the upper part.

The A11 horizon is 4 to 10 inches thick. It is dark grayish brown, dark brown, or grayish brown. In cultivated areas, the surface layer is slightly lighter colored and has a thin crust when dry. This horizon is neutral to moderately alkaline. The A12 horizon is very dark grayish brown, dark grayish brown, or dark brown.

The B2 horizon in places is light yellowish brown, olive brown, light olive brown, grayish brown, or pale yellow. It is calcareous in the lower part. Thickness ranges from 12 to 24 inches.

The C horizon is clay, silty clay loam, or shaly clay, and in places it is stratified. It is light brownish gray, brownish yellow, yellow, grayish brown, light brownish gray, light yellowish brown, olive yellow, light olive brown, or light gray. The C horizon is mottled in two or three of these colors, and in places, it has a yellowish or brownish matrix and mottles of the other colors. In places, it has few to common fine concretions of calcium carbonate and gypsum crystals.

Brackett series

This series consists of shallow, well drained, loamy soils on uplands. The soils formed in interbedded limestone and marl. Slopes range from 3 to 30 percent.

Typical pedon of Brackett clay loam, 3 to 16 percent slopes; from junction of Ranch Roads 2338 and 970 in Andice (northwest of Georgetown), 1.9 miles north on Ranch Road 970, 1.5 miles north on county road, and 100 feet east, in a pasture:

A—0 to 5 inches; pale brown (10YR 6/3) gravelly clay loam, brown (10YR 5/3) moist; moderate fine and very fine granular and subangular blocky structure; hard, firm; many grass roots; few wormcasts of lighter colors from soil material below; about 15 percent, by volume, limestone fragments 3 to 10 millimeters in diameter; fragments are common on the surface; calcareous; moderately alkaline; clear wavy boundary.

B2—5 to 16 inches; pale yellow (2.5Y 7/4) clay loam, light yellowish brown (2.5Y 6/4) moist; moderate very fine subangular blocky structure; hard, friable; few fine roots; about 5 percent, by volume, weakly cemented limestone fragments that are 3 to 10 millimeters in diameter; few soft masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Cr—16 to 60 inches; very pale brown (10YR 8/4) loam, very pale brown (10YR 7/4) moist; interbedded with weakly cemented platy limestone.

The A horizon is light brownish gray, brown, grayish brown, pale brown, or very pale brown. It is clay loam, gravelly clay loam, or gravelly silty clay loam. It is 3 to 11 inches thick.

The B2 horizon is very pale brown, pale brown, brown, pale yellow, light brownish gray, light yellowish brown, or grayish brown. It is clay loam, loam, gravelly clay loam, or gravelly loam.

The Cr horizon is calcareous loam or silt loam that is interbedded with weakly and strongly cemented limestone. In some places, this horizon is limestone interbedded with silty shale or marl.

Branyon series

The Branyon series consists of deep, moderately well drained, clayey soils on ancient stream terraces. The soils formed in clayey sediment. Slopes are mostly less than 1 percent and range to 3 percent.

Typical pedon of Branyon clay, 0 to 1 percent slopes; from the intersection of Texas Highway 95 and county road in Granger, 0.5 mile northwest on county road, and 50 feet south, in a field:

Ap—0 to 6 inches, dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine subangular blocky and granular structure; extremely hard, very firm; moderately alkaline; abrupt smooth boundary.

A11—6 to 30 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm; few concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

A12—30 to 44 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate medium subangular blocky structure; extremely hard, very firm; many concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

AC—44 to 60 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist, gray and dark gray streaks throughout; moderate medium subangular blocky structure; prominent slickensides; extremely hard, very firm; many concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

C—60 to 72 inches; light gray (10YR 7/2) silty clay, light brownish gray (10YR 6/2) moist; common fine yellow (10YR 7/8) mottles; massive; extremely hard, very firm; many soft masses and concretions of calcium carbonate; moderately alkaline.

The solum ranges from 60 to 72 inches in thickness. The soil has chroma of less than 1.5 to a depth of 38 inches or more. When dry, cracks 1 inch to 3 inches wide extend to a depth of 20 to 60 inches or more.

The A horizon is dark gray or very dark gray in the upper part and gray or dark gray in the lower part. It ranges in thickness from 25 to 60 inches.

The AC horizon is gray, grayish brown, dark grayish brown, pale brown, very pale brown, or light brownish gray. Darker streaks of material from the A horizon and lighter colored splotches of material from the C horizon are common.

The C horizon is clay, silty clay, or silty clay loam. Water-bearing gravel and sand are at a depth of 15 to 25 feet in most places.

Burleson series

The Burleson series consists of deep, moderately well drained, clayey soils on ancient stream terraces. The soils formed in clayey sediment. Slopes range from 0 to 3 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of a county road and U.S. Highway 79 in Thrall, 0.7 mile northwest on the county road, 0.5 mile east on private field road, and 50 feet south, in a field:

Ap—0 to 8 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; upper part is a massive, packed crust 1/4 to 1/2 inch thick, lower part has strong fine subangular blocky structure; extremely hard, very firm; noncalcareous; mildly alkaline; abrupt smooth boundary.

A11—8 to 22 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate medium subangular blocky structure; extremely hard, very firm; noncalcareous; mildly alkaline; gradual wavy boundary.

A12—22 to 58 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few medium gray (10YR 6/1) mottles in the lower part; medium subangular blocky structure; common slickensides and shiny pressure faces; extremely hard, very firm; few concretions of calcium carbonate 2 to 5 millimeters in diameter; few fine chert pebbles; noncalcareous; mildly alkaline; gradual wavy boundary.

AC—58 to 64 inches; gray (10YR 6/1) clay, gray (10YR 5/1) moist; darker streaks and splotches from overlying horizons; weak subangular blocky structure; intersecting slickensides and shiny pressure faces; extremely hard, very firm; few concretions of calcium carbonate; noncalcareous; mildly alkaline.

In virgin areas, these soils have a gilgai microrelief. The microknolls are 3 to 10 inches higher than the microdepressions; the distance between the center of a microknoll and the center of a microdepression is 5 to 15 feet. When the soils are dry, cracks 1 inch to 3 inches wide extend to a depth of 25 to 60 inches. The boundary of the A and AC horizons is cyclic. Combined, the A and AC horizons are 40 to 60 inches thick. In most places, they exceed 48 inches in thickness.

The A horizon is very dark gray, dark gray, or gray. It is 6 to 20 inches thick on the microknolls and 20 to 50 inches thick in the microdepressions. Reaction is medium acid to moderately alkaline.

The AC horizon is dark gray, gray, or light brownish gray. It is clay or silty clay, mildly alkaline or moderately alkaline, and calcareous or noncalcareous.

In some places, there is a calcareous C horizon below a depth of 40 inches.

Castephen series

This series consists of shallow, well drained, clayey soils on uplands. The soils formed in interbedded chalk and marl. Slopes range from 1 to 5 percent.

Typical pedon of Castephen silty clay, 1 to 3 percent slopes; from the junction of Texas Highway 418 and Farm Road 971 in Georgetown, 1.2 miles east on Farm

Road 971, 3 miles northeast on County Road 152, and 300 feet north, in a pasture:

Ap—0 to 8 inches; dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, firm; common fine roots; few fine chalk fragments; calcareous; moderately alkaline; clear smooth boundary.

A12—8 to 16 inches; dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; common fragments of chalk 1/8 inch to 3 inches across; calcareous; moderately alkaline; abrupt smooth boundary.

Cr—16 to 22 inches; very pale brown (10YR 7/4) interbedded chalk and loamy marl, light yellowish brown (10YR 6/4) moist.

The solum ranges from 8 to 20 inches in thickness. Calcium carbonate equivalent averages 40 to 70 percent. Fragments of chalk range from 2 to 35 percent by volume.

The A horizon is dark brown, brown, dark grayish brown, or very dark grayish brown. It ranges in thickness from 11 to 18 inches. Silicate clay content ranges from 21 to 35 percent. Texture is silty clay, silty clay loam, and clay loam.

The Cr horizon is chalk or chalky limestone that is interbedded with marl and limy earth.

Crawford series

The Crawford series consists of moderately deep, well drained, clayey soils on uplands. The soils formed in clayey sediment on strongly and weakly cemented limestone. Slopes range from 0 to 4 percent.

Typical pedon of Crawford clay, 1 to 3 percent slopes; from junction of Farm Roads 970 and 2338, 0.5 mile east on Farm Road 970, 0.5 mile east on county road, and 100 feet north, in a pasture:

Ap—0 to 6 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; weak very fine angular blocky structure; very hard, firm; few fine pebbles of chert; neutral; clear smooth boundary.

A11—6 to 14 inches; dark reddish brown (5YR 3/2) clay, dark reddish brown (5YR 2/2) moist; moderate medium angular blocky structure; extremely hard, very firm; shiny faces of peds; neutral; gradual wavy boundary.

A12—14 to 27 inches; dark reddish brown (5YR 3/2) clay, dark reddish brown (5YR 2/2) moist; moderate to strong medium blocky structure; extremely hard, very firm; few intersecting slickensides; shiny pressure faces; few fragments of limestone; neutral; abrupt irregular boundary.

R—27 to 30 inches; grayish white, fractured limestone that has reddish brown clay in fractures and fine crevices.

The solum ranges from 20 to 40 inches in thickness. When dry, these soils have cracks 0.4 inch to 2 inches wide that extend to a depth of 20 inches or more.

The A horizon is brown, dark reddish brown, dark brown, reddish brown, or very dark brown. In most places, the color becomes more reddish as depth increases. Texture is clay or silty clay.

The R horizon is finely to coarsely fractured limestone or limestone that is interbedded with weakly consolidated limy material.

Crockett series

The Crockett series consists of deep, moderately well drained, loamy soils on uplands. The soils formed in calcareous marine marls and shales. Slopes range from 1 to 5 percent.

Typical pedon of Crockett fine sandy loam, 2 to 5 percent slopes, eroded; from junction of Farm Roads 112 and 486 at Shiloh (southeast of Taylor), 1.9 mile south on county road, and 100 feet north, in a pasture:

A1—0 to 4 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; strong fine granular structure; very hard, friable; slightly acid; abrupt wavy boundary.

B21t—4 to 18 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine and medium reddish brown (5YR 5/4) mottles; weak medium and coarse blocky structure; few streaks of material from overlying horizon in filled cracks; extremely hard, very firm; neutral; gradual wavy boundary.

B22t—18 to 40 inches; olive gray (5Y 5/2) clay, olive gray (5Y 4/2) moist; few fine reddish brown (5YR 5/4) mottles; weak medium and coarse blocky structure; few streaks from overlying horizons in filled cracks; extremely hard, very firm; noncalcareous; mildly alkaline; gradual wavy boundary.

B3—40 to 52 inches; brownish yellow (10YR 6/6) clay, yellowish brown (10YR 5/6) moist; common fine reddish brown (5YR 5/4) mottles; weak coarse blocky structure; extremely hard, very firm; noncalcareous; mildly alkaline; gradual wavy boundary.

Cca—52 to 60 inches; brownish yellow (10YR 6/6) silty clay, yellowish brown (10YR 5/6) moist; common fine reddish brown (5YR 5/4) mottles; massive; extremely hard, very firm; common concretions of calcium carbonate, mainly concentrated in a zone 2 inches thick at the top of this horizon; calcareous; moderately alkaline.

The solum ranges from 40 to 55 inches in thickness. Alkalinity increases with depth, and in places, calcium carbonate or gypsum has accumulated in the B3 and Cca horizons. When dry, these soils have cracks 0.4 inch or more wide in the upper part of the subsoil.

The A horizon is 4 to 9 inches thick. It is brown, light brown, dark grayish brown, dark brown, grayish brown, or light yellowish brown. This horizon is slightly acid to mildly alkaline.

The Bt horizons are mottled in shades of red, brown, yellow, or gray. Matrix colors are grayish brown, olive gray, reddish brown, brown, dark yellowish brown, brown, yellowish brown, light yellowish brown, brownish yellow, or yellow.

The C horizon is mottled silty clay or shaly clay that is stratified in part. Mottles are mainly yellowish, brownish, or grayish.

Deleon series

The Deleon series consists of deep, moderately well drained, loamy soils on flood plains of streams. The soils formed in clayey and loamy alluvium. The areas are long and narrow, and they parallel shallow drainageways. Slopes are 0 to 1 percent.

Typical pedon of Deleon clay loam, frequently flooded; from the junction of Farm Roads 619 and 1466 near Beyersville (south of Taylor), 1.6 miles southeast on Farm Road 619, 0.9 mile south on county road, 0.25 mile south on private road, and 0.25 mile east, on bottom land:

A11—0 to 30 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; noncalcareous; mildly alkaline; abrupt smooth boundary.

A12—30 to 40 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and subangular blocky structure; hard, friable; noncalcareous; mildly alkaline; abrupt smooth boundary.

C—40 to 60 inches; light olive brown (2.5Y 5/4) silty clay loam, olive brown (2.5Y 4/4) moist; massive; hard, friable; few fine concretions of calcium carbonate in the lower part; matrix noncalcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness. When dry, this soil has cracks 1/2 to 1 inch wide that extend to a depth of 20 inches or more.

The A horizon is very dark gray, dark grayish brown, or dark brown. Below a depth of about 10 inches it is silty clay loam or clay loam. In some places, strata of lighter colored, sandier material are below a depth of 40 inches. Reaction of the A horizon is mildly to moderately alkaline.

The B2 horizon, where present, is about 1 unit of value higher in color.

The C horizon is light olive brown, grayish brown, or very pale brown. It is clay loam, sandy clay loam, clay, or clay loam. In most places, this horizon is stratified with sandy material.

Demona series

The Demona series consists of deep, moderately well drained, sandy soils on uplands. The soils formed in sandy and clayey sediments. Slopes range from 1 to 5 percent.

Typical pedon of Demona loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Roads 112 and 486 at Shiloh (southeast of Taylor), 2.3 miles south and 1.9 miles west on county roads, 0.5 mile north on another county road, and 50 feet east, in a pasture:

A1—0 to 14 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; slightly hard, friable; neutral; abrupt smooth boundary.

A2—14 to 22 inches; very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose, friable; neutral; abrupt wavy boundary.

B21t—22 to 49 inches; brownish yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common fine and medium red (2.5YR 4/6) and few fine gray (10YR 6/1) mottles; weak coarse blocky structure; very hard, very firm; neutral; gradual wavy boundary.

B22t—49 to 54 inches; mottled brownish yellow (10YR 6/6) and light gray (10YR 7/2) sandy clay; common fine and medium red (2.5YR 4/6) mottles; weak coarse blocky structure; neutral; gradual wavy boundary.

C—54 to 60 inches; light gray (10YR 7/2) clay loam, light brownish gray (10YR 6/2) moist; common fine red and yellowish red mottles; massive; very hard, very firm; neutral.

The solum is more than 50 inches thick.

The A horizon is 20 to 40 inches thick. It is brown, light brown, reddish yellow, light brownish gray, light yellowish brown, pale brown, very pale brown, or grayish brown. The lighter colors are mainly in the lower part of the horizon. Reaction is medium acid to mildly alkaline.

The Bt horizon is clay or sandy clay that is reddish brown, light gray, red, reddish yellow, light yellowish brown, brownish yellow, or yellow. In most places, the upper part of this horizon is strongly mottled in these colors; the lower part has a distinct matrix color and common mottles. Reaction is medium acid to neutral.

The C horizon is grayish and yellowish sandy clay loam or clay loam.

Denton series

The Denton series consists of moderately deep, well drained, clayey soils on uplands. The soils formed in clayey material and underlying limestone in shallow valleys in the western part of the county. Slopes range from 0 to 5 percent.

Typical pedon of Denton silty clay, 1 to 3 percent slopes; from the junction of Texas Highway 195 and Farm Road 970 in Florence, 2 miles west and south on Farm Road 970, and 200 feet west, in a field:

Ap—0 to 6 inches; dark brown (7.5YR 3/2) silty clay, very dark brown (7.5YR 2/2) moist; moderate medium and fine granular structure and subangular blocky; hard, firm; calcareous; moderately alkaline; clear smooth boundary.

A11—6 to 18 inches; dark brown (7.5YR 4/2) silty clay, dark brown (7.5YR 3/2) moist; moderate medium and fine subangular blocky structure; hard, firm, sticky and plastic; common fine and medium pores; few vertical streaks, apparently of material from the Ap horizon; few fine fragments of limestone; calcareous; moderately alkaline; gradual boundary.

A12—18 to 33 inches; dark brown (10YR 4/3) silty clay, dark brown (10YR 3/3) moist; moderate medium and fine angular blocky structure; very hard, firm, sticky and plastic; common dark streaks; few limestone fragments; few concretions of calcium carbonate in lower part; calcareous; moderately alkaline; clear boundary.

Cca—33 to 36 inches; very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) moist; massive; about 30 percent, by volume, limestone pebbles; hard, firm, slightly sticky and plastic; common concretions of calcium carbonate; common soft masses of calcium carbonate; calcareous; moderately alkaline; abrupt irregular boundary.

R—36 to 38 inches; indurated limestone that is interbedded with calcareous silt loam material.

The solum ranges from 22 to 40 inches in thickness. When dry, these soils have cracks 0.4 inch or more wide in the upper 20 inches.

The A horizon is brown, dark brown, dark yellowish brown, or dark grayish brown.

The B horizon, where present, is 3 to 15 inches thick. It is light yellowish brown, brown, or yellowish brown. Texture is clay, silty clay, or silty clay loam.

The underlying material consists mainly of indurated limestone. In places, this horizon has interbedded marl and limy earth.

Doss series

The Doss series consists of shallow, well drained, clayey soils on uplands. The soils formed in limy earth interbedded with weakly cemented limestone. Slopes range from 1 to 5 percent.

Typical pedon of Doss silty clay, 1 to 5 percent slopes; from the intersection of Interstate 35 and Texas Highway 195, 2 miles northwest on Texas Highway 195, 1,300 feet east on county road, 600 feet north on another county road, and 100 feet east, in a field:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine pores; few fragments of weakly cemented limestone up to 3 inches across that are partly coated with weakly cemented calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B2ca—9 to 19 inches; brown (7.5YR 5/4) silty clay loam, dark brown (7.5YR 4/4) moist; moderate fine and medium subangular blocky structure; hard, firm; common fine pores; common insect tunnels; common fine weakly cemented masses of calcium carbonate; few fragments of limestone up to 3 inches across; calcareous; moderately alkaline; clear smooth boundary.

Cr—19 to 36 inches; pale yellow (2.5Y 7/4) silty clay loam that is interbedded with indurated limestone fragments 1/2 inch to 3 inches across, light yellowish brown (2.5Y 6/4) moist; many soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 11 to 20 inches thick. Fragments of limestone that are 1 inch to 6 inches across cover up to 15 percent of the surface.

The A horizon is dark grayish brown, very dark grayish brown, or dark brown. It ranges from 5 to 9 inches in thickness.

The Bca horizon is brown, yellowish brown, dark yellowish brown, or dark brown. Texture is silty clay, silty clay loam, or clay loam. Concretions and fragments of limestone make up 1 to about 15 percent of the volume of the horizon.

The Cr horizon is very pale brown, light gray, white, pale yellow, or light yellowish brown limy earth that is interbedded with indurated fragments of limestone.

Eckrant series

The Eckrant series consists of shallow and very shallow, well drained, stony and clayey soils on uplands. The soils formed in clayey material on indurated limestone. Slopes range from 1 to 30 percent.

Typical pedon of Eckrant extremely stony clay, 0 to 3 percent slopes; from the intersection of Interstate 35 and Ranch Road 2338 in Georgetown, 2 miles northwest on Ranch Road 2338, and 300 feet north, in rangeland:

A11—0 to 4 inches; very dark gray (10YR 3/1) extremely stony clay, black (10YR 2/1) moist; limestone, cobbles, and stones cover approximately 25 percent of the surface; moderate fine subangular blocky and granular structure; hard, firm; few fine and medium roots; about 20 percent, by volume, limestone pebbles, cobbles, and stones; calcareous; moderately alkaline; clear irregular boundary.
A12—4 to 11 inches; very dark gray (10YR 3/1) extremely stony clay, black (10YR 2/1) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; about 40 percent limestone pebbles, cobbles, and stones; calcareous; moderately alkaline; abrupt wavy boundary.
R—11 to 16 inches; coarsely fractured, indurated limestone.

The solum ranges from 5 to 20 inches in thickness. Limestone fragments cover about 10 to 60 percent of the surface.

The fine-earth fraction of the A horizon is clay, silty clay, or clay loam. Pebbles, cobbles, and stones make up 35 to 80 percent of the matrix. Texture is cobbly clay or extremely stony clay. Colors are very dark gray, very dark brown, very dark grayish brown, or dark brown.

The R layer is whitish or grayish, fractured indurated limestone.

Eddy series

The Eddy series consists of very shallow and shallow, well drained, gravelly and loamy soils on uplands. The soils formed in soft marine chalk (fig. 23). Slopes range from 0 to 8 percent.

Typical pedon of Eddy very gravelly clay loam, 3 to 8 percent slopes; from junction of U.S. Highway 79 and Interstate 35 in Round Rock, 4.5 miles east on U.S. 79, 0.9 miles south on county road, and 100 feet east, in a pasture:

A11—0 to 2 inches; grayish brown (10YR 5/2) very gravelly clay loam, dark grayish brown (10YR 4/2) moist; about 35 percent of surface is covered with angular chalk pebbles; hard, friable; moderately alkaline; abrupt smooth boundary.
A12—2 to 6 inches; grayish brown (10YR 5/2) very gravelly clay loam, dark grayish brown (10YR 4/2) moist; about 50 percent, by volume, pebbles of angular, weakly cemented white chalk; fine-earth fraction decreases with depth; hard, friable; moderately alkaline; abrupt wavy boundary.
Cr—6 to 18 inches; white (10YR 8/2) chalk; hard but breakable with a spade; hardness ranges almost up to 3 (Mohs' scale) in the lower part.

The A horizon is light brownish gray and grayish brown. Thickness ranges from 4 to 14 inches. Chalk fragments range from a few to about 50 percent in the upper part and from 35 to 75 percent in the lower part. Hardness of the chalk substratum ranges from about 1 to 3 on Mohs' scale and increases with depth.

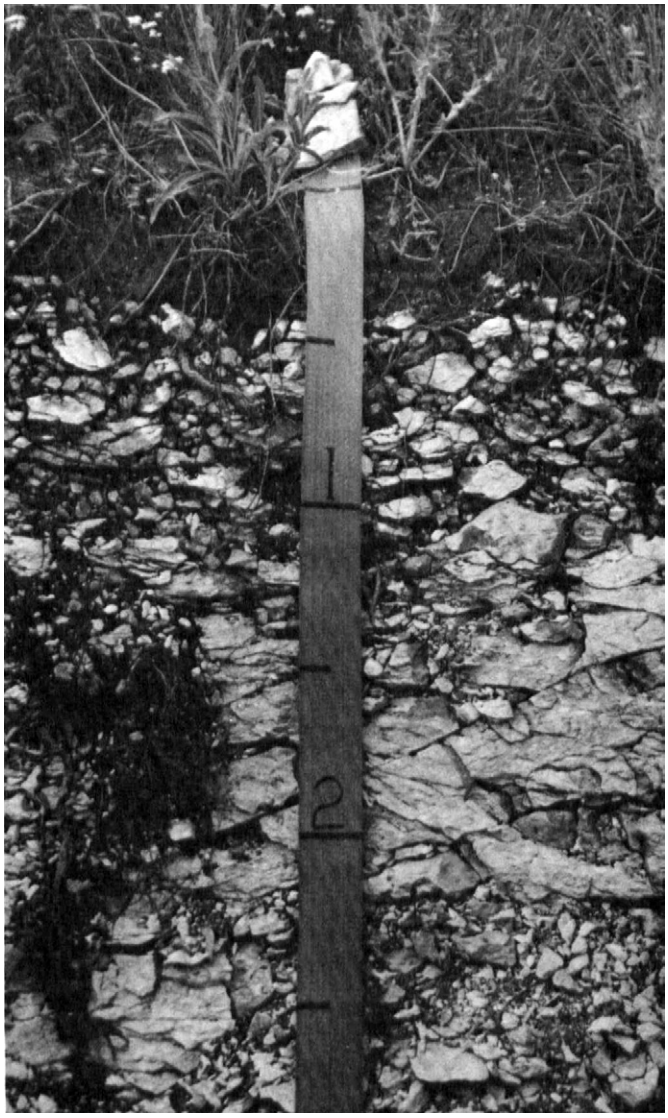


Figure 23.—Profile of Eddy very gravelly clay loam, 0 to 3 percent slopes. This soil has a thin surface layer that is underlain by chalk.

Fairlie series

This series consists of deep, moderately well drained, clayey soils on uplands. The soils formed in interbedded limy material and weakly cemented limestone. Slopes range from 0 to 4 percent.

Typical pedon of Fairlie clay, 1 to 2 percent slopes; from Leander (southwest of Georgetown), 1 mile west on Ranch Road 2243, 1.4 miles southeast on county road, and 100 feet west, in a field:

A11—0 to 8 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine subangular blocky structure; extremely hard, very firm; calcareous; moderately alkaline; abrupt smooth boundary.
A12—8 to 21 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium subangular blocky structure; very hard, very firm; few slickensides in lower part; calcareous; moderately alkaline; gradual wavy boundary.
AC1—21 to 38 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate fine angular blocky structure; common intersecting slickensides and shiny surface on peds; streaks of dark gray in filled cracks; very hard, very firm; calcareous; moderately alkaline; gradual wavy boundary.
AC2—38 to 46 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine angular blocky structure; common intersecting slickensides and shiny surface on peds; very hard, very firm; calcareous; moderately alkaline; clear smooth boundary.
Cr—46 to 54 inches; yellowish brown (10YR 5/4) weakly cemented limestone interbedded with limy material, pale yellow (2.5Y 8/4) moist.

The solum ranges from 40 to 60 inches in thickness. When dry, the soils have cracks ranging from 0.4 inch to 3 inches in width that extend to a depth of more than 24 inches. These are cyclic soils, and in undisturbed areas, gilgai microrelief consists of microknolls 4 to 12 inches higher than microdepressions; the distance between the center of a knoll and the center of a depression is 5 to 12 feet.

The A horizon is very dark gray, dark gray, or black. It ranges in thickness from 20 to 40 inches.

The AC horizon is dark gray, gray, dark grayish brown, or grayish brown. In places, the soil has a few rounded, dark concretions that are probably ferromanganese. Streaks of darker material from the A horizon are common in filled cracks.

The Cr horizon is weakly to strongly cemented limestone or somewhat weathered limestone that is interbedded with marl or other limy earth. Hardness is about 2 or 3 on the Mohs' scale.

Ferris series

The Ferris series consists of deep, well drained, clayey soils on uplands. The soils formed in marine clays and marls. Slopes range from 5 to 30 percent.

Typical pedon of Ferris clay, in an area of Ferris-Heiden complex, 5 to 20 percent slopes, severely eroded; from the intersection of Texas Highway 95 and Farm Road 1466 at Coupland (south of Taylor), 1.1 miles east on Farm Road 1466, and 400 feet north, in a pasture:

A—0 to 8 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm; calcareous; moderately alkaline; clear wavy boundary.
AC—8 to 34 inches; mottled grayish brown (2.5Y 5/2) and olive yellow (2.5Y 6.6) clay; moderate medium and coarse subangular blocky structure; shiny surface on peds and common slickensides; extremely hard, very firm; calcareous; moderately alkaline; gradual wavy boundary.
C—34 to 60 inches; light brownish gray (2.5Y 6/2) shaly clay, grayish brown (2.5YR 5/2) moist; many streaks and splotches of reddish yellow along rock seams; coarse blocky rock structure; extremely hard, very firm; calcareous; moderately alkaline.

The solum ranges from 30 to about 50 inches in thickness. When dry, these soils have cracks that extend to a depth of more than 20 inches.

The A horizon generally is 6 to 10 inches thick; in a few places it extends to a depth of 16 inches. It is dark grayish brown, grayish brown, light olive brown, or light olive gray.

The AC horizon is light olive brown, light brownish gray, light yellowish brown, pale olive, olive yellow, or light olive gray, or it is mottled with two or more of these colors.

The C horizon is silty clay or shaly clay and is yellow, light olive brown, light brownish gray, light yellowish brown, pale yellow, or yellow. In most places, this horizon is mottled with two or more colors.

Georgetown series

This series consists of moderately deep, well drained, loamy and stony soils on uplands. The soils formed in clayey material over indurated limestone. Slopes range from 0 to 3 percent.

Typical pedon of Georgetown clay loam, 0 to 2 percent slopes; from Williamson County Courthouse in Georgetown, 1 mile south-southwest and about 1,000 feet southwest of West Side Intermediate School, in rangeland:

A—0 to 7 inches; brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky and granular structure; hard, firm; few fine roots; few fragments of chert; slightly acid; clear smooth boundary.

B21t—7 to 18 inches; reddish brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) moist; moderate fine blocky structure; very hard, very firm; few fine roots; few fine pores; clay films on faces of peds; few fragments of chert; neutral; abrupt wavy boundary.

B22t—18 to 35 inches; reddish brown (5YR 5/4) cobbly clay, reddish brown (5YR 4/4) moist; moderate fine and very fine blocky structure; very hard, firm; common fine roots; estimated 25 percent, by volume, limestone and chert fragments 1 inch to 4 inches in diameter; clay films on peds; slightly acid; abrupt wavy boundary.

R—35 to 47 inches; fractured limestone that has brownish and pinkish silty clay loam in interstices and crevices.

The solum ranges from 20 to 40 inches in thickness. The A horizon is very dark brown, very dark grayish brown, dark grayish brown, reddish brown, or brown. It ranges from 5 to 11 inches in thickness. It is clay loam or stony clay loam. Stone-sized limestone fragments make up less than 3 percent of the surface.

The Bt horizon is red, reddish brown, dark reddish brown, yellowish red, brown, or reddish yellow. It is clay, stony clay, or cobbly clay; the clay content in the fine earth fraction ranges from 60 to 80 percent. Coarse fragments increase with depth and make up 2 to 35 percent of the volume.

The R layer is indurated or strongly cemented limestone. In some places, the limestone is interbedded with limy earth.

Heiden series

The Heiden series consists of deep, well drained, clayey soils on uplands. The soils formed in marine clays and shales. Slopes range from 5 to 30 percent.

Typical pedon of Heiden clay, 5 to 8 percent slopes, eroded; from Thrall (east of Taylor), 3 miles east on U.S. Highway 79, 2 miles north and east on county road, 1 mile south and east on another county road, and 200 feet north, in a field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong fine subangular blocky and granular structure; extremely hard, very firm; calcareous; moderately alkaline; abrupt smooth boundary.

A11—8 to 22 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; extremely hard, very firm; calcareous; moderately alkaline; gradual wavy boundary.

AC—22 to 44 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine and medium olive yellow mottles; moderate medium subangular blocky structure; extremely hard, very firm; shiny surface on peds and prominent slickensides; calcareous; moderately alkaline; gradual wavy boundary.

C—44 to 60 inches; pale olive (5Y 6/4) shaly clay, olive (5Y 5/4) moist; scattered fine reddish yellow and yellow mottles; platy rock structure; extremely hard, very firm; calcareous; moderately alkaline.

Combined thickness of the A and AC horizons ranges from 40 to 65 inches. The horizons are thinnest on microknolls and thickest in microdepressions. When dry, this soil has cracks 0.4 inch to 4 inches wide that extend to a depth of 20 inches. The A horizon is very dark grayish brown, dark grayish brown, grayish brown, or dark gray. In places where the surface layer is dark gray, it generally is 8 to 10 inches thick. Texture is clay or extremely stony clay.

The AC horizon is grayish brown, light olive brown, or light yellowish brown. Mottles are olive yellow, pale yellow, yellow, or olive. Texture is clay or silty clay.

The C horizon is clay or shaly clay. It is dominantly olive or pale olive and is mottled with yellow, light brownish gray, light yellowish brown, light olive brown, olive yellow, pale yellow, yellow, olive, or pale olive.

Houston Black series

The Houston Black series consists of deep, moderately well drained, clayey soils on uplands. The soils formed in marine silty clays and shales. Slopes range from 0 to 5 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes; from Hoxie (northeast of Taylor), 1.8 miles southwest on county road, 1 mile southeast on another county road, and 200 feet north, in a field:

Ap—0 to 6 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine and medium subangular blocky and granular structure; extremely hard, very firm; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 32 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; extremely hard, very firm; few chert pebbles; calcareous; moderately alkaline; gradual wavy boundary.

AC1—32 to 54 inches; dark grayish brown (2.5Y 4/2) clay, very dark grayish brown (2.5Y 3/2) moist; many streaks of dark gray in filled cracks; few fine yellow (2.5Y 7/8) mottles; prominent slickensides and shiny surface on peds; few chert pebbles; moderate medium subangular blocky structure; extremely hard, very firm; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC2—54 to 62 inches; grayish brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; common fine yellow mottles and a few coarse splotches of dark grayish brown; weak blocky structure; moderately alkaline.

Thickness of the combined A and AC horizons is 60 to 100 inches or more. When the soil is dry, cracks range from 0.4 inch to 4 inches in width and extend to a depth of 20 inches or more. In virgin areas, the microknolls and microdepressions of the gilgai relief are repeated at intervals of 10 to 24 feet. Chroma is less than 1.5 to a depth of 30 to 60 inches in the center of microdepressions and 10 to 18 inches in the center of microknolls.

The A horizon is dark gray or very dark gray.

The AC1 horizon is grayish brown, dark grayish brown, brown, or light olive brown. It has common fine to medium grayish, yellowish, or olive mottles.

The AC2 horizon is dark grayish brown, light brownish gray, or grayish brown. Mottles are common to many and are olive or yellowish. Texture is clay, silty clay, or shale.

Krum series

The Krum series consists of deep, well drained, clayey soils on ancient high stream terraces. The soils formed in clayey sediment. Slopes range from 0 to 3 percent.

Typical pedon of Krum silty clay, 0 to 1 percent slopes; from the intersection of U.S. Highway 79 and Farm Road 1660 in Hutto (southeast of Georgetown), 2.9 miles south and east on Farm Road 1660, and 200 feet south, in a field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; compound moderate fine subangular blocky and moderate medium granular structure; hard, firm, sticky and plastic; common roots; few fine pores; few strongly cemented concretions of calcium carbonate up to 5 millimeters in diameter; few white flakes of calcium carbonate, some of which are fragments of snail shells; calcareous; moderately alkaline; clear smooth boundary.

A1—6 to 26 inches; very dark grayish brown (10YR 3/2) silty clay; very dark brown (10YR 2/2) moist; moderate very fine subangular blocky structure, few very fine angular blocky peds; hard, firm, sticky and plastic; few very fine weakly cemented concretions of calcium carbonate; few very fine whitish soft masses of calcium carbonate in the lower part; common roots; many fine pores; calcareous; moderately alkaline; gradual wavy boundary.

B2—26 to 44 inches; brown (7.5YR 5/4) silty clay, dark brown (7.5YR 4/4) moist; moderate medium angular blocky structure; shiny pressure faces; hard, very firm, sticky and plastic; darker soil material of the A horizon above extends to bottom of this layer along partly sealed cracks; few roots; common fine pores; few (less than 1 percent, by volume) weakly and strongly cemented concretions and fine powdery masses of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—44 to 62 inches; reddish yellow (7.5YR 6/6) silty clay, strong brown (7.5YR 5/6) moist; massive; hard, firm, sticky and plastic; few fine roots; about 5 percent, by volume, weakly and strongly cemented concretions and a few powdery masses of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

C—62 to 72 inches; reddish yellow (7.5YR 6/6) silty clay, strong brown (7.5YR 5/6) moist; massive; hard, firm, sticky and plastic; about 2 percent, by volume, weakly and strongly cemented concretions and powdery masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 38 to 60 inches thick. When dry, this soil has cracks 0.4 inch to 1.2 inches wide that extend to a depth of 25 to 50 inches.

The A horizon is very dark grayish brown, dark grayish brown, or dark brown. It is 20 to 30 inches thick.

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

The C horizon is light reddish brown, light brown, reddish yellow, or brownish yellow. It is silty clay, silty clay loam, or clay loam. Calcium carbonate segregations make up 2 to 20 percent of the volume.

Oakalla series

The Oakalla series consists of deep, well drained, loamy soils on bottom lands. The soils formed in loamy alluvium along the major streams. Slopes are mostly less than 1 percent.

Typical pedon of Oakalla silty clay loam, occasionally flooded; from the intersection of Farm Roads 1660 and 973 at Rices Crossing (southwest of Taylor), 0.3 mile south on Farm Road 973, and 100 feet west, in a field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; few fine broken snail shells on soil surface; calcareous; moderately alkaline; abrupt smooth boundary.
A11—8 to 22 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; calcareous; moderately alkaline; clear smooth boundary.
A12—22 to 32 inches; dark brown (10YR 4/3) silty clay loam, dark brown (10YR 3/3) moist; weak fine granular structure; hard, friable; few yellow streaks in old worm channels; calcareous; moderately alkaline; clear smooth boundary.
B2—32 to 60 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; hard, friable; common fine threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, or dark brown. It ranges in thickness from 27 to 60 inches or more. It is silty clay loam, clay loam, loam, or silty clay.

The B horizon, where present, is brown, grayish brown, light yellowish brown, or yellowish brown. It is silty clay loam, clay loam, or loam.

In some places, there is a C horizon at a depth of 30 inches or more. It is similar in color and texture to the B2 horizon, but it does not have a definite structure.

Padina series

The Padina series consists of deep, well drained, sandy soils on uplands. The soils formed in marine sands and clays. Slopes range from 1 to 8 percent.

Typical pedon of Padina fine sand, 1 to 8 percent slopes; from the intersection of Farm Roads 112 and 486 at Shiloh (southeast of Taylor), 1.5 miles northeast on Farm Road 486, 1.9 miles southeast on county road, and 100 feet east, in a pasture:

A1—0 to 22 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; slightly acid; abrupt smooth boundary.
A2—22 to 65 inches; very pale brown (10YR 8/4) fine sand, very pale brown (10YR 7/4) moist; single grained; loose; medium acid; clear wavy boundary.
B21t—65 to 78 inches; mottled reddish yellow (7.5YR 6/8), light reddish brown (5YR 6/3), and white (5YR 8/1) sandy clay loam; weak granular structure; hard, friable; medium acid.

The solum ranges from about 65 to 100 inches or more in thickness. Reaction ranges from neutral to strongly acid.

The A horizon is light brownish gray, pale brown, very pale brown, or light yellowish brown. Thickness ranges from 40 to about 70 inches. Reaction ranges from slightly acid to neutral.

The B2t horizon is mottled dominantly in brownish yellow, light gray, reddish yellow, light reddish brown, yellowish red, and white and to a lesser extent in other shades of red, brown, gray, or yellow. Texture ranges from sandy clay loam to fine sandy loam. This horizon has small discrete, rounded bodies of reddish yellow sandy clay loam. It is strongly acid to slightly acid.

Queeny series

The Queeny series consists of shallow and very shallow, well drained, loamy soils on uplands that are underlain by cemented caliche over thick beds of gravel and sand. The soils formed in ancient loamy alluvium. Slopes range from 1 to 20 percent.

Typical pedon of Queeny clay loam, 1 to 5 percent slopes; from the junction of U.S. Highway 79 and Farm Road 619 (east of Taylor), 0.4 mile south on Farm Road 619, and 200 feet west, in a gravel pit:

A11—0 to 10 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; hard, friable; scattered small pieces of waterworn gravel; calcareous; moderately alkaline; clear smooth boundary.
A12—10 to 13 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; strong fine granular structure; hard, friable; scattered small pieces of waterworn gravel; calcareous; moderately alkaline; clear smooth boundary.
Ccam—13 to 32 inches; reddish yellow (7.5YR 7/8) strongly cemented caliche that contains embedded gravel and sand; calcareous; moderately alkaline; clear wavy boundary.
IIC—32 to 80 inches; stratified thick layers to thin lenses of reddish yellow fine earth and gravel (1/4 to 1 inch in diameter); large soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 4 to 14 inches thick over a petrocalcic horizon.

The A horizon is dark brown, dark grayish brown, very dark grayish brown, grayish brown, or brown.

The Ccam horizon has an estimated hardness of 2 to 3 on the Mohs' scale and is uniformly plugged with carbonates.

In most places, calcareous marine marl is at a depth of about 12 feet.

Rader series

The Rader series consists of deep, moderately well drained, loamy soils on uplands. The soils formed in

clayey marine sediment. Slopes range from 0 to 2 percent.

Typical pedon of Rader fine sandy loam, 0 to 2 percent slopes; from Shiloh (southeast of Taylor), 2 miles south and east on a county road, and 100 feet south, in a pasture:

Ap—0 to 6 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; weak fine granular structure; hard, friable; slightly acid; abrupt smooth boundary.

A2—6 to 18 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak fine granular structure; hard, friable; slightly acid; clear wavy boundary.

B&A—18 to 28 inches; distinctly mottled light gray (10YR 7/2) sandy loam and brownish yellow (10YR 6/6) sandy clay; weak medium subangular blocky structure; hard, friable; medium acid; clear wavy boundary.

B21t—28 to 42 inches; distinctly mottled brownish yellow (10YR 6/6), light gray (10YR 7/2), and reddish brown (2.5YR 4/4) sandy clay; weak medium and coarse subangular blocky structure; extremely hard, very firm; medium acid; gradual wavy boundary.

B22t—42 to 50 inches; mottled light gray (10YR 7/2) and brownish yellow (10YR 6/6) sandy clay; weak coarse blocky structure; extremely hard, very firm; mildly alkaline; gradual wavy boundary.

B23t—50 to 62 inches; light gray (10YR 7/2) sandy clay, light brownish gray (10YR 6/2) moist; weak medium and coarse subangular blocky structure; extremely hard, very firm; mildly alkaline.

The solum is 60 inches thick or more. In places where lime has been added, the surface layer is alkaline.

The A horizon is 14 to 18 inches thick and is light brown, brown, yellowish brown, light yellowish brown, very pale brown, or light brownish gray. The lighter colors are mainly in the A2 horizon. Reaction ranges from slightly acid to medium acid.

The B&A horizon is mainly Bt material. The Bt part is strong brown, pale brown, or brownish yellow. It is sandy clay loam, clay loam, or loam. The A2 part is light gray, white, or light brownish gray, fine sandy loam, loamy fine sand, or loam. The thickness of the Bt part increases with depth.

The Bt horizon is mottled dominantly with grays and browns and with some yellows and reds. Texture is sandy clay, clay, or clay loam. In some places, a few concretions of calcium carbonate are in the lower part.

Rosanky series

The Rosanky series consists of deep, well drained, loamy soils on uplands. The soils formed in marine sandstone. Slopes range from 1 to 8 percent.

Typical pedon of Rosanky fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Roads 112 and 486, at Shiloh (southeast of Taylor), 1.5 miles northeast on Farm Road 486, and 1,700 feet east, in a field:

Ap—0 to 6 inches; brown (7.5YR 5/2) fine sandy loam, dark brown (7.5YR 4/2) moist; weak fine granular structure; hard, friable; slightly acid; abrupt smooth boundary.

A2—6 to 12 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; hard, friable; slightly acid; clear smooth boundary.

B21t—12 to 26 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate fine and medium subangular blocky and granular structure; hard, firm; medium acid; gradual wavy boundary.

B22t—26 to 39 inches; red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; common fine reddish yellow mottles; moderate medium subangular blocky structure; hard, firm; strongly acid; gradual wavy boundary.

B23t—39 to 54 inches; reddish yellow (5YR 7/8) clay loam, reddish yellow (5YR 6/8) moist; weak subangular blocky and granular structure; hard, friable; strongly acid; gradual wavy boundary.

B3—54 to 60 inches; reddish yellow (5YR 7/8) sandy clay loam, reddish yellow (5YR 6/8) moist; weak fine granular structure; hard, friable; few streaks of very dark brown strongly weathered iron oxide in the lower part; strongly acid; gradual wavy boundary.

C—60 to 80 inches; stratified reddish yellow (7.5YR 7/6) and reddish brown (2.5YR 5/4) fine sandy loam and weakly consolidated sandstone; hard, friable; strongly acid.

The A horizon is brown, yellowish brown, dark brown, pink, light brown, reddish brown, pale brown, light yellowish brown, or very pale brown. The lighter colors are in the A2 part of the horizon. Texture is fine sandy loam or loamy fine sand. Reaction ranges from slightly acid to medium acid.

The B2 horizon is red, reddish yellow, or yellowish red. The upper part of the B2 horizon is medium acid to strongly acid clay or sandy clay. The lower part is medium acid to strongly acid sandy clay, clay loam, or sandy clay loam. The clay content decreases with depth.

The C horizon is reddish or yellowish, medium acid to strongly acid, massive to weakly consolidated sandstone or fine sandy loam.

Sunev series

The Sunev series consists of deep, well drained, loamy soils on stream terraces. The soils formed in loamy alluvium (fig. 24). Slopes range from 0 to 3 percent.

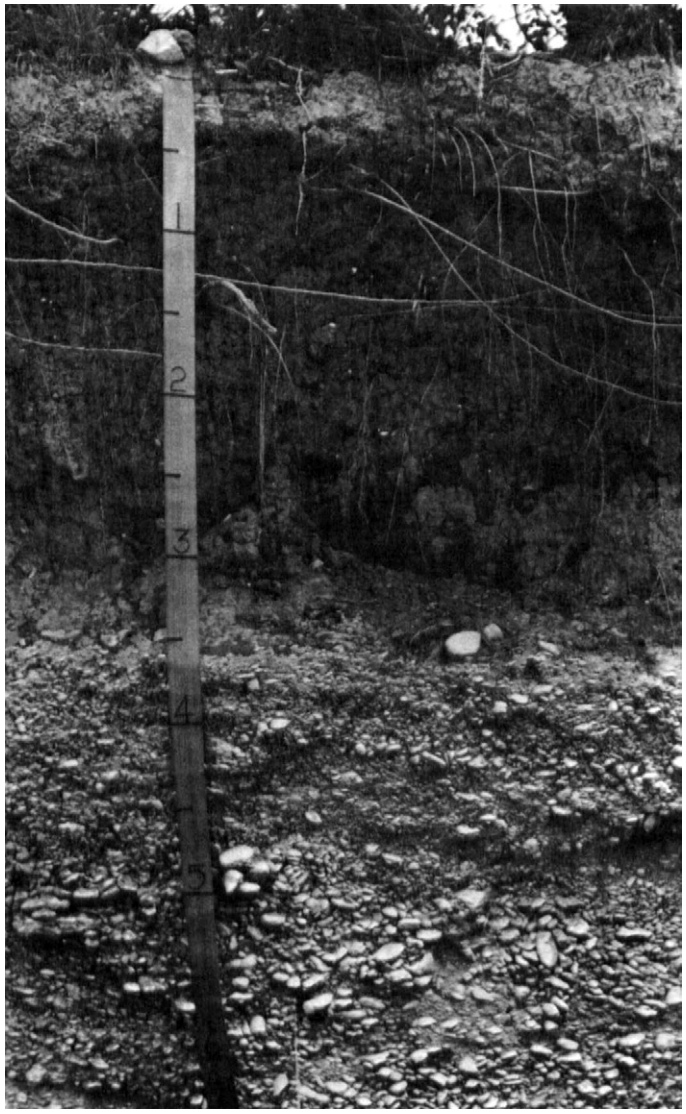


Figure 24.—Profile of Sunev silty clay loam, 1 to 3 percent slopes. In this area there is a gravelly layer at a depth of about 42 inches.

Typical pedon of Sunev silty clay loam, 1 to 3 percent slopes; from Liberty Hill (south of Georgetown), 1.3 miles south, and 200 feet west, in a pasture:

A1—0 to 18 inches; dark grayish brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; strong fine granular structure; many sand-sized fragments of limestone; hard, friable; calcareous; moderately alkaline; clear smooth boundary.

B2Ca—18 to 52 inches; light yellowish brown (10YR 6/4) silty clay loam, yellowish brown (10YR 5/4) moist; moderate fine and medium granular structure; common concretions and soft masses of calcium carbonate; hard, friable; calcareous; moderately alkaline; clear smooth boundary.

Cca—52 to 60 inches; reddish yellow (7.5YR 8/6) silty clay loam, reddish yellow (7.5YR 7/6) moist; massive; common concretions and soft masses of calcium carbonate; hard, friable; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. Calcium carbonate equivalent in the 10- to 40-inch control section is 40 to 70 percent.

The A horizon is dark brown, very dark grayish brown, or dark grayish brown. This horizon ranges from 9 to 18 inches in thickness.

The B horizon is brown, light brown, reddish yellow, light yellowish brown, yellowish brown, pale brown, or very pale brown. Texture is silty clay loam or clay loam. In a few places, thin layers of gravel are in this horizon.

The Cca horizon is reddish yellow or very pale brown. It is clay loam, silty clay loam, or loam. It is underlain by mixed sand and gravel in most places.

Tinn series

The Tinn series consists of deep, somewhat poorly drained, clayey soils on flood plains. The soils formed in clayey alluvium. Slopes are mostly less than 0.5 percent.

Typical pedon of Tinn clay, frequently flooded; from the intersection of Farm Road 112 and Loop 427 in Taylor, 900 feet west on Loop 427, and 100 feet south, in a pasture:

A11—0 to 33 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong fine subangular blocky structure; a stratum of sand and gravel 3 inches thick is at a depth of about 14 inches; extremely hard, very firm; calcareous; moderately alkaline; clear smooth boundary.

A12—33 to 58 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate medium subangular blocky structure; shiny surface on many peds; extremely hard, very firm; calcareous; moderately alkaline; clear smooth boundary.

B2—58 to 77 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; a few splotches and seams of dark gray (10YR 4/1); weak medium subangular blocky structure; extremely hard, very firm; calcareous; moderately alkaline; clear smooth boundary.

C—77 to 80 inches; mixture of dark gray and brownish yellow clay, gravel, and sand; massive; extremely hard, very firm; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. Reaction ranges from mildly to moderately alkaline.

Texture of the control section is clay or silty clay. When dry, these soils have cracks 2 centimeters or more wide in the upper part of the subsoil. In some places, there are thin layers of sand and gravel or other soil material of varying texture.

The A horizon is dark gray or very dark gray.

The B2 horizon is light gray, grayish brown, or dark grayish brown.

The C horizon is moderately alkaline. It consists of clay and silty clay mixed and stratified with poorly graded sand and gravel. The degree of stratification varies from place to place.

Uhland series

The Uhland series consists of deep, somewhat poorly drained, loamy soils on flood plains of local streams and along drainageways on uplands. The soils formed in loamy alluvium. Slopes are less than 1 percent.

Typical pedon of Uhland clay loam, frequently flooded; from the intersection of Farm Road 619 and county road at Structure (southeast of Taylor), 3 miles southeast on Farm Road 619, and 100 feet east, in a pasture:

A—0 to 7 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; strong fine granular structure; hard, friable; mildly alkaline; abrupt smooth boundary.

IIC1—7 to 44 inches; yellowish brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; massive to platy structure; distinctly stratified loamy sediments; few fine grayish brown (10YR 5/2) mottles mainly along interfaces of strata; hard, friable; mildly alkaline; abrupt smooth boundary.

IIC2—44 to 56 inches; brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) moist; massive; numerous loamy and clayey strata; hard, friable; mildly alkaline; clear smooth boundary.

IIC3—56 to 67 inches; yellow (10YR 7/6) fine sandy loam, brownish yellow (10YR 6/6) moist; hard, friable; mildly alkaline.

The A horizon is brown, dark grayish brown, grayish brown, or dark brown. The texture varies from place to place and within short distances, but this horizon is mostly clay loam, loam, or fine sandy loam. Thickness ranges from 4 to 12 inches. Reaction ranges from slightly acid to mildly alkaline.

The IIC horizon is brown, yellowish brown, brownish yellow, and light gray stratified fine sandy loam or loam. Strata range from 1/8 inch to about 1 foot in thickness. Average clay content of the 10- to 40-inch control section is 10 to 18 percent.

Whitewright series

The Whitewright series consists of shallow, well drained, loamy soils on uplands. The soils formed in weakly to strongly cemented platy chalk. Slopes range from 1 to 5 percent.

Typical pedon of Whitewright silty clay loam, 1 to 5 percent slopes; from the junction of Farm Roads 971 and 1105 in Weir (east of Georgetown), 1.1 miles north on Farm Road 1105, 0.6 mile east, and 50 feet south, in a field:

Ap—0 to 5 inches; light brownish gray (10YR 6/2) silty clay loam, grayish brown (10YR 5/2) moist; moderate medium and fine subangular blocky and granular structure; hard, firm; few fragments of chalk 1/4 inch to 1 1/2 inches across the long axis; calcareous; moderately alkaline; clear abrupt boundary.

B2—5 to 15 inches; very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) moist; moderate fine and medium subangular blocky structure; common fragments of platy chalk 1 inch to 2 inches across; calcareous; moderately alkaline; abrupt wavy boundary.

Cr—15 to 38 inches; white (10YR 8/2) strongly weathered chalk, light gray (10YR 7/2) moist; upper few inches interbedded with darker material similar to that of the B2 horizon; chalk is less weathered in lower part; calcareous; moderately alkaline.

The solum ranges from 11 to 19 inches in thickness.

The A horizon is light brownish gray, pale brown, grayish brown, or dark grayish brown.

The B horizon is light brownish gray, light gray, pale brown, light yellowish brown, very pale brown, or brown. Texture is silty clay loam, gravelly silty clay loam, or gravelly clay loam. Fragments of chalk range from few to common. The number of fragments increases in the lower part of the horizon.

The Cr horizon is weathered, weakly to strongly cemented, whitish platy chalk. The chalk in the upper part of this horizon is thinly interbedded in the fractures and cleavage planes with darker material.

Wilson series

The Wilson series consists of deep, somewhat poorly drained, loamy soils on uplands. The soils formed in marine clays. Slopes range from 0 to 3 percent.

Typical pedon of Wilson clay loam, 1 to 3 percent slopes; from the intersection of Farm Roads 619 and 1466 near Beyersville (southeast of Taylor), 2 miles south, and 100 feet east, in a field:

A1—0 to 5 inches; gray (10YR 5/1) clay loam, dark gray (10YR 4/1) moist; moderate fine granular structure; very hard, friable; noncalcareous; neutral; abrupt wavy boundary.

B21tg—5 to 32 inches; very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; weak coarse blocky structure; extremely hard, very firm; vertical cracks filled with material from the A1 horizon; noncalcareous; mildly alkaline; gradual wavy boundary.

B22tg—32 to 46 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; weak coarse blocky structure; extremely hard, very firm; vertical cracks filled with material from above; scattered fine hard pieces of calcium carbonate; calcareous; mildly alkaline; gradual wavy boundary.

B3tg—46 to 60 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; weak coarse blocky structure; extremely hard, very firm; many small concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—60 to 72 inches; mottled olive and grayish clayey shale; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches or more in thickness. When dry, these soils have cracks 0.4 inch or more wide in the upper part of the subsoil.

The A horizon is dark gray, very dark gray, gray, dark grayish brown, or grayish brown. It is 5 to 10 inches thick. Areas in cultivation have a 1/4-inch thick, light-colored crust on the surface. Reaction is slightly acid to neutral.

The Bt horizon is very dark gray, dark gray, or gray in the upper part and light brownish gray, olive gray, gray, or grayish brown in the lower part. In some places, brownish, yellowish, and olive mottles increase with depth. In places, they make up the major part of the horizon below a depth of about 40 inches. Reaction is mildly to moderately alkaline.

Formation of the soils

Five factors are involved in soil development. These are parent material, climate, living organisms, topography, and time. The influence of each factor and the relationship of one factor to another are discussed in this section.

Parent material

L. E. Garner, Bureau of Economic Geology, University of Texas, helped prepare this section.

Soils in Williamson County formed in several types of parent material. In the western part of the county, the parent material is primarily limestone, dolomite, and interbedded limestone and marl. Soils in the central part of the county derived mainly from chalk, marl, limestone, marly limestone, and mudstone. Bedrock parent material in the eastern part of the county includes clayey mudstone, chalky marl, silty mudstone, and sandstone. Ancient alluvium on high terraces is the parent material in a large area in the eastern part of the county, especially in the vicinity of Taylor. Alluvium is the parent material of soils along the North San Gabriel River, South San Gabriel River, Brushy Creek, and many smaller streams.

The soils in the western part of Williamson County formed mainly in sediment that derived from rocks of Lower Cretaceous age. These rocks are the Glen Rose and Walnut Formations, the Comanche Peak Limestone, and the Edwards Limestone.

The Glen Rose Formation is about 400 feet thick. It consists mainly of interbedded, fine-grained, hard to soft limestone, marly limestone, and dolomite. The upper part of the formation is mainly thin-bedded and forms a stairstep topography. In the thick-bedded lower part, the stairstep topography is less developed, and in some places it is absent. Soils in the Brackett-Eckrant-Doss general soil map unit are dominant on the Glen Rose Formation.

The Walnut Formation, which is made up of clay, limestone, and shale, ranges from about 150 feet in thickness in southern Williamson County to 250 feet near the northern county line. Soils of the Denton-Eckrant-Doss general soil map unit are dominant on the Walnut Formation.

The Comanche Peak Limestone ranges from 30 to 90 feet in thickness in Williamson County. It thins southward and pinches out in Travis County. The dominant soils on this material are those in the Denton-Eckrant-Doss general soil map unit.

The Edwards Limestone is about 150 feet thick. It consists of hard, granular and fine-grained limestone and dolomite that has abundant chert nodules. Soils of the Eckrant-Georgetown general soil map unit are dominant on the Edwards Limestone.

Soils in the central part of the county formed mainly in sediment that derived from rocks of Lower and Upper Cretaceous age. Lower Cretaceous formations include the Georgetown Formation, the Del Rio Clay, and the Buda Limestone. Upper Cretaceous formations include the Eagle Ford Group and the Austin Chalk Formation.

The Georgetown Formation is about 50 feet thick. It consists of interbedded hard, fine-grained limestone and softer, nodular, marly limestone. Soils of the Denton-Eckrant-Doss general soil map unit are dominant on soft limestone, and Eckrant-Georgetown soils are dominant on hard limestone.

The Del Rio Clay is in a relatively narrow belt that lies mainly along Interstate 35; this formation is about 75 feet thick. It is calcareous clay mudstone that has abundant ram's horn oyster shells. Soils in the Branyon-Houston Black-Burleson general soil map unit are dominant on the Del Rio Clay.

The Buda Limestone consists of moderately hard to hard limestone about 40 feet thick that commonly has a reddish stain. Soils in the Eckrant-Georgetown general soil map unit are dominant on this formation.

The Eagle Ford Group is about 50 feet thick. It is calcareous claystone in the upper part, silty limestone and calcareous siltstone flags in the middle part, and shale in the lower part, which has a basal bentonite bed. Soils in the Austin-Houston Black-Castephen general soil map unit are dominant on the Eagle Ford Group.

The Austin Chalk consists of limestone, marly limestone, and chalk. The total thickness of the Austin Chalk is about 300 feet. Soils in the Austin-Houston Black-Castephen general soil map unit are dominant on this formation.

Soils in the eastern part of the county developed on stratigraphic units that range from Upper Cretaceous to Recent in age. Upper Cretaceous units include the Taylor and Navarro Groups. Eocene units include the Midway and Wilcox Groups. Pleistocene units include high, broad gravel deposits and younger terrace

sediments along streams. Recent alluvium includes flood plain sediments and indistinct low terrace deposits.

The Taylor Group consists of the Ozan Formation, Pecan Gap Chalk, and Marlbrook Marl and has a total thickness of about 1,000 feet. The Ozan Formation and the Marlbrook Marl are composed of calcareous clay, and the Pecan Gap Chalk is a chalky marl. The Houston Black soil is dominant on formations of the Taylor Group.

The Navarro Group is about 300 feet thick and includes the Neylandville Formation, Corsicana Marl, and Kemp Clay. These formations consist mainly of calcareous clay. Soils in the Branyon-Houston Black-Burleson general soil map unit are on this group.

The Midway Group includes the Kincaid and Wills Point Formations. These formations have a total thickness of about 400 feet in Williamson County. They are made up of glauconitic clay and sand, micaceous clay, and minor amounts of sandy clay and sand. Soils in the Wilson-Crockett-Behring general soil map unit are dominant on the Midway Group.

The Wilcox Group consists of the Hooper, Simsboro, and Calvert Bluff Formations. The Hooper and Simsboro Formations crop out in Williamson County and have a total thickness of about 800 feet. The Hooper and Calvert Bluff Formations are mainly mudstone and some interbedded sandstone. The Hooper Formation also has a minor amount of lignite. The Simsboro Formation consists primarily of sand and some mudstone, clay, and conglomerate. Soils in the Axtell-Rader general soil map unit are dominant on these formations.

Pleistocene high terraces in the vicinity of Taylor consist of calcareous sand and mud near the surface that are underlain by limestone gravel. Soils in the Branyon-Houston Black-Burleson general soil map unit formed in the high terrace deposits.

Along the North San Gabriel River, Brushy Creek, and smaller streams, the Pleistocene and Recent alluvial deposits consist primarily of limestone, sand and gravel, and sandy mud. The alluvium ranges from a few feet to as much as 40 feet in thickness. Soils in the Oakalla-Sunev general soil map unit formed in alluvial sand and gravel. Soils in the Tinn general soil map unit formed in clayey alluvium.

Climate

The effect of climate on soil is due to temperature, moisture, wind, and evaporation. The amount of rainfall varies widely from year to year. Soil temperatures vary depending mainly on the color of the soil surface and the vegetative cover.

Winds generally are southerly from March to September and northerly during the rest of the year. Wind velocity is not an important factor in soil movement, but there is some soil blowing in fields in the Texas Blackland Prairie and Texas Claypan Land Resource Areas in the county. In some areas there is minor damage to crops.

Evaporation is significant early in summer when the humidity is down and the winds are warm. Much soil moisture is lost through cracks and from capillary water movement, especially in the clayey soils. Where this loss is serious, fields can be tilled to loosen the surface in an effort to interrupt capillary action and close the cracks. Some farmers leave a mulch of crop residue on the surface.

In ancient time, probably under a different climate, the high terraces near Hutto, Taylor, Thrall, and Granger were formed. These terraces cannot now be related to local streams.

Living organisms

Organisms such as bacteria, earthworms, insects, and rodents have contributed and still are contributing to the development of soils in the county. The activities of organisms and of roots and the addition of organic residue aid soil development both physically and chemically. Nitrogen in particular is added to the soil, and the porosity of the soil is increased so that water and air pass through more freely. The natural development of soils often is arrested by man's use of the soils. Inadequate management in cultivating or grazing can result in compacted layers, erosion, low fertility, and low vigor of the plant and animal life in the soils. The net result generally is a soil that has a thinner surface layer and that is less fertile and less productive.

Topography

The more sloping soils generally are thinner because erosion increases in proportion to slope gradient. Even on slopes that are protected against erosion, there is less moisture insoak and consequently less soil development. The soils are thicker and better developed on north- and northwest-facing slopes because less evaporation and cooler soil temperatures are conducive to better plant cover, less runoff, and less erosion.

Time

The length of time in which climate, living organisms, and topography have acted on the parent material affects the kind of soil that is developed. Long-term weathering of parent material generally results in a soil that has a clay-enriched subsoil (an argillic horizon). In addition to the downward movement of clay in such a soil, calcium carbonate has also moved downward, leaving an acid solum. At the other extreme of soil development in terms of time are the frequently flooded soils on bottom lands. Each flood changes the profile to some degree. Consequently, these soils are very young pedogenically and have poorly defined horizonation.

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Glossary

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

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

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

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

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

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

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

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

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

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.

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

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

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

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

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

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

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. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

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

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

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

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

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

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

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

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

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 (in tables). Bedrock is too near the surface for 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 they are wet 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.

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

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

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

Excess lime (in tables). Excess carbonates in the soil that restrict the growth of some plants.

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.

Flagstone. A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist, 6 to 15 inches (15 to 37.5 centimeters) long.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

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

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

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

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.5 centimeters) in diameter.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

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

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

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

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

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

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

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

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

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake in inches per hour is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

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

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

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

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

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

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

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

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

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

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

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

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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. The soil is not strong enough to support loads.

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

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Parent material. The unconsolidated organic and mineral material in which soil forms.

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

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

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

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

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

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

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

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

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

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

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.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to insure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

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 water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded 1951-78 at Taylor, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	58.8	35.6	47.2	83	15	110	1.92	.48	3.06	4	0.1
February	63.1	38.9	51.1	85	19	137	2.82	1.26	4.14	5	.2
March	71.0	46.1	58.6	90	25	299	1.92	.63	2.98	4	.1
April	79.3	56.0	67.7	93	36	531	3.58	1.55	5.30	5	.0
May	85.2	63.2	74.2	96	47	750	3.70	1.65	5.45	5	.0
June	92.3	69.5	80.9	100	57	927	3.34	1.01	5.23	4	.0
July	96.6	72.1	84.4	106	64	1,066	1.46	.22	2.40	3	.0
August	97.3	71.6	84.5	105	63	1,070	2.18	.36	3.57	4	.0
September	90.8	66.6	78.7	102	50	861	4.51	1.91	6.70	6	.0
October	81.4	55.8	68.6	95	37	577	3.66	.87	5.88	4	.0
November	69.4	45.4	57.4	88	25	249	2.67	.76	4.20	5	.0
December	62.0	38.0	50.0	82	18	106	2.38	.90	3.60	5	.0
Yearly:											
Average	78.9	54.9	66.9	---	---	---	---	---	---	---	---
Extreme	---	---	---	107	13	---	---	---	---	---	---
Total	---	---	---	---	---	6,683	34.14	25.23	42.41	54	0.4

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50° F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded 1951-78 at Taylor, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	March 5	March 22	March 30
2 years in 10 later than--	February 24	March 13	March 24
5 years in 10 later than--	February 6	February 24	March 13
First freezing temperature in fall:			
1 year in 10 earlier than--	November 20	November 12	October 30
2 years in 10 earlier than--	November 30	November 20	November 6
5 years in 10 earlier than--	December 19	December 6	November 20

TABLE 3.--GROWING SEASON

[Recorded 1951-78 at Taylor, Texas]

Probability	Length of growing season if daily minimum temperature is--		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	275	250	224
8 years in 10	288	262	233
5 years in 10	313	284	252
2 years in 10	341	305	270
1 year in 10	363	317	280

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AgC2	Altoga silty clay loam, 3 to 5 percent slopes, eroded	8,450	1.2
AgD2	Altoga silty clay loam, 5 to 8 percent slopes, eroded	1,070	0.2
AuA	Austin silty clay, 0 to 1 percent slopes	760	0.1
AuB	Austin silty clay, 1 to 3 percent slopes	25,660	3.6
AwC2	Austin-Whitewright complex, 1 to 5 percent slopes, eroded	21,670	3.0
AxB	Axtell fine sandy loam, 0 to 3 percent slopes	790	0.1
AxC2	Axtell fine sandy loam, 2 to 5 percent slopes, eroded	8,240	1.2
BeB	Behring clay loam, 1 to 3 percent slopes	3,660	0.5
BeC2	Behring clay loam, 3 to 5 percent slopes, eroded	4,520	0.6
BkC	Brackett clay loam, 1 to 5 percent slopes	6,880	0.9
BkE	Brackett gravelly clay loam, 3 to 16 percent slopes	17,550	2.5
BkG	Brackett-Rock outcrop complex, 16 to 30 percent slopes	1,900	0.3
BrA	Branyon clay, 0 to 1 percent slopes	34,560	4.8
BrB	Branyon clay, 1 to 3 percent slopes	34,690	4.8
BuA	Burleson clay, 0 to 1 percent slopes	34,560	4.8
BuB	Burleson clay, 1 to 3 percent slopes	1,780	0.2
CaB	Castephen silty clay, 1 to 3 percent slopes	9,490	1.3
CaC	Castephen silty clay, 3 to 5 percent slopes	4,120	0.6
CfA	Crawford clay, 0 to 1 percent slopes	1,120	0.2
CfB	Crawford clay, 1 to 3 percent slopes	9,370	1.3
CrB	Crockett loam, 1 to 3 percent slopes	2,170	0.3
CrC2	Crockett loam, 2 to 5 percent slopes, eroded	5,000	0.6
De	Deleon clay loam, occasionally flooded	1,120	0.2
Df	Deleon soils, frequently flooded	1,230	0.2
DmB	Demona loamy fine sand, 1 to 5 percent slopes	2,600	0.4
DnA	Denton silty clay, 0 to 1 percent slopes	630	0.1
DnB	Denton silty clay, 1 to 3 percent slopes	28,380	4.0
DnC	Denton silty clay, 3 to 5 percent slopes	4,030	0.6
DoC	Doss silty clay, 1 to 5 percent slopes	32,200	4.5
EaD	Eckrant cobbly clay, 1 to 8 percent slopes	47,400	6.5
EeB	Eckrant extremely stony clay, 0 to 3 percent slopes	42,530	5.9
ErE	Eckrant-Rock outcrop complex, rolling	26,150	3.6
ErG	Eckrant-Rock outcrop complex, hilly	2,290	0.3
EyB	Eddy very gravelly clay loam, 0 to 3 percent slopes	3,870	0.5
EyD	Eddy very gravelly clay loam, 3 to 8 percent slopes	5,350	0.7
FaA	Fairlie clay, 0 to 1 percent slopes	4,460	0.6
FaB	Fairlie clay, 1 to 2 percent slopes	25,310	3.5
FhE	Ferris-Heiden complex, 5 to 20 percent slopes, severely eroded	8,390	1.2
GeB	Georgetown clay loam, 0 to 2 percent slopes	4,270	0.6
GsB	Georgetown stony clay loam, 1 to 3 percent slopes	30,710	4.3
HeB	Heiden clay, 1 to 3 percent slopes	1,810	0.2
HeC2	Heiden clay, 3 to 5 percent slopes, eroded	7,440	1.0
HeD2	Heiden clay, 5 to 8 percent slopes, eroded	10,970	1.5
HsE	Heiden extremely stony clay, 3 to 12 percent slopes	790	0.1
HuA	Houston Black clay, 0 to 1 percent slopes	3,140	0.4
HuB	Houston Black clay, 1 to 3 percent slopes	48,830	6.8
HuC2	Houston Black clay, 3 to 5 percent slopes, eroded	22,510	3.1
KsA	Krum silty clay, 0 to 1 percent slopes	7,780	1.1
KsB	Krum silty clay, 1 to 3 percent slopes	19,030	2.6
Oa	Oakalla silty clay loam, occasionally flooded	8,740	1.2
Oc	Oakalla soils, channeled	3,730	0.5
Of	Oakalla soils, frequently flooded	7,600	1.1
PaD	Padina fine sand, 1 to 8 percent slopes	1,540	0.2
QuC	Queeny clay loam, 1 to 5 percent slopes	2,890	0.4
RaB	Rader fine sandy loam, 0 to 2 percent slopes	2,060	0.3
RkD	Rosanky loamy fine sand, 1 to 8 percent slopes	1,130	0.2
RoC	Rosanky fine sandy loam, 1 to 5 percent slopes	2,590	0.4
SuA	Sunev silty clay loam, 0 to 1 percent slopes	1,130	0.2
SuB	Sunev silty clay loam, 1 to 3 percent slopes	8,640	1.2
Tc	Tinn clay, occasionally flooded	6,070	0.8
Tn	Tinn clay, frequently flooded	16,170	2.2
Uh	Uhland soils, frequently flooded	1,550	0.2
WhC	Whitewright silty clay loam, 1 to 5 percent slopes	2,400	0.3
WnA	Wilson clay loam, 0 to 1 percent slopes	1,640	0.2
WnB	Wilson clay loam, 1 to 3 percent slopes	7,450	1.0
	Water	14,080	2.0
	Total	720,640	100.0

TABLE 5.---YIELDS PER ACRE OF CROPS AND PASTURE

[Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Cotton lint	Grain sorghum	Pasture
	Lb	Bu	AUM*
AgC2---------- Altoga	225	35	4.5
AgD2---------- Altoga	---	---	3.5
AuA---------- Austin	400	80	6.5
AuB---------- Austin	350	75	6.5
AwC2---------- Austin-Whitewright	---	45	4.0
AxB---------- Axtell	---	---	5.5
AxC2---------- Axtell	---	---	5.0
BeB---------- Behring	350	70	6.5
BeC2---------- Behring	250	60	6.0
BkC---------- Brackett	---	---	---
BkE---------- Brackett	---	---	---
BkG---------- Brackett-Rock outcrop	---	---	---
BrA---------- Branyon	550	90	7.5
BrB---------- Branyon	550	85	7.5
BuA---------- Burleson	550	85	7.5
BuB---------- Burleson	550	80	7.5
CaB---------- Castephen	---	45	4.0
CaC---------- Castephen	---	40	3.5
CfA, CfB---------- Crawford	400	90	6.5
CrB---------- Crockett	350	54	6.0
CrC2---------- Crockett	200	45	6.0

See footnote at end of table.

TABLE 5.---YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Grain sorghum	Pasture
	Lb	Bu	AUM*
De---------- Deleon	450	70	6.5
Df---------- Deleon	---	---	6.5
DmB---------- Demona	---	---	6.0
DnA---------- Denton	350	65	6.0
DnB---------- Denton	350	65	6.0
DnC---------- Denton	300	55	5.0
DoC---------- Doss	---	---	4.0
EaD, EeB---------- Eckrant	---	---	---
ErE---------- Eckrant-Rock outcrop	---	---	---
ErG---------- Eckrant-Rock outcrop	---	---	---
EyB---------- Eddy	---	---	---
EyD---------- Eddy	---	---	---
FaA---------- Fairlie	500	85	7.0
FaB---------- Fairlie	450	80	7.0
FhE---------- Ferris-Heiden	---	---	---
GeB---------- Georgetown	---	---	4.0
GsB---------- Georgetown	---	---	4.0
HeB---------- Heiden	400	80	5.5
HeC2---------- Heiden	350	45	5.0
HeD2---------- Heiden	---	---	3.5
HsE---------- Heiden	---	---	---
HuA---------- Houston Black	550	90	7.5
HuB---------- Houston Black	550	85	7.5

See footnote at end of table.

TABLE 5.---YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Map symbol and soil name	Cotton lint	Grain sorghum	Pasture
	Lb	Bu	AUM*
HuC2---------- Houston Black	400	80	6.5
KsA---------- Krum	450	75	8.0
KsB---------- Krum	400	70	8.0
Oa---------- Oakalla	---	65	6.5
Oc, Of---------- Oakalla	---	---	6.5
PaD---------- Padina	---	---	---
QuC---------- Queeny	---	---	1.5
RaB---------- Rader	---	70	7.0
RkD---------- Rosanky	---	40	5.0
RoC---------- Rosanky	---	45	5.0
SuA---------- Sunev	300	70	6.5
SuB---------- Sunev	250	55	6.5
Tc---------- Tinn	550	90	7.5
Tn---------- Tinn	---	---	---
Uh---------- Uhland	---	---	7.5
WhC---------- Whitewright	---	30	3.0
WnA---------- Wilson	350	55	6.0
WnB---------- Wilson	300	45	6.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--RANGELAND PRODUCTIVITY

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Normal	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
AgC2, AgD2---- Altoga	Clay Loam----	6,500	5,000	3,800
AuA, AuB---- Austin	Clay Loam----	6,500	5,000	3,000
AwC2:*				
Austin----	Clay Loam----	6,500	5,000	3,000
Whitewright----	Chalky Ridge----	4,500	3,500	2,000
AxB, AxC2---- Axtell	Claypan Savannah----	5,000	3,500	2,500
BeB, BeC2---- Behring	Blackland----	7,000	5,000	3,500
BkC---- Brackett	Adobe----	4,000	3,200	1,800
BkE---- Brackett	Steep Adobe----	3,500	2,500	1,500
BkG:*				
Brackett----	Steep Adobe----	3,000	2,200	1,500
Rock outcrop.				
BrA, BrB---- Branyon	Blackland----	7,000	5,500	3,500
BuA, BuB---- Burleson	Blackland----	7,000	5,500	4,000
CaB, CaC---- Castephen	Chalky Ridge----	4,200	3,200	1,900
CfA, CfB---- Crawford	Deep Redland----	6,000	5,000	3,500
CrB, CrC2*---- Crockett	Claypan Prairie----	6,000	5,000	3,000
De---- Deleon	Loamy Bottomland----	6,000	5,000	3,500
Df*---- Deleon	Loamy Bottomland----	5,000	4,000	3,000
DmB---- Demona	Sandy----	5,000	4,000	3,000
DnA, DnB, DnC---- Denton	Clay Loam----	6,500	5,000	3,000
DoC---- Doss	Shallow----	3,000	2,500	2,000
EaD, EeB---- Eckrant	Low Stony Hills----	3,000	2,500	1,500
ErE:*				
Eckrant----	Steep Rocky----	1,800	1,400	800
Rock outcrop.				

See footnote at end of table.

TABLE 6.---RANGELAND PRODUCTIVITY--Continued

Map symbol and soil name	Range site	Potential annual production for kind of growing season		
		Favorable	Normal	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
ErG:*				
Eckrant	Steep Rocky	1,800	1,400	800
Rock outcrop.				
EyB, EyD	Chalky Ridge	4,500	3,500	2,000
Eddy				
FaA, FaB	Blackland	7,000	5,500	3,500
Fairlie				
FhE:*				
Ferris	Eroded Blackland	7,000	5,500	4,000
Heiden	Eroded Blackland	7,000	6,000	3,500
GeB, GsB	Redland	4,500	3,500	2,500
Georgetown				
HeB, HeC2, HeD2, HsE	Blackland	7,000	6,000	3,500
Heiden				
HuA, HuB, HuC2	Blackland	7,000	6,000	3,500
Houston Black				
KsA, KsB	Clay Loam	6,500	6,000	4,000
Krum				
Oa, Oc*, Of*	Loamy Bottomland	5,500	4,500	2,500
Oakalla				
PaD	Deep Sand	4,500	3,500	2,200
Padina				
QuC	Chalky Ridge	4,000	3,000	1,800
Queeny				
RaB	Sandy Loam	6,000	4,500	3,500
Rader				
RkD	Sandy	5,000	4,200	2,500
Rosanky				
RoC	Sandy Loam	6,000	4,500	3,000
Rosanky				
SuA, SuB	Clay Loam	7,000	5,500	3,500
Sunev				
Tc, Tn	Clayey Bottomland	7,000	6,000	4,000
Tinn				
Uh*	Loamy Bottomland	7,500	6,500	4,000
Uhland				
WhC	Chalky Ridge	4,500	3,500	2,000
Whitewright				
WnA, WnB	Claypan Prairie	6,000	4,500	3,000
Wilson				

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AgC2---------- Altoga	Slight----------	Slight----------	Moderate: slope.	Slight----------	Moderate: excess lime.
AgD2---------- Altoga	Slight----------	Slight----------	Severe: slope.	Slight----------	Moderate: excess lime.
AuA---------- Austin	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
AuB---------- Austin	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
AwC2:*					
Austin----------	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
Whitewright----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Severe: thin layer.
AxB---------- Axtell	Moderate: percs slowly.	Slight----------	Moderate: percs slowly.	Severe: erodes easily.	Slight.
AxC2---------- Axtell	Moderate: percs slowly.	Slight----------	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
BeB, BeC2---------- Behring	Moderate: too clayey.	Slight----------	Moderate: slope, too clayey.	Slight----------	Severe: too clayey.
BkC---------- Brackett	Severe: depth to rock.	Severe: depth to rock.	Severe: small stones, depth to rock.	Slight----------	Severe: thin layer.
BkE---------- Brackett	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, small stones, depth to rock.	Slight----------	Severe: thin layer.
BkG:*					
Brackett----------	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope, small stones, depth to rock.	Moderate: slope.	Severe: slope, thin layer.
Rock outcrop.					
BrA---------- Branyon	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
BrB---------- Branyon	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.
BuA---------- Burleson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BuB---------- Burleson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
CaB, CaC---------- Castephen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: too clayey.	Severe: thin layer, too clayey.
CfA, CfB---------- Crawford	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.
CrB, CrC2*---------- Crockett	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
De---------- Deleon	Severe: flooding.	Moderate: too clayey.	Moderate: too clayey, flooding.	Moderate: too clayey.	Severe: too clayey.
Df*---------- Deleon	Severe: flooding.	Moderate: flooding, too clayey.	Severe: flooding.	Moderate: too clayey, flooding.	Severe: flooding, too clayey.
DmB---------- Demona	Moderate: wetness.	Moderate: wetness.	Moderate: slope.	Moderate: wetness.	Moderate: wetness, droughty.
DnA---------- Denton	Moderate: too clayey.	Moderate: too clayey.	Moderate: small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
DnB, DnC---------- Denton	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, small stones, too clayey.	Moderate: too clayey.	Severe: too clayey.
DoC---------- Doss	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: too clayey.	Severe: thin layer.
EaD, EeB---------- Eckrant	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones.	Severe: large stones, thin layer.
ErE:* Eckrant----------	Severe: large stones, depth to rock.	Severe: large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.	Severe: large stones, thin layer.
Rock outcrop.					
ErG:* Eckrant----------	Severe: slope, large stones, depth to rock.	Severe: slope, large stones, depth to rock.	Severe: large stones, slope, depth to rock.	Severe: large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.					
EyB, EyD---------- Eddy	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Severe: small stones, depth to rock.	Slight----------	Severe: small stones, thin layer.
FaA, FaB---------- Fairlie	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
FhE:*					
Ferris	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
Heiden	Moderate: slope, percs slowly, too clayey.	Moderate: slope, too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
GeB Georgetown	Slight	Slight	Moderate: small stones.	Slight	Moderate: thin layer.
GsB Georgetown	Moderate: large stones, small stones.	Moderate: large stones, small stones.	Severe: small stones.	Slight	Severe: large stones.
HeB, HeC2 Heiden	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
HeD2 Heiden	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
HsE Heiden	Moderate: large stones, percs slowly, too clayey.	Moderate: large stones, percs slowly, too clayey.	Severe: large stones.	Moderate: too clayey.	Severe: small stones, too clayey.
HuA Houston Black	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
HuB, HuC2 Houston Black	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
KsA Krum	Moderate: too clayey.	Moderate: too clayey.	Moderate: small stones.	Moderate: too clayey.	Severe: too clayey.
KsB Krum	Moderate: too clayey.	Moderate: too clayey.	Moderate: small stones, slope.	Moderate: too clayey.	Severe: too clayey.
Oa Oakalla	Severe: flooding.	Moderate: too clayey.	Moderate: flooding, dusty.	Moderate: dusty.	Moderate: flooding, excess lime.
Oc*, Of* Oakalla	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding, dusty.	Severe: flooding.
PaD Padina	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
QuC Queeny	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight	Severe: thin layer.
RaB Rader	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RkD---------- Rosanky	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Slight----------	Slight.
RoC---------- Rosanky	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
SuA---------- Sunev	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: excess lime.
SuB---------- Sunev	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: excess lime.
Tc---------- Tinn	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Tn---------- Tinn	Severe: flooding, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: wetness, too clayey.	Severe: wetness, flooding, too clayey.
Uh*---------- Uhland	Severe: flooding.	Moderate: flooding, wetness.	Severe: flooding.	Moderate: wetness, flooding.	Severe: flooding.
WhC---------- Whitewright	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight----------	Severe: thin layer.
WnA, WnB---------- Wilson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
AgC2, AgD2--------- Altoga	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
AuA---------- Austin	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
AuB---------- Austin	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
AwC2:*									
Austin----------	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Whitewright-------	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
AxB, AxC2--------- Axtell	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
BeB, BeC2--------- Behring	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
BkC---------- Brackett	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
BkE---------- Brackett	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Fair.
BkG:*									
Brackett----------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Very poor	Very poor	Fair.
Rock outcrop.									
BrA, BrB---------- Branyon	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
BuA, BuB---------- Burleson	Good	Good	Poor	Poor	Very poor	Very poor	Fair	Very poor	Poor.
CaB, CaC---------- Castephen	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
CfA, CfB---------- Crawford	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
CrB, CrC2*--------- Crockett	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
De---------- Deleon	Fair	Fair	Fair	Fair	Poor	Poor	Fair	Poor	Fair.
Df*---------- Deleon	Very poor	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair.
DmB---------- Demona	Fair	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
DnA, DnB---------- Denton	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
DnC---------- Denton	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
DoC---------- Doss	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
EaD, EeB---------- Eckrant	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
ErE*, ErG:* Eckrant----------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Rock outcrop.									
EyB, EyD---------- Eddy	Poor	Poor	Poor	Fair	Very poor	Very poor	Poor	Very poor	Poor.
FaA, FaB---------- Fairlie	Good	Good	Fair	Fair	Poor	Poor	Good	Poor	Fair.
FhE:* Ferris----------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Heiden----------	Poor	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
GeB---------- Georgetown	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
GsB---------- Georgetown	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
HeB---------- Heiden	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
HeC2---------- Heiden	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
HeD2---------- Heiden	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
HsE---------- Heiden	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
HuA, HuB---------- Houston Black	Good	Good	Poor	Fair	Poor	Poor	Fair	Poor	Fair.
HuC2---------- Houston Black	Fair	Good	Poor	Fair	Poor	Very poor	Fair	Very poor	Fair.
KsA, KsB---------- Krum	Good	Good	Fair	Fair	Poor	Very poor	Good	Very poor	Fair.
Oa---------- Oakalla	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Oc*, Of*---------- Oakalla	Very poor	Poor	Fair	Good	Poor	Very poor	Poor	Very poor	Fair.
PaD---------- Padina	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
QuC---------- Queeny	Poor	Poor	Poor	Fair	Very poor	Very poor	Poor	Very poor	Poor.
RaB---------- Rader	Fair	Good	Good	Good	Poor	Poor	Good	Poor	Good.
RkD, RoC---------- Rosanky	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herba-ceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
SuA, SuB---------- Sunev	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
Tc---------- Tinn	Fair	Fair	Fair	Good	Poor	Fair	Fair	Poor	Good
Tn---------- Tinn	Poor	Fair	Fair	Good	Poor	Fair	Fair	Poor	Good
Uh*---------- Uhland	Poor	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair.
WhC---------- Whitewright	Fair	Good	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
WnA, WnB---------- Wilson	Fair	Fair	Good	Fair	Fair	Fair	Fair	Fair	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AgC2, AgD2--- Altoga	Moderate: too clayey.	Severe: shrink-swell.	Moderate: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: excess lime.
AuA, AuB--- Austin	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Severe: too clayey.
AwC2:*						
Austin---	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: depth to rock, shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Severe: too clayey.
Whitewright---	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, slope, depth to rock.	Severe: low strength.	Severe: thin layer.
AxB, AxC2--- Axtell	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.
BeB, BeC2--- Behring	Moderate: too clayey, cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
BkC--- Brackett	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Severe: low strength.	Severe: thin layer.
BkE--- Brackett	Severe: depth to rock.	Moderate: slope, depth to rock.	Severe: depth to rock.	Severe: slope.	Severe: low strength.	Severe: thin layer.
BkG:*						
Brackett---	Severe: depth to rock, slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.	Severe: low strength, slope.	Severe: slope, thin layer.
Rock outcrop.						
BrA, BrB--- Branyon	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
BuA, BuB--- Burleson	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
CaB--- Castephen	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: thin layer, too clayey.
CaC--- Castephen	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: slope, depth to rock.	Moderate: depth to rock.	Severe: thin layer, too clayey.
CfA, CfB--- Crawford	Severe: depth to rock, cutbanks cave.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
CrB, CrC2*--- Crockett	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Slight.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
De Deleon	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: too clayey.
Df* Deleon	Moderate: too clayey, flooding.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: low strength, flooding, shrink-swell.	Severe: flooding, too clayey.
DmB Demona	Severe: cutbanks cave, wetness.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: low strength.	Moderate: wetness, droughty.
DnA, DnB, DnC Denton	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
DoC Doss	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Severe: thin layer.
EaD, EeB Eckrant	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer.
ErE:* Eckrant	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: large stones, thin layer.
Rock outcrop.						
ErG:* Eckrant	Severe: depth to rock, large stones, slope.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: slope, depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: large stones, slope, thin layer.
Rock outcrop.						
EyB Eddy	Severe: depth to rock.	Moderate: depth to rock, large stones.	Severe: depth to rock.	Moderate: depth to rock, large stones.	Moderate: depth to rock, large stones.	Severe: small stones, thin layer.
EyD Eddy	Severe: depth to rock.	Moderate: depth to rock, large stones.	Severe: depth to rock.	Moderate: slope, depth to rock, large stones.	Moderate: depth to rock, large stones.	Severe: small stones, thin layer.
FaA, FaB Fairlie	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
FhE:* Ferris	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
Heiden	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: low strength, shrink-swell.	Severe: too clayey.
GeB Georgetown	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: thin layer.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
GsB---------- Georgetown	Severe: depth to rock.	Severe: shrink-swell.	Severe: depth to rock, shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: large stones.
HeB, HeC2, HeD2--- Heiden	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
HsE---------- Heiden	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: small stones, too clayey.
HuA, HuB, HuC2---- Houston Black	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
KsA, KsB---------- Krum	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
Oa---------- Oakalla	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Moderate: flooding, excess lime.
Oc*, Of*---------- Oakalla	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
PaD---------- Padina	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
QuC---------- Queeny	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: thin layer.
RaB---------- Rader	Severe: wetness.	Moderate: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness, shrink-swell.	Severe: low strength.	Slight.
RkD---------- Rosanky	Moderate: too clayey.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
RoC---------- Rosanky	Moderate: too clayey.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength.	Slight.
SuA, SuB---------- Sunev	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: excess lime.
Tc---------- Tinn	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, too clayey.
Tn---------- Tinn	Severe: wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding, too clayey.
Uh*---------- Uhland	Severe: wetness.	Severe: flooding.	Severe: flooding, wetness.	Severe: flooding.	Severe: flooding.	Severe: flooding.
WhC---------- Whitewright	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: depth to rock.	Moderate: shrink-swell, depth to rock.	Severe: low strength.	Severe: thin layer.
WnA, WnB---------- Wilson	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AgC2, AgD2 Altoga	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey, excess lime.
AuA, AuB Austin	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
AwC2:* Austin	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
Whitewright	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack, thin layer.
AxB Axtell	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
AxC2 Axtell	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BeB, BeC2 Behring	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BkC Brackett	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
BkE Brackett	Severe: depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, small stones.
BkG:* Brackett	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Poor: area reclaim, small stones, slope.
Rock outcrop.					
BrA Branyon	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BrB Branyon	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BuA Burleson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BuB Burleson	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
CaB, CaC---------- Castephen	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim.
CfA, CfB---------- Crawford	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, thin layer.
CrB, CrC2*---------- Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
De, Df*---------- Deleon	Severe: flooding, percs slowly.	Severe: flooding.	Severe: flooding, too clayey.	Severe: flooding.	Poor: too clayey, hard to pack.
DmB---------- Demona	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Severe: wetness, too clayey.	Severe: seepage.	Poor: too clayey, hard to pack.
DnA, DnB, DnC------- Denton	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
DoC---------- Doss	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
EaD, EeB---------- Eckrant	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, large stones, thin layer.
ErE:* Eckrant----------	Severe: depth to rock, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.					
ErG:* Eckrant----------	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope, large stones.	Severe: depth to rock, slope.	Poor: area reclaim, large stones, slope.
Rock outcrop.					
EyB, EyD---------- Eddy	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock.	Poor: area reclaim, thin layer.
FaA, FaB---------- Fairlie	Severe: percs slowly.	Moderate: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: too clayey.
FhE:* Ferris----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
Heiden----------	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
GeB, GsB---------- Georgetown	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: area reclaim, too clayey, hard to pack.
HeB, HeC2, HeD2----- Heiden	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
HsE---------- Heiden	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
HuA---------- Houston Black	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
HuB, HuC2---------- Houston Black	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
KsA---------- Krum	Severe: percs slowly.	Slight----------	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
KsB---------- Krum	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Oa, Oc*, Of*-------- Oakalla	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey, excess lime.
PaD---------- Padina	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
QuC---------- Queeny	Severe: cemented pan.	Severe: cemented pan, seepage.	Moderate: cemented pan.	Slight----------	Poor: area reclaim, thin layer.
RaB---------- Rader	Severe: wetness, percs slowly.	Slight----------	Severe: too clayey.	Moderate: wetness.	Moderate: too clayey, wetness.
RkD, RoC---------- Rosanky	Severe: percs slowly.	Moderate: slope.	Slight----------	Slight----------	Poor: thin layer.
SuA---------- Sunev	Slight----------	Moderate: seepage.	Moderate: too clayey.	Slight----------	Fair: too clayey, excess lime.
SuB---------- Sunev	Slight----------	Moderate: seepage, slope.	Moderate: too clayey.	Slight----------	Fair: too clayey, excess lime.
Tc, Tn---------- Tinn	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
Uh*---------- Uhland	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Fair: wetness.

See footnote at end of table.

TABLE 10.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary ¢landfill	Area sanitary landfill	Daily cover for landfill
WhC---------- Whitewright	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: area reclaim, hard to pack, thin layer.
WnA---------- Wilson	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
WnB---------- Wilson	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," "probable," and "improbable"]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
AgC2, AgD2---------- Altoga	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, excess lime.
AuA, AuB---------- Austin	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
AwC2:*				
Austin----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Whitewright----------	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
AxB, AxC2---------- Axtell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BeB, BeC2---------- Behring	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
BkC, BkE---------- Brackett	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones.
BkG:*				
Brackett----------	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, slope.
Rock outcrop.				
BrA, BrB---------- Branyon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BuA, BuB---------- Burleson	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CaB, CaC---------- Castephen	Poor: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, too clayey, thin layer.
CfA, CfB---------- Crawford	Poor: area reclaim, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CrB, CrC2*---------- Crockett	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
De, Df*---------- Deleon	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
DmB---------- Demona	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
DnA, DnB, DnC---------- Denton	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, small stones.
DoC---------- Doss	Poor: area reclaim, low strength.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: area reclaim, thin layer, excess lime.
EaD, EeB---------- Eckrant	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Poor: area reclaim, large stones, thin layer.
ErE*, ErG:* Eckrant----------	Poor: area reclaim, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Improbable: excess fines, thin layer, large stones.	Poor: area reclaim, large stones, thin layer.
Rock outcrop.				
EyB, EyD---------- Eddy	Poor: area reclaim.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, small stones, thin layer.
FaA, FaB---------- Fairlie	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
FhE:* Ferris----------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Heiden----------	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GeB, GsB---------- Georgetown	Poor: area reclaim, low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: small stones.
HeB, HeC2, HeD2, HsE-- Heiden	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
HuA, HuB, HuC2-------- Houston Black	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KsA, KsB---------- Krum	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Oa, Oc*, Of*---------- Oakalla	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, excess lime.
PaD---------- Padina	Good----------	Improbable: thin layer.	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
QuC---------- Queeny	Poor: area reclaim, thin layer.	Improbable: excess fines, thin layer.	Improbable: excess fines, thin layer.	Poor: thin layer.
RaB---------- Rader	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
RkD, RoC---------- Rosanky	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
SuA, SuB---------- Sunev	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.
Tc, Tn---------- Tinn	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Uh*---------- Uhland	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, area reclaim.
WhC---------- Whitewright	Poor: area reclaim, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: area reclaim, thin layer.
WnA, WnB---------- Wilson	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AgC2, AgD2-------- Altoga	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Slope, excess lime.	Favorable------	Excess lime.
AuA, AuB---------- Austin	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, depth to rock.	Depth to rock	Depth to rock.
AwC2:* Austin-----------	Moderate: depth to rock.	Moderate: thin layer, hard to pack.	Deep to water	Slow intake, depth to rock, slope.	Depth to rock	Depth to rock.
Whitewright------	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
AxB--------------- Axtell	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
AxC2-------------- Axtell	Slight---------	Severe: hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
BeB--------------- Behring	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
BeC2-------------- Behring	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly---	Percs slowly.
BkC--------------- Brackett	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Large stones, depth to rock.	Large stones, depth to rock.
BkE--------------- Brackett	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Large stones, slope, depth to rock.	Large stones, slope, depth to rock.
BkG:* Brackett--------- Rock outcrop.	Severe: depth to rock, slope.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Large stones, slope, depth to rock.	Large stones, slope, depth to rock.
BrA, BrB---------- Branyon	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
BuA, BuB---------- Burleson	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
CaB--------------- Castephen	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slow intake, depth to rock.	Depth to rock	Depth to rock, excess lime.
CaC--------------- Castephen	Severe: depth to rock.	Severe: thin layer.	Deep to water	Slow intake, depth to rock, slope.	Depth to rock	Depth to rock, excess lime.
CfA, CfB---------- Crawford	Moderate: depth to rock.	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
CrB--------------- Crockett	Slight---------	Moderate: piping, hard to pack.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.
CrC2*------------- Crockett	Moderate: slope.	Moderate: piping, hard to pack.	Deep to water	Percs slowly, slope, erodes easily.	Erodes easily, percs slowly.	Erodes easily, percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
De, Df*---------- Deleon	Slight---------	Moderate: hard to pack.	Deep to water	Slow intake, percs slowly, flooding.	Percs slowly---	Percs slowly.
DmB---------- Demona	Severe: seepage.	Moderate: hard to pack, wetness.	Slope, cutbanks cave.	Wetness, droughty, fast intake.	Wetness, soil blowing.	Droughty.
DnA, DnB---------- Denton	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
DnC---------- Denton	Moderate: depth to rock, slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
DoC---------- Doss	Severe: depth to rock, seepage.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
EaD, EeB---------- Eckrant	Severe: depth to rock, seepage.	Severe: thin layer, large stones.	Deep to water	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, depth to rock.
ErE*, ErG:* Eckrant---------- Rock outcrop.	Severe: depth to rock, seepage.	Severe: thin layer, large stones.	Deep to water	Large stones, droughty, depth to rock.	Slope, large stones, depth to rock.	Large stones, slope, depth to rock.
EyB, EyD---------- Eddy	Severe: depth to rock.	Severe: thin layer, large stones.	Deep to water	Large stones, droughty, depth to rock.	Large stones, depth to rock.	Large stones, droughty.
FaA, FaB---------- Fairlie	Moderate: thin layer, depth to rock.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
FhE:* Ferris---------- Heiden----------	Severe: slope. Slight---------	Severe: hard to pack. Severe: hard to pack.	Deep to water Deep to water	Slow intake, percs slowly, slope. Slow intake, percs slowly, slope.	Slope, percs slowly. Slope, percs slowly.	Slope, percs slowly. Slope, percs slowly.
GeB, GsB---------- Georgetown	Moderate: depth to rock.	Severe: hard to pack.	Deep to water	Percs slowly, depth to rock.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
HeB---------- Heiden	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
HeC2, HeD2-------- Heiden	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly---	Percs slowly.
HsE---------- Heiden	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Slope, large stones, percs slowly.	Large stones, percs slowly.
HuA, HuB---------- Houston Black	Slight---------	Severe: hard to pack.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
HuC2---------- Houston Black	Moderate: slope.	Severe: hard to pack.	Deep to water	Slow intake, percs slowly, slope.	Percs slowly---	Percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
KsA, KsB---------- Krum	Slight---------	Severe: hard to pack.	Deep to water	Slow intake----	Favorable------	Favorable.
Oa, Oc*, Of*------ Oakalla	Moderate: seepage.	Moderate: hard to pack.	Deep to water	Flooding, excess lime.	Flooding-------	Excess lime.
PaD---------- Padina	Severe: seepage.	Severe: seepage, piping.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.	Droughty.
QuC---------- Queeny	Severe: cemented pan.	Severe: thin layer.	Deep to water	Cemented pan, slope.	Cemented pan---	Cemented pan.
RaB---------- Rader	Slight---------	Moderate: hard to pack, wetness.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.	Percs slowly.
RkD---------- Rosanky	Slight---------	Severe: piping.	Deep to water	Fast intake, slope.	Erodes easily	Erodes easily.
RoC---------- Rosanky	Slight---------	Severe: piping.	Deep to water	Slope----------	Erodes easily	Erodes easily.
SuA, SuB---------- Sunev	Moderate: seepage.	Moderate: piping.	Deep to water	Excess lime----	Favorable------	Excess lime.
Tc, Tn---------- Tinn	Slight---------	Severe: hard to pack, wetness.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
Uh*---------- Uhland	Slight---------	Severe: piping, wetness.	Flooding-------	Wetness, flooding.	Wetness--------	Erodes easily.
WhC---------- Whitewright	Severe: depth to rock.	Severe: thin layer.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
WnA, WnB---------- Wilson	Slight---------	Severe: hard to pack, wetness.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

[Absence of an entry indicates that data were not estimated]

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
AgC2, AgD2----- Altoga	0-46	Silty clay loam	CL, CH	A-6, A-7-6	0	95-100	95-100	90-100	70-99	34-52	18-33
	46-60	Silty clay, silty clay loam, clay loam.	CL	A-6, A-7-6	0	95-100	95-100	90-100	58-99	34-48	18-33
AuA----- Austin	0-14	Silty clay-----	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-96	45-69	25-44
	14-36	Silty clay, clay, silty clay loam.	CH, CL	A-7-6, A-6	0-5	95-100	90-100	80-100	75-96	35-65	16-40
	36-48	Weathered bedrock	---	---	---	---	---	---	---	---	---
AuB----- Austin	0-13	Silty clay-----	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-96	45-69	25-44
	13-34	Silty clay, clay, silty clay loam.	CH, CL	A-7-6, A-6	0-5	95-100	90-100	80-100	75-96	35-65	16-40
	34-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
AwC2:*											
Austin-----	0-12	Silty clay-----	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-96	45-69	25-44
	12-32	Silty clay, clay, silty clay loam.	CH, CL	A-7-6, A-6	0-5	95-100	90-100	80-100	75-96	35-65	16-40
	32-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Whitewright-----	0-5	Silty clay loam	CL, CH	A-6, A-7	0-5	95-100	90-100	80-100	60-98	34-52	15-32
	5-13	Silty clay loam, clay loam, gravelly clay loam.	CL, CH	A-6, A-7	0-5	85-100	80-100	70-100	60-98	34-52	15-32
	13-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
AxB, AxC2----- Axtell	0-4	Fine sandy loam	SM, ML, SM-SC, CL-ML	A-2-4, A-4	0	90-100	80-100	75-100	28-75	<31	NP-7
	4-44	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-98	41-65	25-40
	44-60	Clay, clay loam, sandy clay.	CL, CH	A-7-6	0-2	90-100	75-100	75-100	51-98	41-65	25-40
BeB----- Behring	0-4	Clay loam-----	CL, CH	A-7-6, A-6	0	95-100	95-100	90-100	75-95	35-55	18-34
	4-34	Clay, silty clay	CL, CH	A-7-6	0	95-100	95-100	90-100	75-95	45-65	25-40
	34-46	Clay, silty clay	CL, CH	A-7-6	0	90-100	85-100	85-100	75-100	45-75	25-50
	46-60	Shaly clay, silty clay loam, silty clay.	CH	A-7-6	0-2	85-100	85-100	80-100	75-100	51-75	30-50
BeC2----- Behring	0-4	Clay loam-----	CL, CH	A-7-6, A-6	0	95-100	95-100	90-100	75-95	35-55	18-34
	4-32	Clay, silty clay	CL, CH	A-7-6	0	95-100	95-100	90-100	75-95	45-65	25-40
	32-42	Clay, silty clay	CL, CH	A-7-6	0	90-100	85-100	85-100	75-100	45-75	25-50
	42-60	Shaly clay, silty clay loam, silty clay.	CH	A-7-6	0-2	85-100	85-100	80-100	75-100	51-75	30-50
BkC----- Brackett	0-10	Clay loam-----	CL, SC, GC	A-6, A-4, A-7-6	0-20	70-100	60-100	54-95	40-85	28-45	9-26
	10-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BkE----- Brackett	0-16	Gravelly clay loam.	CL, SC, GC	A-6, A-4, A-7-6	0-20	70-100	60-100	54-95	40-85	28-45	9-26
	16-60	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
BkG:*											
Brackett	0-12	Gravelly silty clay loam.	CL, SC, GC	A-6, A-4, A-7-6	0-20	70-100	60-100	54-95	40-85	28-45	9-26
	12-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
BrA, BrB	0-60	Clay	CH	A-7-6	0	95-100	85-100	80-100	75-100	54-80	35-55
Branyon	60-72	Clay, silty clay, clay loam.	CH, CL, GC, SC	A-2, A-4, A-6, A-7	0-10	40-100	35-100	30-100	25-100	25-80	8-60
BuA, BuB	0-58	Clay	CH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-96	51-90	27-55
Burleson	58-64	Clay, silty clay	CH	A-7-6, A-7-5	0-1	95-100	80-100	75-99	70-95	51-90	30-55
CaB, CaC	0-16	Silty clay	CL, CH	A-6, A-7-6	0-2	80-95	60-95	55-92	51-85	30-55	15-38
Castephen	16-22	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
CfA, CfB	0-27	Clay	CH, CL	A-7-6	0-5	85-100	85-100	75-100	70-100	47-80	28-50
Crawford	27-30	Weathered bedrock	---	---	---	---	---	---	---	---	---
CrB, CrC2*	0-4	Loam	SM, ML, CL, SC	A-4, A-6	0-2	95-100	95-100	90-100	35-98	15-35	3-15
Crockett	4-18	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	65-98	36-60	22-45
	18-52	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	51-98	36-60	18-43
	52-60	Clay loam, sandy clay loam, loam.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-60	15-40
De	0-22	Sandy clay, clay	CH, CL	A-7	0	95-100	95-100	95-100	85-100	41-60	25-41
Deleon	22-62	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	95-100	95-100	90-100	70-100	35-60	20-41
Df*	0-40	Clay loam	CH, CL	A-7	0	95-100	95-100	95-100	85-100	41-60	25-41
Deleon	40-54	Clay, silty clay, silty clay loam.	CH, CL	A-7, A-6	0	95-100	95-100	90-100	70-100	35-60	20-41
DmB	0-22	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4, A-4, A-3	0	80-100	70-100	65-100	7-45	<25	NP-5
Demona	22-54	Sandy clay, clay	CH, CL, SC	A-7-6	0	80-100	80-100	80-100	41-85	33-60	20-40
	54-60	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-2-6, A-7-6, A-6	0	80-100	80-100	80-100	25-97	25-72	11-53
DnA, DnB, DnC	0-33	Silty clay	CH, CL	A-7-6	0-10	80-100	80-100	80-100	75-95	49-70	26-45
Denton	33-36	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-20	80-100	80-100	80-100	70-95	41-60	21-40
	36-38	Weathered bedrock	---	---	---	---	---	---	---	---	---
DoC	0-19	Silty clay, silty clay loam.	CL, CH	A-7-6	0-20	84-100	81-100	75-100	61-95	41-61	20-39
Doss	19-36	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
EaD	0-13	Cobbly clay	GC, SC, CH	A-7-6, A-2-7	25-75	45-100	40-100	35-98	30-94	47-76	26-54
Eckrant	13-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
EeB	0-11	Extremely stony clay.	GC, SC, CH	A-7-6, A-2-7	25-75	45-98	40-98	35-98	30-94	51-76	31-54
Eckrant	11-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
ErE*, ErG:*											
Eckrant	0-11	Extremely stony silty clay loam.	GC, SC, CH	A-7-6, A-2-7	25-75	45-98	40-98	35-98	30-94	51-76	31-54
	11-16	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
EyB, EyD	0-6	Very gravelly clay loam.	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
Eddy	6-18	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
FaA, FaB	0-8	Clay	CH, CL	A-7	0	95-100	90-100	90-100	85-100	41-70	25-45
Fairlie	8-46	Silty clay loam, silty clay, clay.	CH	A-7	0	95-100	95-100	90-100	85-100	51-80	28-53
	46-54	Weathered bedrock	---	---	---	---	---	---	---	---	---
FhE:*											
Ferris	0-60	Clay	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
Heiden	0-22	Clay	CH	A-7-6	0	95-100	90-100	80-100	75-99	51-80	32-55
	22-60	Clay, silty clay	CH, CL	A-7-6	0	90-100	90-100	75-100	70-99	50-80	32-55
GeB	0-7	Clay loam	CL	A-6, A-7-6	0-5	75-95	75-95	70-95	65-95	35-50	20-30
Georgetown	7-35	Clay, stony clay, cobbly clay.	CH	A-7-6	0-15	56-100	56-100	51-98	51-98	60-80	35-50
	35-47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
GsB	0-7	Stony clay loam	CL	A-6, A-7-6	1-15	56-90	56-90	51-85	51-80	35-50	20-30
Georgetown	7-35	Clay, stony clay	CH	A-7-6	5-15	56-100	56-99	51-95	51-92	60-80	35-50
	35-47	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
HeB, HeC2, HeD2	0-22	Clay	CH	A-7-6	0	95-100	90-100	80-100	75-99	51-80	32-55
Heiden	22-60	Clay, silty clay	CH, CL	A-7-6	0	90-100	90-100	75-100	70-99	50-80	32-56
HsE	0-18	Very stony clay	CH	A-7-6	5-20	75-99	70-98	60-97	55-95	55-80	35-55
Heiden	18-60	Clay, silty clay	CH, CL	A-7-6	0	83-100	81-100	75-100	70-99	45-80	31-60
HuA, HuB, HuC2	0-32	Clay	CH	A-7-6	0	94-100	94-100	94-100	85-100	58-98	34-72
Houston Black	32-62	Clay, silty clay	CH	A-7-6	0	94-100	93-100	92-100	85-100	58-100	34-75
KsA, KsB	0-6	Silty clay	CH, CL	A-7-6	0	95-100	85-100	85-100	85-95	47-65	25-42
Krum	6-44	Silty clay, clay	CH, CL	A-7-6	0	93-100	85-100	80-100	65-95	46-74	28-50
	44-72	Silty clay loam, silty clay, clay.	CH, CL	A-7-6, A-6	0	85-100	75-100	70-99	65-95	36-60	20-39
Oa, Oc*, Of*	0-60	Silty clay loam	CL, CH	A-6, A-7-6	0-2	85-100	80-100	70-100	65-95	25-54	14-36
Oakalla											
PaD	0-65	Fine sand, loamy fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3	0	100	95-100	85-100	8-28	<25	NP-5
Padina	65-99	Sandy clay loam, fine sandy loam.	SC	A-2, A-4, A-6	0	90-100	90-100	90-100	25-50	22-36	8-20
QuC	0-18	Clay loam	CL, SC, CH	A-6, A-7-6	0-5	75-95	75-95	50-95	40-75	30-52	12-31
Queeny	18-32	Cemented	---	---	---	---	---	---	---	---	---
	32-99	Variable	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
RaB---------- Rader	0-12	Fine sandy loam	ML, CL-ML, SC, SM-SC	A-2, A-4	0	90-100	90-100	70-100	28-70	18-28	3-10
	12-28	Sandy clay loam, loam, clay loam.	SC, CL	A-6	0	90-100	90-100	80-100	36-75	26-40	11-22
	28-50	Sandy clay, clay, clay loam.	CL, CH	A-6, A-7	0	90-100	90-100	85-100	51-90	36-60	18-38
	50-62	Sandy clay loam, sandy clay, clay.	SC, CL	A-6, A-7	0	90-100	90-100	75-100	36-75	30-52	11-30
RkD---------- Rosanky	0-14	Loamy fine sand	SM, SP-SM	A-2-4, A-4	0-2	80-100	75-100	75-100	12-50	<30	NP-7
	14-46	Sandy clay, clay	CL, SC, CH	A-6, A-7-6	0-2	85-100	75-100	75-100	49-90	37-56	19-34
	46-80	Weathered bedrock	---	---	---	---	---	---	---	---	---
RoC---------- Rosanky	0-12	Fine sandy loam	SM, SP-SM	A-2-4, A-4	0-2	80-100	75-100	75-100	12-50	<30	NP-7
	12-39	Sandy clay, clay	CL, SC, CH	A-6, A-7-6	0-2	85-100	75-100	75-100	49-90	37-62	19-40
	39-60	Sandy clay loam, clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2	0	80-100	75-100	75-100	36-60	23-40	5-19
	60-80	Weathered bedrock	---	---	---	---	---	---	---	---	---
SuA, SuB---------- Sunev	0-18	Silty clay loam	CL, CH	A-6, A-7-6	0	90-100	80-100	80-100	60-93	30-61	12-37
	18-52	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	85-100	80-100	70-100	51-88	28-52	8-33
	52-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	80-100	75-100	70-100	51-72	25-40	8-20
Tc, Tn---------- Tinn	0-44	Clay----------	CH, CL	A-7	0	95-100	95-100	85-100	80-100	45-75	25-54
	44-60	Clay, silty clay	CH	A-7	0	95-100	90-100	80-100	80-100	55-75	35-54
Uh*---------- Uhland	0-7	Clay loam--------	CL	A-6, A-7	0-5	95-100	95-100	90-100	55-90	30-45	12-25
	7-67	Stratified fine sandy loam to loam.	CL, SC, ML, SM	A-4, A-6	0-5	90-100	90-100	80-100	36-65	22-35	3-12
WhC---------- Whitewright	0-5	Silty clay loam	CL, CH	A-6, A-7	0-5	95-100	90-100	80-100	60-98	34-52	15-32
	5-15	Silty clay loam, clay loam, gravelly clay loam.	CL, CH	A-6, A-7	0-5	85-100	80-100	70-100	60-98	34-52	15-32
	15-38	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
WnA, WnB---------- Wilson	0-5	Clay loam--------	CL	A-6	0	95-100	85-100	80-100	60-96	25-37	10-21
	5-60	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	38-55	21-35
	60-72	Silty clay, clay, clayey shale.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
AgC2, AgD2------- Altoga	0-46 46-60	35-50 35-50	0.6-2.0 0.6-2.0	0.15-0.18 0.15-0.18	7.9-8.4 7.9-8.4	High---------- Moderate-------	0.32 0.32	5	<2
AuA-------------- Austin	0-14 14-36 36-48	35-55 35-55 ---	0.2-0.6 0.2-0.6 ---	0.15-0.20 0.15-0.20 ---	7.9-8.4 7.9-8.4 ---	High---------- Moderate------- ----------	0.32 0.32 ----	2	1-4
AuB-------------- Austin	0-12 12-32 32-60	35-55 35-55 ---	0.2-0.6 0.2-0.6 ---	0.15-0.20 0.15-0.20 ---	7.9-8.4 7.9-8.4 ---	High---------- Moderate------- ----------	0.32 0.32 ----	2	1-4
AwC2:* Austin---------- 	0-13 13-34 34-48	35-55 35-55 ---	0.2-0.6 0.2-0.6 ---	0.15-0.20 0.15-0.20 ---	7.9-8.4 7.9-8.4 ---	High---------- Moderate------- ----------	0.32 0.32 ----	2	1-4
Whitewright----- 	0-5 5-13 13-22	28-45 28-45 ---	0.6-2.0 0.6-2.0 ---	0.15-0.20 0.13-0.20 ---	7.9-8.4 7.9-8.4 ---	Moderate------- Moderate------- ----------	0.32 0.32 ----	2	.5-1
AxB, AxC2-------- Axtell	0-4 4-44 44-60 39-75	7-18 40-55 40-55 25-50	0.6-2.0 <0.06 <0.06 0.2-0.6	0.11-0.15 0.13-0.18 0.13-0.15 0.13-0.18	5.1-6.5 4.5-5.5 5.1-7.3 5.6-8.4	Low---------- High---------- High---------- High----------	0.43 0.37 0.37 0.37	5	.5-1
BeB-------------- Behring	0-4 4-34 34-46 46-60	35-55 35-55 35-55 35-55	0.06-0.2 0.06-0.2 0.06-0.2 <0.06	0.15-0.20 0.15-0.20 0.15-0.20 0.05-0.10	6.6-8.4 6.6-8.4 7.4-8.4 7.4-8.4	Moderate------- High---------- High---------- High----------	0.32 0.32 0.32 0.32	5	1-3
BeC2------------- Behring	0-4 4-32 32-42 42-60	35-55 35-55 35-55 35-55	0.06-0.2 0.06-0.2 0.06-0.2 <0.06	0.15-0.20 0.15-0.20 0.15-0.20 0.05-0.10	6.6-8.4 6.6-8.4 7.4-8.4 7.4-8.4	Moderate------- High---------- High---------- High----------	0.32 0.32 0.32 0.32	5	1-3
BkC, BkE--------- Brackett	0-10 10-60	15-35 ---	0.2-0.6 ---	0.10-0.20 ---	7.9-8.4 ---	Low---------- ----------	0.17 ----	2	<1
BkG*: Brackett-------- 	0-12 12-60	15-35 ---	0.2-0.6 ---	0.10-0.20 ---	7.9-8.4 ---	Low---------- ----------	0.17 ----	2	<1
Rock outcrop.									
BrA, BrB--------- Branyon	0-60 60-72	45-60 30-60	<0.06 <2.0	0.15-0.18 0.11-0.18	7.9-8.4 7.9-8.4	Very high------ Very high------	0.32 0.32	5	2-4
BuA, BuB--------- Burleson	0-58 58-64	35-60 35-60	<0.06 <0.06	0.12-0.18 0.12-0.18	5.6-8.4 7.4-8.4	High---------- High----------	0.32 0.32	5	1-3
CaB, CaC--------- Castephen	0-16 16-22	24-43 ---	0.6-2.0 ---	0.08-0.14 ---	7.9-8.4 ---	Moderate------- ----------	0.32 ----	1	1-3
CfA, CfB--------- Crawford	0-27 27-30	42-60 ---	<0.06 ---	0.14-0.18 ---	6.1-8.4 ---	Very high------ ----------	0.32 ----	2	1-3
CrB, CrC2*------- Crockett	0-4 4-18 18-52 52-60	5-20 40-60 40-60 15-45	0.6-2.0 <0.06 <0.06 0.06-0.2	0.11-0.20 0.14-0.18 0.14-0.18 0.15-0.20	5.6-7.3 5.6-7.3 6.1-8.4 7.4-8.4	Low---------- High---------- High---------- Moderate-------	0.43 0.32 0.32 0.32	5	.5-2
De--------------- Deleon	0-22 22-62	40-55 18-45	0.06-0.2 0.06-0.2	0.14-0.18 0.14-0.22	6.6-8.4 7.9-8.4	High---------- High----------	0.32 0.32	5	1-3

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
Df*----------	0-40	40-55	0.06-0.2	0.14-0.18	6.6-8.4	High----------	0.32	5	1-3
Deleon	40-54	18-45	0.06-0.2	0.14-0.22	7.9-8.4	High----------	0.32		
DmB----------	0-22	5-15	2.0-6.0	0.05-0.10	5.6-7.8	Very low-------	0.17	5	<1
Demona	22-54	35-50	0.2-0.6	0.15-0.18	5.1-6.5	Moderate-------	0.24		
	54-60	20-45	0.2-0.6	0.14-0.18	5.1-6.5	Moderate-------	0.24		
DnA, DnB, DnC----	0-33	35-60	0.06-0.2	0.15-0.20	7.9-8.4	High----------	0.32	2	1-4
Denton	33-36	35-60	0.06-0.2	0.15-0.20	7.9-8.4	High----------	0.32		
	36-38	---	---	---	---	----------	----		
DoC----------	0-19	32-48	0.2-0.6	0.15-0.20	7.9-8.4	Moderate-------	0.24	1	1-3
Doss	19-36	---	---	---	---	----------	----		
EaD----------	0-13	35-60	0.2-0.6	0.05-0.12	6.6-8.4	Moderate-------	0.10	1	1-3
Eckrant	13-16	---	---	---	---	----------	----		
EeB----------	0-11	35-60	0.2-0.6	0.05-0.12	6.6-8.4	Moderate-------	0.10	1	1-3
Eckrant	11-16	---	---	---	---	----------	----		
ErE*, ErG:*									
Eckrant----------	0-11	35-60	0.2-0.6	0.05-0.12	6.6-8.4	Moderate-------	0.10	1	1-3
	11-16	---	---	---	---	----------	----		
Rock outcrop.									
EyB, EyD----------	0-6	20-40	0.6-2.0	0.10-0.13	7.9-8.4	Low----------	0.24	1	<2
Eddy	6-18	---	---	---	---	----------	----		
FaA, FaB----------	0-8	32-50	<0.06	0.14-0.20	7.4-8.4	Very high------	0.32	5	1-4
Fairlie	8-46	35-60	<0.06	0.14-0.20	7.4-8.4	Very high------	0.32		
	46-54	---	---	---	---	----------	----		
FhE:*									
Ferris----------	0-60	40-60	<0.06	0.15-0.18	7.9-8.4	Very high------	0.32	4	.5-2
Heiden----------	0-22	40-60	<0.06	0.15-0.20	7.9-8.4	Very high------	0.32	5	1-4
	22-60	40-60	<0.06	0.12-0.20	7.9-8.4	Very high------	0.32		
GeB----------	0-7	20-40	0.2-0.6	0.15-0.20	6.1-7.8	Moderate-------	0.32	2	1-4
Georgetown	7-35	60-80	0.06-0.2	0.12-0.20	6.1-7.8	High----------	0.32		
	35-47	---	---	---	---	----------	----		
GsB----------	0-7	20-40	0.2-0.6	0.11-0.19	6.1-7.8	Moderate-------	0.28	2	1-4
Georgetown	7-35	60-80	0.06-0.2	0.11-0.20	6.1-7.8	High----------	0.32		
	35-47	---	---	---	---	----------	----		
HeB, HeC2, HeD2--	0-22	40-60	<0.06	0.15-0.20	7.9-8.4	Very high------	0.32	5	1-4
Heiden	22-60	40-60	<0.06	0.12-0.20	7.9-8.4	Very high------	0.32		
HsE----------	0-18	40-60	<0.06	0.10-0.18	7.9-8.4	Very high------	0.28	5	1-4
Heiden	18-60	40-60	<0.06	0.12-0.20	7.9-8.4	Very high------	0.32		
HuA, HuB, HuC2---	0-32	40-60	<0.06	0.15-0.20	7.4-8.4	Very high------	0.32	5	1-4
Houston Black	32-62	40-60	<0.06	0.15-0.20	7.4-8.4	Very high------	0.32		
KsA, KsB----------	0-6	35-55	0.2-0.6	0.15-0.20	7.4-8.4	High----------	0.32	5	1-3
Krum	6-44	40-60	0.2-0.6	0.14-0.20	7.9-8.4	High----------	0.32		
	44-72	35-60	0.2-0.6	0.14-0.20	7.9-8.4	High----------	0.32		
Oa, Oc*, Of*-----	0-60	25-43	0.6-2.0	0.12-0.19	7.9-8.4	Moderate-------	0.32	5	1-3
Oakalla									
PaD----------	0-65	2-10	6.0-20	0.05-0.08	5.6-7.3	Very low-------	0.17	5	<1
Padina	65-99	18-35	0.6-2.0	0.14-0.18	5.1-6.5	Low----------	0.24		

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
							K	T	
	In	Pct	In/hr	In/in	pH				Pct
QuC----------	0-18	22-35	0.6-2.0	0.14-0.19	7.9-8.4	Moderate-------	0.17	1	1-3
Queeny	18-32	---	---	---	---	----------	----		
	32-99	---	---	---	---	----------	----		
RaB----------	0-12	5-20	2.0-6.0	0.10-0.15	4.5-6.5	Low----------	0.32	5	.5-2
Rader	12-28	18-30	0.2-0.6	0.12-0.18	4.5-5.5	Moderate-------	0.32		
	28-50	35-50	<0.06	0.12-0.18	4.5-6.5	High----------	0.32		
	50-62	24-45	0.06-0.2	0.12-0.18	4.5-8.4	Moderate-------	0.32		
RkD, RoC-----	0-14	6-18	0.6-2.0	0.08-0.12	6.1-7.3	Low----------	0.32	5	<2
Rosanky	14-46	15-35	0.2-0.6	0.10-0.16	5.1-6.0	Low----------	0.37		
	46-80	---	---	---	---	----------	----		
SuA, SuB-----	0-18	20-40	0.6-2.0	0.11-0.16	7.9-8.4	Moderate-------	0.28	5	1-3
Sunev	18-52	20-40	0.6-2.0	0.11-0.16	7.9-8.4	Low----------	0.28		
	52-60	20-40	0.6-2.0	0.11-0.16	7.9-8.4	Low----------	0.28		
Tc, Tn----------	0-44	35-60	0.06-0.2	0.15-0.20	7.4-8.4	High----------	0.32	5	1-4
Tinn	44-60	40-60	<0.06	0.15-0.20	7.4-8.4	High----------	0.32		
Uh*----------	0-7	28-35	0.2-0.6	0.15-0.20	6.1-8.4	Moderate-------	0.32	5	.5-1
Uhland	7-67	10-18	0.2-0.6	0.10-0.14	6.1-8.4	Low----------	0.43		
WhC----------	0-5	28-45	0.6-2.0	0.15-0.20	7.9-8.4	Moderate-------	0.32	2	.5-1
Whitewright	5-15	28-45	0.6-2.0	0.13-0.20	7.9-8.4	Moderate-------	0.32		
	15-38	---	---	---	---	----------	----		
WnA, WnB-----	0-5	27-40	0.2-0.6	0.15-0.20	5.6-7.3	Low----------	0.43	5	.5-2
Wilson	5-60	35-50	<0.06	0.14-0.20	5.6-8.4	High----------	0.37		
	60-72	35-50	<0.06	0.12-0.15	6.6-8.4	High----------	0.37		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "frequent," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
AgC2, AgD2-------- Altoga	C	None---------	---	---	>6.0	---	---	>60	---	High-----	Low.
AuA, AuB---------- Austin	C	None---------	---	---	>6.0	---	---	20-40	Soft	High-----	Low.
AwC2:*											
Austin-----------	C	None---------	---	---	>6.0	---	---	20-40	Soft	High-----	Low.
Whitewright------	C	None---------	---	---	>6.0	---	---	10-20	Soft	High-----	Low.
AxB, AxC2--------- Axtell	D	None---------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
BeB, BeC2--------- Behring	D	None---------	---	---	>6.0	---	---	>60	---	High-----	Low.
BkC, BkE---------- Brackett	C	None---------	---	---	>6.0	---	---	10-20	Soft	High-----	Low.
BkG:*											
Brackett---------	C	None---------	---	---	>6.0	---	---	10-20	Soft	High-----	Low.
Rock outcrop.											
BrA, BrB---------- Branyon	D	None---------	---	---	>6.0	---	---	>60	---	High-----	Low.
BuA, BuB---------- Burleson	D	None---------	---	---	>6.0	---	---	>60	---	High-----	Low.
CaB, CaC---------- Castephen	C	None---------	---	---	>6.0	---	---	8-20	Soft	High-----	Low.
CfA, CfB---------- Crawford	D	None---------	---	---	>6.0	---	---	20-40	Hard	High-----	Low.
CrB, CrC2*-------- Crockett	D	None---------	---	---	>6.0	---	---	>60	---	High-----	Low.
De---------------- Deleon	C	Occasional	Brief-----	May-Oct	>6.0	---	---	>60	---	High-----	Low.
Df*--------------- Deleon	C	Frequent----	Brief-----	May-Oct	>6.0	---	---	>60	---	High-----	Low.
DmB--------------- Demona	C	None---------	---	---	1.5-3.5	Perched	May-Oct	>60	---	High-----	Moderate.
DnA, DnB, DnC----- Denton	D	None---------	---	---	>6.0	---	---	22-40	Hard	High	Low.
DoC--------------- Doss	C	None---------	---	---	>6.0	---	---	11-20	Soft	High-----	Low.
EaD, EeB---------- Eckrant	D	None---------	---	---	>6.0	---	---	5-20	Hard	High-----	Low.
ErE*, ErG:*											
Eckrant----------	D	None---------	---	---	>6.0	---	---	5-20	Hard	High-----	Low.
Rock outcrop.											
EyB, EyD---------- Eddy	C	None---------	---	---	>6.0	---	---	4-14	Soft	High-----	Low.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
FaA, FaB---------- Fairlie	D	None--------	---	---	>6.0	---	---	40-60	Soft	High-----	Low.
FhE:*											
Ferris----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Heiden----------	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
GeB, GsB---------- Georgetown	D	None--------	---	---	>6.0	---	---	20-40	Hard	High-----	Low.
HeB, HeC2, HeD2, HsE---------- Heiden	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
HuA, HuB, HuC2---- Houston Black	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
KsA, KsB---------- Krum	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
Oa---------- Oakalla	B	Occasional	Very brief to brief.	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
Oc*, Of*---------- Oakalla	B	Frequent----	Very brief to brief.	May-Sep	>6.0	---	---	>60	---	Moderate	Low.
PaD---------- Padina	B	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
QuC---------- Queeny	D	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
RaB---------- Rader	D	None--------	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High-----	Moderate.
RkD, RoC---------- Rosanky	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
SuA, SuB---------- Sunev	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Tc---------- Tinn	D	Occasional	Brief-----	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---	High-----	Low.
Tn---------- Tinn	D	Frequent----	Brief-----	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---	High-----	Low.
Uh*---------- Uhland	B	Frequent----	Brief-----	Mar-May	1.5-3.0	Apparent	Mar-May	>60	---	High-----	Low.
WhC---------- Whitewright	C	None--------	---	---	>6.0	---	---	11-19	Soft	High-----	Low.
WnA, WnB---------- Wilson	D	None--------	---	---	0-1.0	Perched	Nov-Mar	>60	---	High-----	High.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--ENGINEERING INDEX TEST DATA

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--						Percentage smaller than--						Limit	Linear	Ratio
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm						
			Pct											Pct		G/cc	Pct	Pct	Pct
Altoga silty clay loam:[3] (S75TX-491-010)																			
A---------0 to 14	A-6 (14)	CL	0	100	100	100	98	98	95	74	67	39	30	36	21	2.68	16.0	9.7	1.8
B2--------14 to 46	A-7-6(30)	CL	0	100	100	100	100	99	98	90	85	55	44	48	33	2.69	13.0	15.8	2.0
B3ca------46 to 60	A-7-6(22)	CL	0	100	100	100	100	99	98	85	79	51	40	42	26	2.68	14.0	13.0	1.9
Austin silty clay loam:[4] (S75TX-491-022)																			
Ap--------0 to 6	A-7-6(44)	CH	0	100	100	99	99	98	97	95	88	59	50	67	40	2.68	11.0	22.0	2.0
A1--------6 to 14	A-7-6(49)	CH	0	100	100	100	100	99	98	96	91	66	54	69	44	2.70	12.0	22.8	2.0
B21-------14 to 21	A-7-6(42)	CH	0	100	100	100	99	99	98	96	89	67	51	62	39	2.70	11.0	21.0	2.0
B22-------21 to 29	A-7-6(25)	CL	0	100	99	98	98	95	92	87	86	61	45	48	28	2.70	18.0	13.7	1.8
Axtell fine sandy loam:[5] (S76TX-491-003)																			
A1--------0 to 10	A-4 (02)	ML	0	100	100	100	99	98	97	74	50	9	5	27	4	2.63	24.0	1.5	1.5
A2--------10 to 14	A-4 (01)	ML	0	100	100	100	99	98	97	73	47	9	6	24	3	2.66	21.0	1.7	1.6
B21t------14 to 34	A-7-6(38)	CH	0	100	100	100	99	99	98	88	81	58	55	61	40	2.72	14.0	19.4	1.9
B22t------34 to 46	A-7-6(28)	CL	0	100	100	100	100	99	98	84	73	43	39	48	33	2.71	13.0	15.7	1.9
C---------46 to 60	A-7-6(32)	CL-CH	0	100	100	100	100	100	99	90	77	42	37	50	34	2.70	15.0	15.5	1.8
Behring clay loam:[6] (S74TX-491-007)																			
Ap--------0 to 4	A-7-6(25)	CL	0	100	100	100	100	99	97	86	81	41	36	44	29	2.66	12.0	15.2	2.0
A11-------4 to 10	A-7-6(26)	CL	0	100	100	100	100	99	97	86	79	42	36	45	30	2.66	12.0	15.5	2.0
A12------10 to 34	A-7-6(35)	CH	0	100	100	100	100	98	97	90	84	52	45	53	37	2.69	8.0	19.6	2.0
B2-------34 to 46	A-7-6(46)	CH	0	100	100	99	98	98	96	93	91	61	52	64	45	2.73	10.0	22.0	2.0
C---------46 to 60	A-7-6(51)	CH	0	100	100	100	100	100	98	97	93	63	50	68	47	2.76	11.0	22.5	1.9

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX TEST DATA-Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
			Pct											Pct		G/cc	Pct	Pct	Pct
Brackett gravelly clay loam:[7] (S75TX-491-027)																			
A1--------0 to 5	A-6 (04)	CL	0	100	100	100	98	91	76	54	52	30	18	32	12	2.66	20.0	6.2	1.7
B2--------5 to 14	A-6 (07)	CL	0	100	100	97	96	88	79	72	71	40	22	33	12	2.70	23.0	5.0	1.6
Branyon clay:[8] (S75TX-491-015)																			
A---------0 to 6	A-7-6(50)	CH	0	100	100	100	100	100	99	98	93	58	50	65	46	2.70	11.0	22.0	2.0
AC--------6 to 52	A-7-6(55)	CH	0	100	100	100	100	99	98	96	94	60	50	69	52	2.73	12.0	23.0	2.0
C--------52 to 64	A-7-6(22)	CL	0	100	97	96	94	93	92	84	83	47	29	41	27	2.72	14.0	13.0	1.9
Burleson clay:[9] (S78TX-491-009																			
A1--------0 to 45	A-7-6(33)	CH	0	100	100	99	99	98	97	87	83	47	41	53	37	2.68	10.0	19.4	2.0
AC-------45 to 60	A-7-6(36)	CH	0	100	100	100	99	99	96	87	84	50	43	55	40	2.71	11.0	19.6	2.0
Castephen silty clay loam:[10] (S75TX-491-005)																			
A11-------0 to 8	A-7-6(27)	CH	0	100	90	90	89	88	86	80	86	47	38	53	33	2.69	12.0	18.0	1.9
A12-------8 to 15	A-7-6(26)	CH	0	100	99	96	93	90	86	80	87	52	39	54	32	2.69	13.0	17.9	1.9
Crawford clay:[11] (S75TX-491-024)																			
A11-------0 to 6	A-7-6(28)	CL	0	100	100	99	99	98	97	93	90	46	35	47	28	2.61	14.0	14.5	1.8
A12-------6 to 20	A-7-6(39)	CH	0	100	100	100	100	100	99	95	93	63	58	58	37	2.69	12.0	19.8	2.0
A13------20 to 27	A-7-6(43)	CH	0	100	99	99	99	97	96	90	--	58	55	65	43	2.72	8.0	22.3	2.0

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX TEST DATA-Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
			Pct											Pct		G/cc	Pct	Pct	Pct
Crockett fine sandy loam:[3] (S74TX-491-017)																			
A1--------0 to 4	A-4 (04)	CL	0	100	100	100	100	100	99	64	49	20	17	28	9	2.63	18.0	5.5	1.7
B21t-------4 to 18	A-7-6(24)	CH	0	100	100	100	98	95	94	74	68	46	43	53	34	2.68	13.0	17.6	1.9
B22t------18 to 40	A-7-6(28)	CH	0	100	100	100	98	95	94	75	69	43	40	55	39	2.69	10.0	19.6	2.0
B3--------40 to 52	A-7-6(32)	CH	0	100	100	100	99	97	95	76	70	45	41	60	43	2.70	10.0	21.0	2.0
Cca-------52 to 60	A-7-6(28)	CH	0	100	100	99	98	96	95	76	69	40	35	56	37	2.70	15.0	17.8	1.9
Deleon clay loam:[12] (S78TX-491-001)																			
A11--------0 to 30	A-7-6(25)	CL	0	100	100	100	100	100	100	87	81	44	35	44	29	2.66	14.0	14.2	1.9
A12-------30 to 40	A-7-6(31)	CL-CH	0	100	100	100	100	100	100	89	84	47	41	50	33	2.69	12.0	17.0	1.9
C---------40 to 54	A-6 (15)	CL	0	100	100	100	100	100	100	70	62	36	30	39	25	2.69	14.0	12.3	1.9
Demona loamy fine sand:[3] (S78TX-491-003)																			
A1--------0 to 14	A-2-4(00)	SM	0	100	100	100	100	99	99	23	15	6	3	24	2	2.63	22.0	1.1	1.6
A2--------14 to 22	A-2-4(00)	SM	0	100	100	100	100	100	100	22	15	5	3	22	1	2.64	18.0	0.5	1.6
B21t------22 to 49	A-7-6(11)	CL	0	100	100	100	100	99	99	54	53	39	36	43	27	2.66	17.0	12.3	1.8
B22t------49 to 54	A-7-6(25)	CH	0	100	100	100	100	100	99	72	68	47	43	53	37	2.71	15.0	16.3	1.8
C---------54 to 60	A-7-6(58)	CH	0	100	100	100	100	100	100	97	92	59	50	72	53	2.71	11.0	23.6	2.0
Doss silty clay:[3] (S76TX-491-005)																			
A1--------0 to 9	A-7-6(22)	CL	0	100	100	99	99	98	95	85	80	50	37	45	26	2.70	11.0	15.7	2.0
B2ca------9 to 19	A-7-6(13)	CL	0	100	86	86	84	81	76	69	64	43	28	41	21	2.73	14.0	13.2	1.9

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX TEST DATA-Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
			Pct											Pct		G/cc	Pct	Pct	Pct
Eckrant stony clay:[13] (S77TX-491-006)																			
A11--------0 to 4	A-7-6(35)	CH	0	100	100	100	99	99	98	94	90	49	43	56	33	2.60	13.0	18.0	1.9
A12--------4 to 10	A-7-6(25)	CH	0	100	86	85	85	84	82	68	67	43	36	65	37	2.60	12.0	21.0	1.9
Fairlie clay:[14] (S76TX-491-001)																			
Ap---------0 to 8	A-7-6(27)	CL	0	100	95	95	95	94	94	91	86	42	35	45	29	2.65	11.0	15.7	2.0
A11--------8 to 26	A-7-6(39)	CH	0	100	100	100	100	99	97	92	54	45	54	37	2.67	9.0	19.7	2.0
A12-------26 to 36	A-7-6(44)	CH	0	100	100	100	99	98	96	94	94	57	48	60	43	2.70	9.0	21.4	2.0
AC--------36 to 41	A-7-6(47)	CH	0	100	100	100	99	98	96	94	91	56	47	63	46	2.71	10.0	22.2	2.1
Georgetown clay loam:[15] (S77TX-491-013)																			
A1---------0 to 10	A-6 (15)	CL	15	89	89	88	87	87	84	74	70	44	25	40	22	2.62	18.0	10.4	1.7
B21t-------10 to 24	A-7-5(49)	CH	2	100	100	100	100	99	98	95	95	78	76	74	43	2.74	12.0	23.5	1.9
Heiden clay:[16] (S73TX-246-018)																			
A----------0 to 32	A-7-6(37)	CH	0	100	100	100	100	99	98	85	83	60	52	61	41	2.71	9.0	21.5	2.1
AC--------32 to 60	A-7-6(55)	CH	0	100	100	100	99	98	95	89	85	67	60	78	56	2.77	11.0	25.0	2.0
Houston Black clay:[3] (S77TX-491-012)																			
A1---------0 to 32	A-7-6(61)	CH	0	100	98	98	98	98	97	95	93	74	66	82	55	2.70	11.0	25.7	2.0
AC1-------32 to 54	A-7-6(64)	CH	0	100	98	96	95	95	94	93	91	73	65	85	61	2.76	10.0	26.7	2.0
AC2-------54 to 62	A-7-6(76)	CH	0	100	100	100	99	99	99	98	98	78	68	89	68	2.77	9.0	27.9	2.0

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX TEST DATA-Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
			Pct											Pct		G/cc	Pct	Pct	Pct
Krum silty clay loam:[17] (S73TX-246-013)																			
Ap--------0 to 16	A-7-6(34)	CH	0	100	100	100	100	100	99	94	89	55	43	58	32	2.66	14.0	18.6	1.9
A12------16 to 22	A-7-6(36)	CH	0	100	100	100	100	100	99	94	90	59	48	58	34	2.69	13.0	19.3	1.9
B2-------22 to 40	A-7-6(28)	CH	0	100	98	97	95	93	92	85	80	59	48	52	32	2.70	13.0	17.2	1.9
B3-------40 to 47	A-7-6(22)	CL	0	100	100	98	93	90	87	79	74	53	41	46	29	2.68	12.0	15.6	1.9
Cca------47 to 60	A-6 (13)	CL	0	100	100	97	89	85	82	70	66	42	31	38	22	2.72	16.0	11.2	1.9
Oakalla silty clay loam:[3] (S75TX-491-004)																			
A11-------0 to 22	A-7-6(23)	CL	0	100	100	100	100	100	99	90	82	46	34	44	25	2.66	16.0	13.3	1.8
A12------22 to 32	A-7-6(23)	CL	0	100	100	100	100	100	99	88	82	50	40	42	26	2.66	14.0	13.7	1.9
B2-------32 to 60	A-6 (09)	CL	0	100	100	100	100	100	99	86	81	51	40	25	14	2.70	14.0	13.0	1.9
Queeny clay loam:[3] (S77TX-491-007)																			
A11-------0 to 10	A-7-6(23)	CH	0	100	96	94	88	82	77	75	72	42	35	52	31	2.61	13.0	17.0	1.9
A12------10 to 18	A-7-6(17)	CL	0	100	98	97	95	92	85	73	73	52	38	43	25	2.66	14.0	13.7	1.9
Rosanky fine sandy loam:[18] (S73TX-246-020)																			
A1--------0 to 10	A-2-4(00)	SM	0	100	100	100	100	99	98	30	18	4	3	22	3	2.63	20.0	1.5	1.6
A2-------10 to 14	A-2-4(00)	SM	0	100	100	100	100	99	99	33	26	8	6	21	2	2.65	21.0	1.0	1.6
B21t-----14 to 26	A-7-6(18)	CH	0	100	85	85	85	85	85	60	58	48	46	56	34	2.71	15.0	17.2	1.8
B22t-----26 to 39	A-7-6(26)	CH	0	100	100	100	100	100	99	68	63	51	49	62	40	2.73	17.0	18.3	1.8
B23t-----39 to 54	A-7-6(11)	CL	0	100	100	100	100	100	100	59	54	40	36	43	24	2.68	18.0	11.7	1.7
B3-------54 to 60	A-6 (05)	SC	0	100	100	100	100	100	100	47	40	28	25	36	18	2.69	20.0	8.1	1.7

See footnotes at end of table.

TABLE 16.--ENGINEERING INDEX TEST DATA-Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution[1]										Liquid limit[2]	Plasticity index[2]	Particle density	Shrinkage		
			Larger than 3 inches	Percentage passing sieve--						Percentage smaller than--								
	AASHTO	Unified		7/4 inch	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
			Pct											Pct		G/cc	Pct	Pct	Pct
Sunev silty clay loam:[19] (S75TX-491-021)																			
Ap--------0 to 6	A-7-6(38)	CH	0	100	100	100	99	99	98	93	89	55	45	61	36	2.67	16.0	18.2	1.8
A1--------6 to 18	A-7-6(38)	CH	0	100	100	100	100	100	98	92	91	60	46	59	37	2.67	13.0	19.6	2.0
B21-------18 to 28	A-7-6(31)	CH	0	100	99	99	98	98	95	88	86	57	48	52	33	2.70	12.0	18.0	2.0
B22ca----28 to 40	A-7-6(19)	CL	0	100	95	92	90	87	82	72	71	47	38	45	29	2.70	15.0	14.0	1.8
B23ca----40 to 62	A-6 (13)	CL	0	100	100	99	96	93	87	72	69	40	30	38	20	2.69	18.0	9.7	1.8
Tinn clay:[20] (S75TX-491-002)																			
A11-------0 to 22	A-7-6(46)	CH	0	100	100	100	100	100	100	99	96	67	55	61	42	2.68	10.0	21.4	2.0
A12------22 to 44	A-7-6(56)	CH	0	100	100	100	100	100	100	99	95	67	57	69	50	2.70	12.0	22.8	2.0
A13------44 to 60	A-7-6(48)	CH	0	100	100	100	100	100	99	97	94	65	53	62	45	2.76	12.0	21.0	2.0
Uhland clay loam:[3] (S78TX-491-002)																			
A---------0 to 7	A-6 (05)	CL	0	100	100	100	100	100	100	58	46	24	18	32	13	2.61	20.0	5.7	1.6
IIC1------7 to 44	A-4 (00)	SM-SC	0	100	100	100	100	100	100	46	35	14	13	23	4	2.64	19.0	2.4	1.7
IIC2-----44 to 56	A-4 (02)	CL-ML	0	100	100	100	100	100	100	59	46	18	15	26	7	2.64	18.0	4.1	1.7
IIC3-----56 to 67	A-4 (00)	CL-ML	0	100	100	100	100	100	100	58	47	16	14	25	4	2.66	20.0	3.0	1.7
Whitewright silty clay loam:[21] (S77TX-491-021)																			
Ap--------0 to 5	A-7-6(20)	CL	0	100	100	100	100	99	97	89	84	56	41	41	22	2.69	16.0	11.4	1.7
B2--------5 to 15	A-7-6(19)	CL	0	100	100	100	100	99	98	89	90	62	45	42	21	2.71	20.0	10.0	1.7
Wilson clay loam:[3] (S74TX-491-008)																			
A1--------0 to 5	A-6 (06)	CL	0	100	100	100	100	99	98	61	52	24	20	29	14	2.64	15.0	7.2	2.0
B21tg-----5 to 32	A-6 (15)	CL	0	100	100	100	100	100	99	70	65	38	32	39	25	2.63	12.0	13.3	1.9
B22tg----32 to 46	A-7-6(23)	CL-CH	0	100	100	100	100	99	97	72	64	41	35	50	35	2.67	10.0	18.0	2.0
B3tg-----46 to 60	A-7-6(27)	CH	0	100	100	100	100	98	95	75	70	42	35	52	38	2.71	11.0	18.6	2.0

[1]For soil materials larger than 3/8 inch, square mesh wire sieves were used that are slightly larger than equivalent round sieves, but the difference does not seriously affect the data.

[2]Liquid limit and plasticity index values were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[3]See the section "Soil series and their morphology" for location of the pedon.

[4]Austin silty clay loam: 0.2 mile north of I-35 and Texas 195 junction, in a field.

[5]Axtell fine sandy loam: 4.2 miles southeast of Thorndale, 2.3 miles south and east on county road, 500 feet south, in a pasture.

[6]Behring clay loam: 5.5 miles southeast of Structure and 100 feet north, in a field.

[7]Brackett gravelly clay loam: 6 miles west of Liberty Hill, in rangeland.

[8]Branyon clay: 4.2 miles northeast of Hutto, in a pit adjacent to public road.

[9]Burleson clay: 10 miles east on paved road from junction of Texas 95 and Main Street in Granger and 200 feet west, in a field.

[10]Castephen silty clay loam: 1,000 feet south of county road and 3.4 miles northwest of Weit, in a pasture.

[11]Crawford clay: 5 miles west of junction of Farm Road 2243 and I-35, 4 miles south on blacktop road, and 300 feet west, in rangeland.

[12]Deleon clay loam: 2 miles southeast of Beyersville, 1 mile northeast on county road, 0.5 mile south on field road, and 0.3 mile east near Brushy Creek, in a pasture.

[13]Eckrant stony clay: 3 miles west on Farm Road 2338 from junction with I-35 and 300 feet north, in rangeland.

[14]Fairlie clay: 2.4 miles east on Texas 29 from junction with U.S. 183 and 500 feet north, in a field.

[15]Georgetown clay loam: 1.5 miles west on Farm Road 2243 from junction with I-35 and 800 feet north, in rangeland.

[16]Heiden clay: 0.95 mile east of Coupland and 800 feet north of paved county road, in a pasture.

[17]Krum silty clay loam: 2.5 miles west of Norman's Crossing on Farm Road 1660 and 100 feet south, in a field.

[18]Rosanky fine sandy loam: 1.5 miles north of Shiloh on Farm Road 486 and 1,000 feet east, in a pasture.

[19]Sunev silty clay loam: 1 mile southeast of Round Rock, in a field.

[20]Tinn clay: 7.5 miles south of Taylor on Farm Road 112 and 200 feet east, in a pasture.

[21]Whitewright silty clay loam: 1 mile north of Theon, 0.5 mile east, 0.5 mile north on county road, and 150 feet east, in a field.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Altoga	Fine-silty, carbonatic, thermic Typic Ustochrepts
Austin	Fine-silty, carbonatic, thermic Entic Haplustolls
Axtell	Fine, montmorillonitic, thermic Udertic Paleustalfs
Behring	Fine, montmorillonitic, thermic Udertic Haplustolls
Brackett	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Branyon	Fine, montmorillonitic, thermic Udic Pellusterts
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Castephen	Loamy, carbonatic, thermic, shallow Entic Haplustolls
Crawford	Fine, montmorillonitic, thermic Udic Chromusterts
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Deleon	Fine, mixed, thermic Udertic Haplustolls
Demona	Clayey, mixed, thermic Aquic Arenic Paleustalfs
Denton	Fine, montmorillonitic, thermic Vertic Calciustolls
Doss	Loamy, carbonatic, thermic, shallow Typic Calciustolls
Eckrant	Clayey-skeletal, montmorillonitic, thermic Lithic Haplustolls
Eddy	Loamy-skeletal, carbonatic, thermic, shallow Typic Ustorthents
Fairlie	Fine, montmorillonitic, thermic Udic Pellusterts
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Georgetown	Very-fine, mixed, thermic Udic Argiustolls
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
Houston Black	Fine, montmorillonitic, thermic Udic Pellusterts
Krum	Fine, montmorillonitic, thermic Vertic Haplustolls
Oakalla	Fine-loamy, carbonatic, thermic Cumulic Haplustolls
Padina	Loamy, siliceous, thermic Grossarenic Paleustalfs
Queeny	Loamy, mixed, thermic, shallow Petrocalcic Calciustolls
Rader	Fine-loamy, mixed, thermic Aquic Paleustalfs
Rosanky	Fine, mixed, thermic Ultic Paleustalfs
Sunev	Fine-loamy, carbonatic, thermic Typic Calciustolls
Tinn	Fine, montmorillonitic (calcareous), thermic Vertic Haplaquolls
Uhland	Coarse-loamy, mixed, nonacid, thermic Aquic Ustifluvents
Whitewright	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs

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