# SOIL SURVEY OF
# Caldwell County, Texas

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

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

Major fieldwork for this soil survey was completed in the period 1966–70. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1970. 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 Hays-Caldwell-Travis Soil and Water Conservation District.

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

# HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in determining the suitability of tracts of land for farming, industry, and recreation.

### Locating Soils

All the soils of Caldwell County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside, and a pointer shows where the symbol belongs.

### Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page number of the pasture and hay group and the range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green; those that have a moderate limitation can be colored yellow; and those that have a severe limitation can be colored red.

*Farmers and those who work with farmers* can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units, the range sites, and the pasture and hay groups.

*Game managers, sportsmen, and others* can find information about soils and wildlife in the section "Wildlife."

*Ranchers and others* can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

*Engineers and builders* can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

*Scientists and others* can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

*Newcomers in Caldwell County* will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the section "Additional Facts About the County."

*Cover:* **Stand of Coastal bermudagrass on a Chaney soil provides good pasture for cattle.**

# Contents



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# SOIL SURVEY OF CALDWELL COUNTY, TEXAS

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

CALDWELL COUNTY is in the south-central part of Texas (fig. 1). It has a total area of 348,160 acres, or 544 square miles. It is about 21 miles long and 25 miles wide.

The western two-thirds of the county is in the Texas Blackland Prairie area. This area slopes upward from the southeast to the northwest, rising from 400 feet to 600 feet in elevation. Most soils on the prairie are deep clays or clay loams. This area is about 243,000 acres in size. About 70 percent of it is cultivated, and cotton and grain sorghum are the main crops. The native vegetation was trees, mainly along streams, and tall grasses.

The eastern one-third of the county is in the Texas Claypan area. The soils in this area are deep and have a fine sandy loam to fine sand surface layer. This area is about 105,000 acres in size, and about 35 percent of it is cultivated. Peanuts, watermelons, truck crops, and forage crops are the main crops. The native vegetation was mostly tall grasses and hardwood trees.

## *How This Survey Was Made*

Soil scientists made this survey to learn what kinds of soil are in Caldwell County, where they are located, and how they can be used. The soil scientists went into the county knowing they would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Crockett and Heiden, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Crockett fine sandy loam, 1 to 3 percent slopes, is one of several phases within the Crockett series.

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

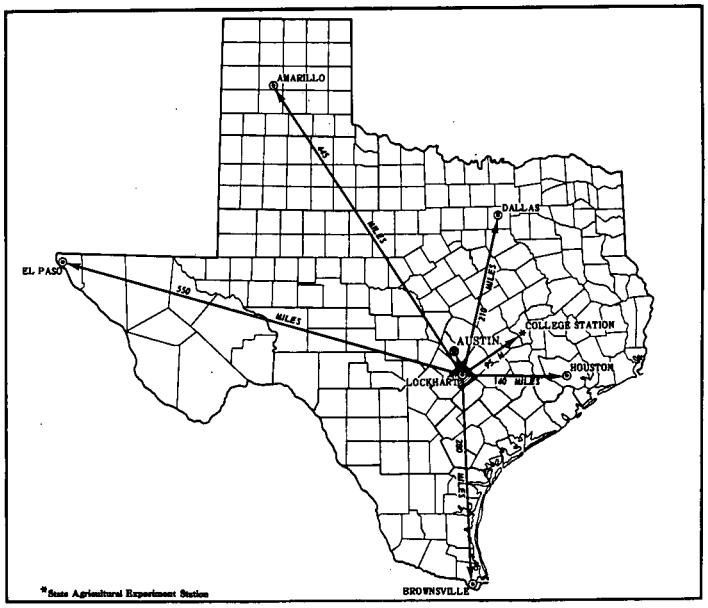


*Figure 1.*—Location of Caldwell County in Texas.

publication was prepared from these aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Caldwell County: soil complexes and undifferentiated groups.

A soil complex consists of areas of two or more soils, so intricately intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Heiden-Wilson complex, 1 to 3 percent slopes, is an example.

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. If there are two or more dominant series represented in the group, the name of the group ordinarily consists of the names of the dominant soils, joined by "and." Arenosa and Patilo soils, undulating, is an undifferentiated soil group in this county.

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or to a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil, and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

## *General Soil Map*

The general soil map at the back of this survey shows, in color, the soil associations in Caldwell County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is useful as a general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The eight soil associations in Caldwell County are discussed in this section. The terms for texture used in the descriptive headings for several of the associations apply to the surface layer. For example, in the title of association 4, the word "sandy" refers to the texture of the surface layer. The soil associations in this county have been grouped into three general kinds of landscapes for broad interpretive purposes. Each of the broad groups and their included soil associations are described in the following paragraphs.

### Deep, Nearly Level to Moderately Steep and Undulating Soils on Uplands

Most areas of soils in this group are used for crops, pasture, or range. Many areas are gradually being developed for improved pasture, wildlife habitat, and recreation, for which they are well suited.

#### *1. Crockett-Heiden association*

*Deep, calcareous to noncalcareous, loamy to clayey soils over shaly clay loams and clays*

This association makes up about 41 percent of the county. It is about 43 percent Crockett soils and 11 percent Heiden soils. The remaining 46 percent is Behring, Burleson, Chaney, Fett, Gowen, Mabank, Uhland, and Wilson soils (fig. 2).

Crockett soils are gently sloping to sloping and undulating and are on ridges. They have a surface layer of brown fine sandy loam about 12 inches thick. The next layer is 26 inches of clay that is dark brown in the upper part and yellowish brown in the lower part. The next layer is light yellowish-brown sandy clay loam 16 inches thick. The underlying material is mixed

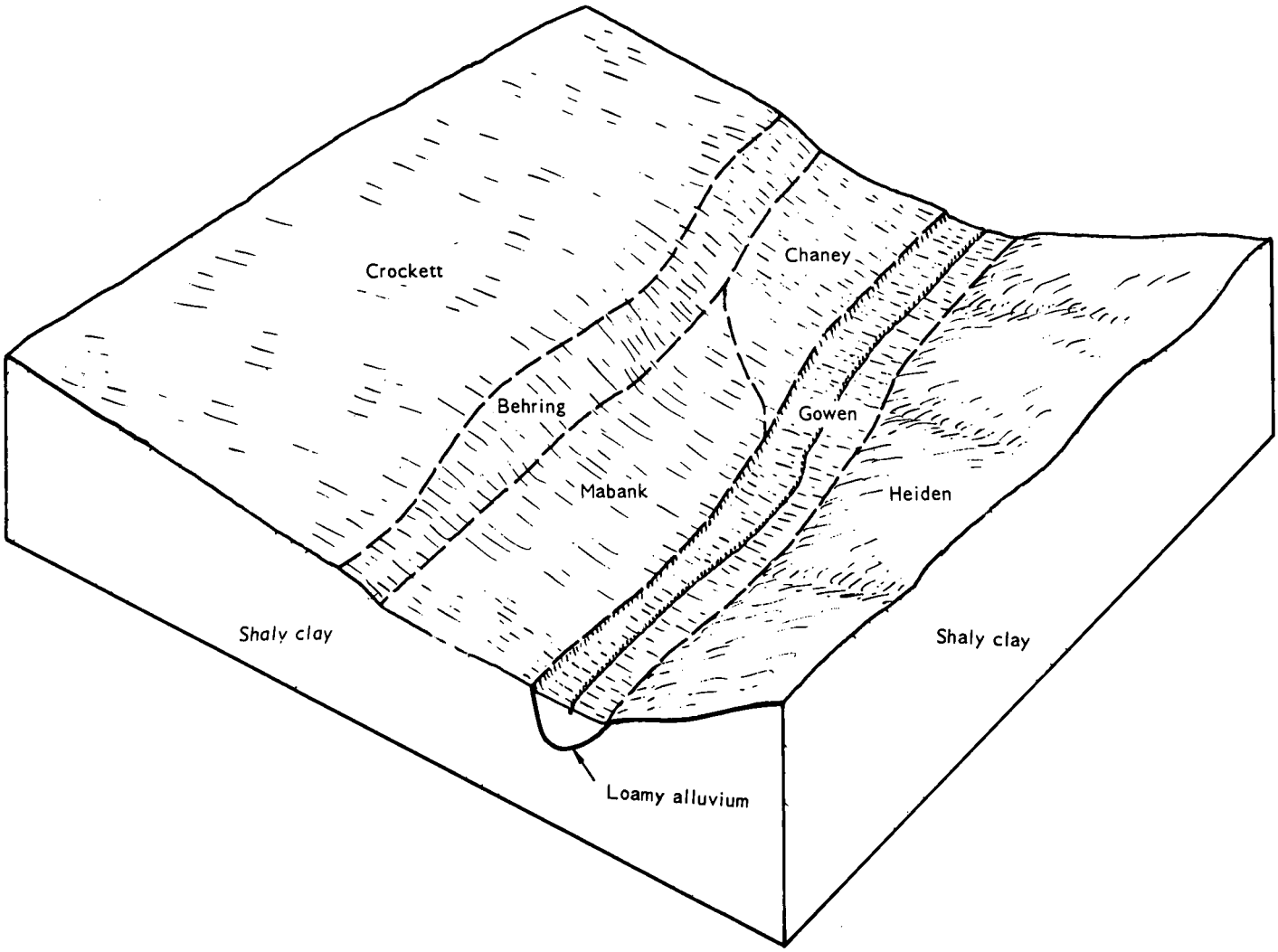


*Figure 2.*—**Typical pattern of soils and underlying material in the Crockett-Heiden association.**

brownish-yellow clay loam and light-gray shaly clay loam.

Heiden soils are gently sloping to moderately steep and undulating and are on the steeper side slopes. They have a surface layer of dark grayish-brown clay about 26 inches thick. The next layer is mottled, light olive-brown clay 28 inches thick. The underlying material is grayish-brown calcareous clay.

This association is used mostly as range and pasture. The soils in this association are well suited to the development of improved pasture. They are suited to wildlife habitat; the population of wildlife, particularly deer and quail, is increasing. These soils have high shrink-swell potential and high corrosivity to uncoated steel; thus, construction sites need extensive study.

### 2. *Heiden-Houston Black association*

*Deep, calcareous, clayey soils over clays*

This association makes up about 15 percent of the county. It is about 44 percent Heiden soils, 31 percent Houston Black soils, and 25 percent less extensive areas of Burleson, Crockett, Trinity, and Wilson soils (fig. 3).

Heiden soils are gently sloping to moderately steep and undulating and are on ridges and side slopes. They have a surface layer of dark grayish-brown clay about 26 inches thick. The next layer is mottled, light olive-brown clay about 28 inches thick. The underlying material is grayish-brown calcareous clay.

Houston Black soils are in less sloping areas and in valleys. They have a surface layer of dark-gray clay about 16 inches thick. The next layer is 28 inches of gray clay. Below this is grayish-brown clay.

This association is used mostly for crops or improved pasture. The soils in this association are well suited to these uses. These soils have very high shrink-swell potential, very slow permeability, and high corrosivity to uncoated steel; thus, an extensive site study is needed before they are used in construction.

### 3. *Burleson-Wilson-Crockett association*

*Deep, noncalcareous gravelly loamy and loamy to clayey soils over clays and shaly clay loams*

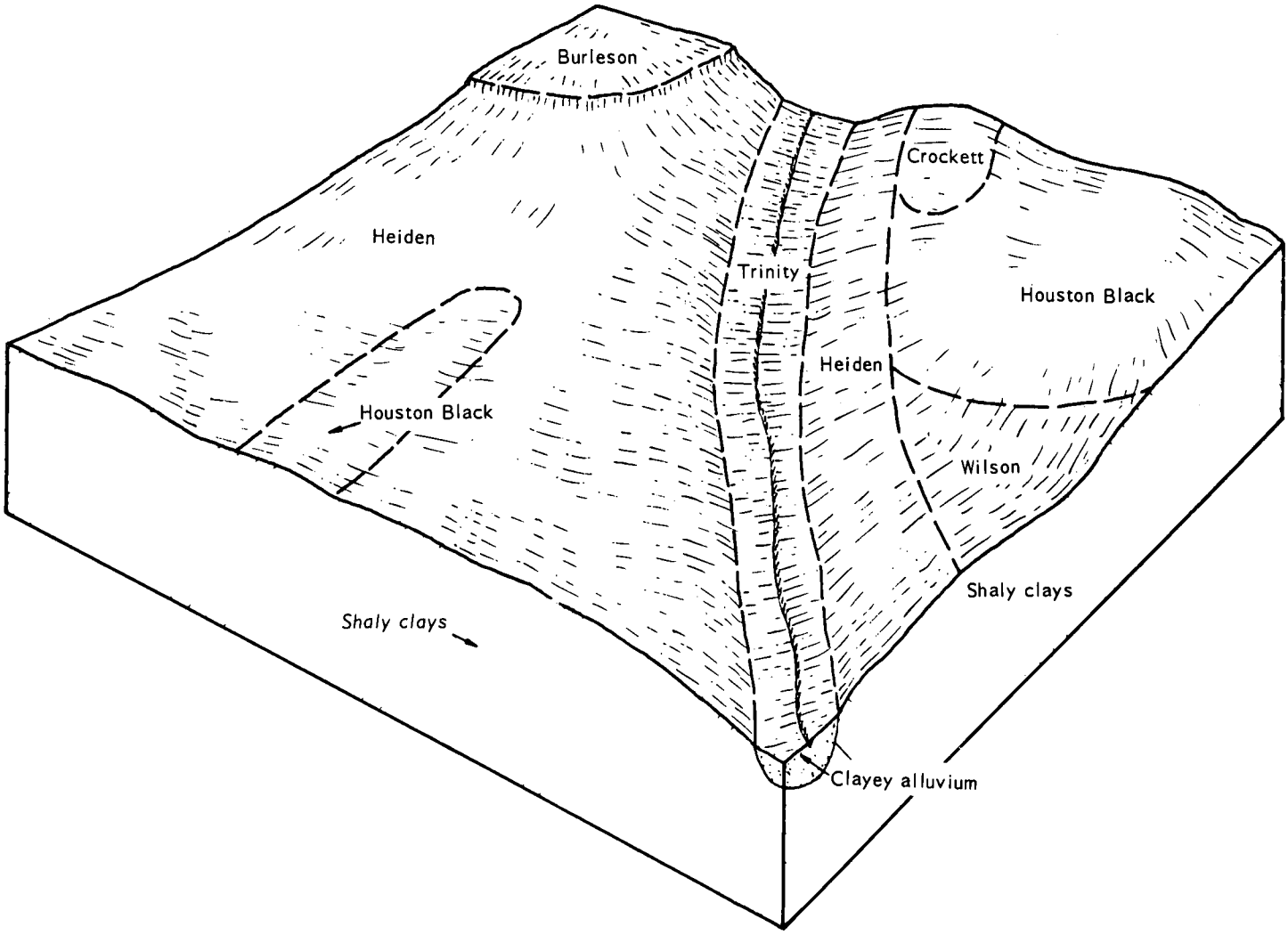


*Figure 3.*—**Typical pattern of soils and underlying material in the Heiden-Houston Black association.**

This association makes up about 1 percent of the county. It is 28 percent Burleson soils, 14 percent Wilson soils, and 11 percent Crockett soils. The remaining 47 percent is less extensive areas of Behring, Gowen, Heiden, Houston Black, Mabank, and Trinity soils.

Burleson soils are nearly level to gently sloping and are on terraces. They have a surface layer of dark-gray and very dark gray clay about 24 inches thick. The next layer is gray clay about 30 inches thick. Below this is grayish-brown clay.

Wilson soils are gently undulating and are in upland valleys. They have a surface layer of very dark gravelly loam about 15 inches thick. The next layer is dark-gray and gray clay about 29 inches thick. Below this is grayish-brown clay.

Crockett soils are gently sloping to sloping and undulating and are on side slopes. They have a surface layer of brown fine sandy loam about 12 inches thick. The next layer is dark-brown and yellowish-brown clay about 26 inches thick. Below this is light yellowish-brown sandy clay loam about 16 inches thick. The underlying material is mixed brownish-yellow clay loam and light-gray shaly clay loam.

Burleson soils in this association are used mostly for crops. Crockett and Wilson soils are used mainly as range, but a few small areas are in improved pasture. The soils have high shrink-swell potential and very slow permeability; thus, an extensive site study is needed before they are used in construction.

## Deep, Gently Sloping and Undulating Soils on Uplands

Most areas of soils in this group are too sandy and too low in available water capacity for row crops. They are used mainly as pasture or range. Much of the acreage is being developed as improved pasture. Small areas are used for truck farming. Wildlife habitat and recreation are other important uses.

### *4. Demona-Patilo-Silstid association*

*Deep, noncalcareous, sandy soils over clays, sandy clay loams, and fine sandy loams*

This association makes up about 22 percent of the county. It is 22 percent Demona soils, 22 percent Patilo soils, and 13 percent Silstid soils. The remaining 43 percent is less extensive areas of Arenosa, Chaney, Jedd, and Rosanky soils (fig. 4).

Demona soils are gently sloping and are in valleys on uplands. They have a surface layer of pale-brown loamy fine sand about 18 inches thick. The next layer is very pale brown loamy fine sand about 8 inches thick. Below this is mottled red, light brownish-gray, and brown clay about 24 inches thick. The next layer is mottled strong-brown, yellowish-red, and light brownish-gray sandy clay loam about 10 inches thick.

Patilo soils are gently sloping and undulating and are in higher positions on uplands than the Demona soils. They have a surface layer of light brownish-gray fine sand about 13 inches thick. The next layer is very pale brown fine sand about 37 inches thick. Below this is mottled yellowish-brown and red sandy clay loam about 9 inches thick. Next is mottled red and pinkish-gray sandy clay about 6 inches thick. Below this is mottled yellowish-red and strong-brown fine sandy loam.

Silstid soils are gently sloping and undulating and are on higher positions on uplands than the Demona soils. They have a surface layer of pale-brown fine sand about 25 inches thick. The next layer is very pale brown fine sand about 12 inches thick. Below this is brownish-yellow and reddish-yellow sandy clay loam about 15 inches thick that has many red mottles in the lower part. The next layer is reddish-yellow sandy clay loam that has many brown and red mottles.

This association is used mostly as range, but small areas are used for truck crops. Many areas are being developed as improved pasture, and the soils are well suited to this use. The population of wildlife, particularly deer and turkey, is increasing. Wildlife is a source of income and recreation. The soils in this association are suitable for most construction uses.

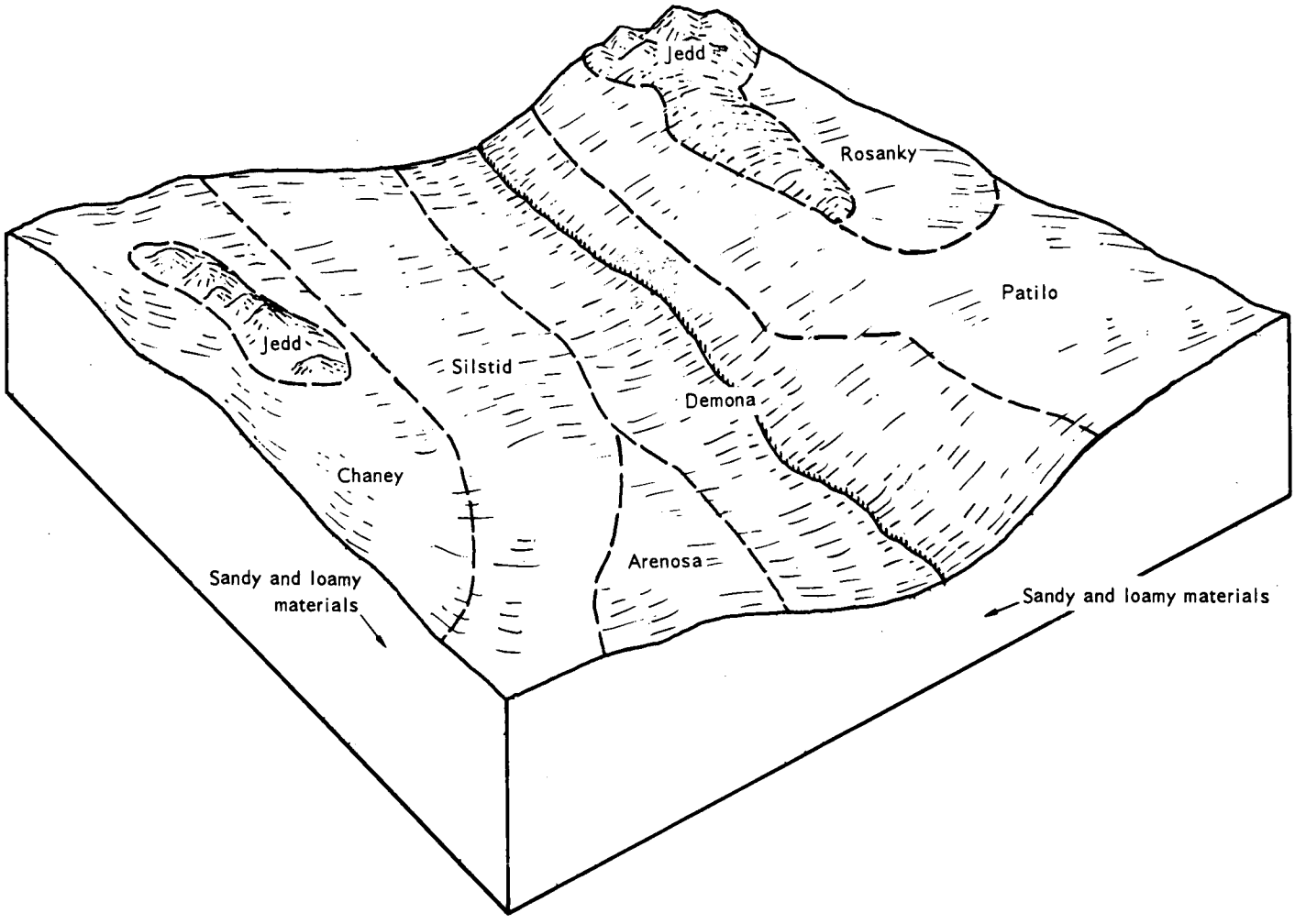


*Figure 4.*—**Typical pattern of soils and underlying material in the Demona-Patilo-Silstid association.**

## Very Shallow to Deep, Nearly Level to Moderately Steep Soils on Bottom Lands and Upland Terraces

Most areas of the deep soils in this group are used for crops. The areas of soils that are shallower are used as pasture and range. Many of the areas on bottom lands are used for recreation.

### 5. *Branyon-Lewisville association*

*Deep, calcareous, clayey soils over clays and clay loams*

This association consists of nearly level to gently sloping soils on old terraces. It makes up about 13 percent of the county. Branyon soils make up 65 percent of the association and Lewisville soils 22 percent. The remaining 13 percent is Queeny and Seawillow soils (fig. 5).

Branyon soils have a surface layer of dark-gray clay about 44 inches thick. The next layer is about 28 inches of gray clay. Below this is about 24 inches of light-gray clay that has a few brown mottles and a few soft masses and concretions of calcium carbonate.

Lewisville soils have a surface layer of very dark grayish-brown silty clay about 12 inches thick. The next layer is dark yellowish-brown silty clay about 12 inches thick. Below this is yellowish-brown silty clay loam about 18 inches thick. The next layer is very pale brown clay loam.

This association is used mostly for crops and improved pasture. The soils in this association have high to very high shrink-swell potential and moderate permeability to very slow permeability. Sites for buildings, sewage systems, and roads should be carefully studied before construction is begun.

### 6. *Trinity association*

*Deep, calcareous, clayey soils over clays*

This association makes up about 5 percent of the county and is on flood plains. Trinity soils make up almost 100 percent of the association. Other soils that occur in minor areas are Gowen, Heiden, Houston Black, and Uhland soils.

Trinity soils have a surface layer of dark-gray clay about 41 inches thick. Below this is dark grayish-brown calcareous clay that extends to a depth of 60 inches.

Areas of this association that are frequently flooded are used mostly for pasture and pecan orchards, and areas that are occasionally flooded are used for crops, improved pasture, and pecan orchards. The soils in this association should not be used as sites for buildings.

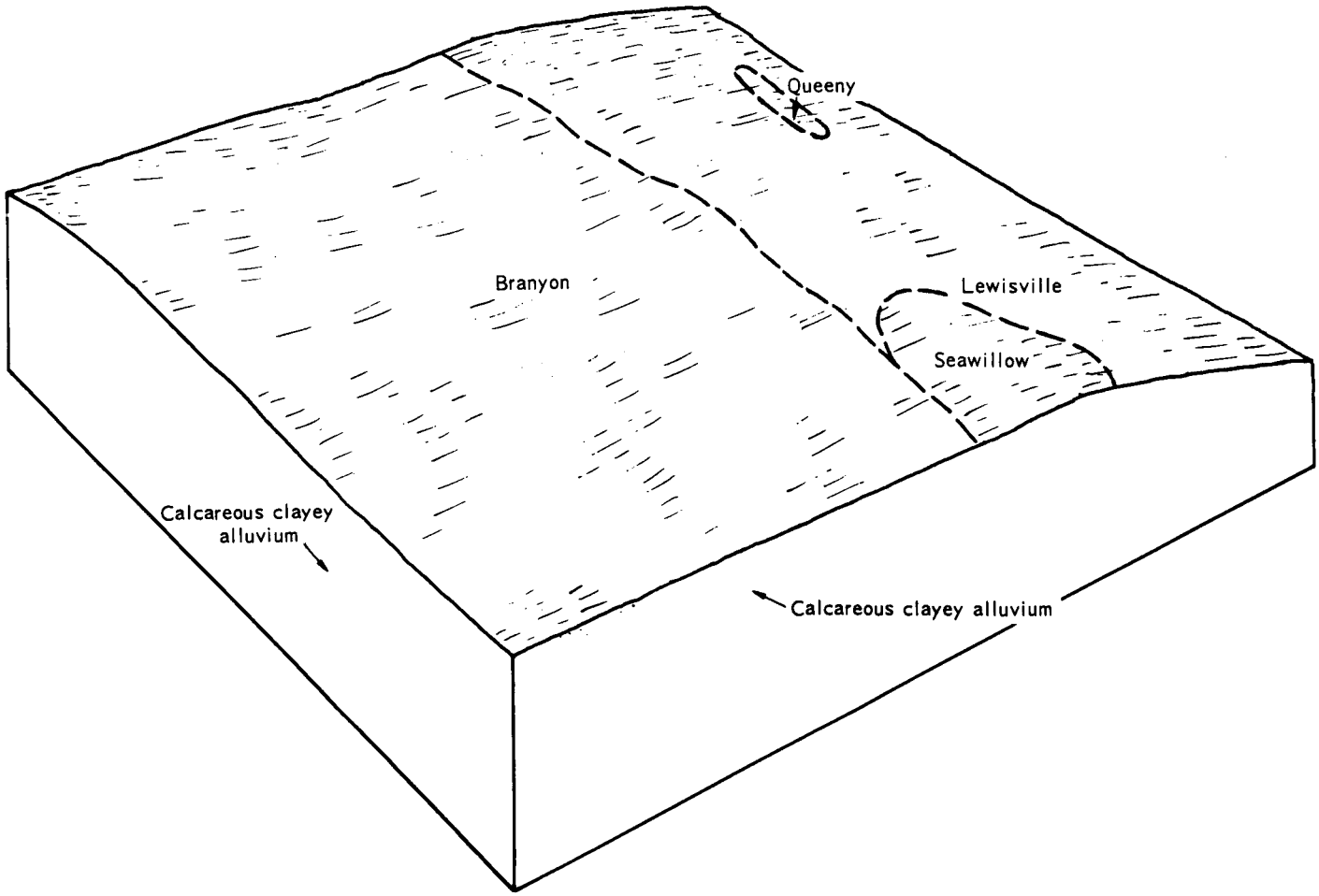


*Figure 5.*—Typical pattern of soils and underlying material in the Branyon-Lewisville association.

### 7. *Bosque association*

*Deep, calcareous, loamy soils over clay loams*

This association makes up about 2 percent of the county and occupies broad areas on the flood plain. It is about 58 percent Bosque soils and 42 percent Lewisville, Seawillow, and Seguin soils (fig. 6).

Bosque soils have a surface layer of dark grayish-brown clay loam about 25 inches thick. The underlying material is pale-brown clay loam that extends to a depth of 60 inches.

Areas of this association that are frequently flooded are used mainly for pasture and pecan orchards, and areas that are occasionally flooded are used for crops and improved pasture. Areas along the San Marcos River are used extensively for camping, boating, and fishing. Other areas of the association also have potential for development of recreational facilities.

### 8. *Lewisville-Queeny association*

*Very shallow to deep, calcareous, clayey to gravelly loamy soils over clay loams and strongly cemented gravel beds*

This association makes up about 1 percent of the county. It is about 37 percent Lewisville soils, 28 percent Queeny soils, and 35 percent Branyon, Menard, and Seawillow soils.

Lewisville soils are nearly level to gently sloping and are on terraces. They have a surface layer of very dark grayish brown silty clay about 12 inches thick. The next layer is 12 inches of dark yellowish-brown silty clay over about 18 inches of yellowish-brown silty clay loam. Below this is very pale brown clay loam.

Queeny soils are gently sloping to moderately steep and are on terraces. They have a surface layer of very dark grayish-brown gravelly loam about 7 inches thick that is about 25 percent, by volume, small rounded limestone gravel and siliceous pebbles. The underlying material is a bed of gravel. It is cemented with calcium carbonate in the upper 4 inches and is 80 percent limestone gravel ¼ inch to 3 inches in diameter in the lower part.

Lewisville soils are used mostly for crops. Queeny soils are used as pasture and are an important source of gravel.

## *Descriptions of the Soils*

This section describes the soil series and mapping units in Caldwell County. Each soil series is described

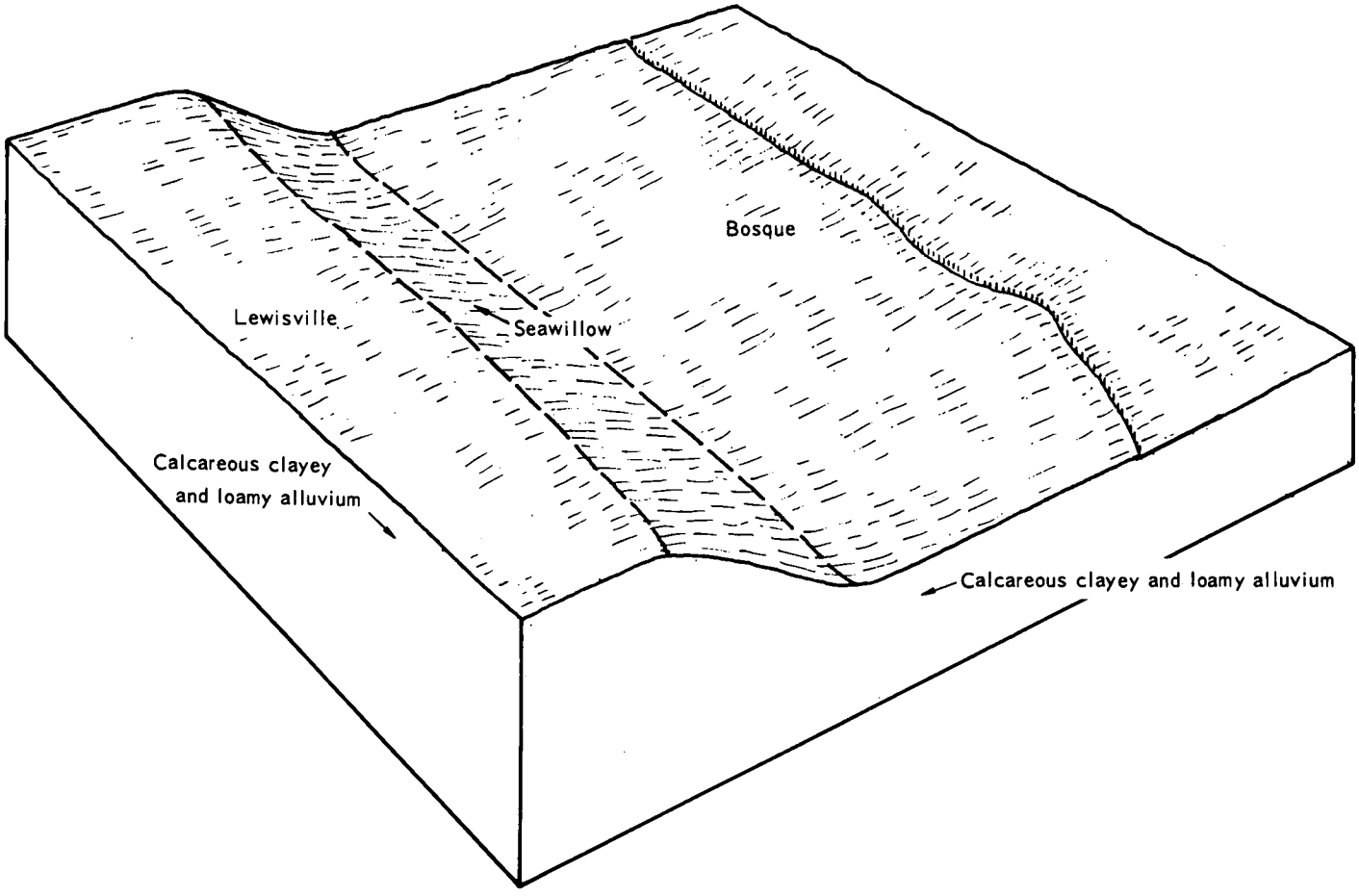


*Figure 6.*—**Typical pattern of soils and underlying material in the Bosque association.**

in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of each series description is the soil profile; that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative of mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, the differences are stated in the description of the mapping unit, or they are differences that are apparent in the name of the mapping unit. Soil colors in this section are expressed both in words and in Munsell color notations and are for dry soils unless otherwise stated.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, pasture and hay group, and range site in which the mapping unit has been placed. The page for the description of each capability unit, pasture and hay group, and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual.[1]

## Arenosa Series

The Arenosa series consists of deep, undulating, sandy soils on uplands. These soils formed in beds of sand.

In a representative profile the surface layer is pale-brown, loose, neutral fine sand about 14 inches thick. The next layer is very pale brown, loose fine sand that extends to a depth of 84 inches.

Arenosa soils are well drained. Permeability is very rapid, and available water capacity is low.

These soils are used mostly as range. A few small areas are used as improved pasture.

Representative profile of Arenosa fine sand in an area of Arenosa and Patilo soils, undulating, 6.2 miles east on Farm Road 713 from its intersection with Farm Road 86 in McMahan, then 100 feet north of the road, in a wooded pasture:

A1—0 to 14 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; neutral; clear, smooth boundary.

C—14 to 84 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few roots; few, small, strongly cemented sandstone fragments; neutral.

The sand is more than 84 inches thick. The A horizon ranges from yellowish brown to pale brown.

**Arenosa and Patilo soils, undulating** (APC).—This mapping unit is made up of soils that formed in deep beds of sand. Most areas are irregular in shape and are 100 to 400 acres in size. Surfaces are convex or concave, and slopes are mostly 2 to 7 percent. This mapping unit is about 70 percent Arenosa soils and 30 percent Patilo soils. Arenosa soils make up 60 to 90 percent of mapped areas, and Patilo soils make up 10 to 40 percent. The soils do not occur in a uniform pattern. Areas of this mapping unit are much larger and their composition is more variable than those of most other mapping units in the county. Mapping has been controlled well enough, however, for the anticipated use of the soils.

An Arenosa fine sand in this mapping unit has the profile described as representative of the series.

Patilo soils have a surface layer of light brownish-gray fine sand about 13 inches thick. The next layer is very pale brown fine sand about 40 inches thick. Below this is mottled yellowish-brown, red, and grayish-brown, strongly acid sandy clay loam about 9 inches thick. The next layer is mottled red and pinkish-gray, strongly acid sandy clay about 6 inches thick. The underlying material is mottled yellowish-red and strong-brown, strongly acid fine sandy loam.

Included with these soils in mapping are small areas of Jedd soils and of Silstid fine sand along drainageways. These included soils make up less than 10 percent of any mapped area.

Most areas of this mapping unit are used as range (fig. 7). Runoff is slow, and the hazards of soil blowing and erosion are slight. Capability unit VIs–1; pasture and hay group 9B; Deep Sand range site.

## Behring Series

The Behring series consists of deep, gently sloping to sloping soils on uplands. These soils formed in alkaline shaly clays.

In a representative profile the surface layer is dark grayish-brown clay loam about 8 inches thick over very dark grayish-brown clay about 16 inches thick. The next layer is about 14 inches of light olive-brown clay that has mottles and streaks of material from the surface layer in filled cracks. Below this is 11 inches of mottled grayish-brown, yellowish-brown, and light olive-brown clay loam that is about 2 percent, by volume, weakly and strongly cemented concretions of calcium carbonate and particles of limestone. The underlying material is mottled yellowish-brown and grayish-brown shaly clay.

Behring soils are moderately well drained. Permeability is slow, and available water capacity is high.

These soils are used mostly for crops and as pasture. A few areas are in native range.

Representative profile of Behring clay loam, 1 to 3 percent slopes, 1.75 miles southeast of Lytton Springs on Farm Road 1854, then 0.25 mile northeast of the road, in a pasture:

A11—0 to 8 inches, dark grayish-brown (2.5Y 4/2) clay

[1] United States Department of Agriculture. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus., 1951. [Supplement issued in May 1962]

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

| Soil | Acres | Percent |
|---|---|---|
| Arenosa and Patilo soils, undulating | 4,590 | 1.3 |
| Behring clay loam, 1 to 3 percent slopes | 3,040 | .8 |
| Behring clay loam, 3 to 5 percent slopes, eroded | 4,680 | 1.3 |
| Behring clay loam, 5 to 8 percent slopes, eroded | 1,190 | .3 |
| Bosque clay loam | 2,170 | .6 |
| Bosque soils, frequently flooded | 1,970 | .5 |
| Branyon clay, 0 to 1 percent slopes | 21,340 | 6.2 |
| Branyon clay, 1 to 3 percent slopes | 9,790 | 2.9 |
| Brazos fine sand, siliceous variant | 1,110 | .3 |
| Burleson clay, 0 to 1 percent slopes | 1,430 | .4 |
| Burleson clay, 1 to 3 percent slopes | 5,770 | 1.6 |
| Chaney loamy fine sand, 1 to 5 percent slopes | 7,220 | 2.1 |
| Chaney loamy fine sand, valleys | 6,890 | 1.9 |
| Chaney soils, 2 to 6 percent slopes, eroded | 7,500 | 2.1 |
| Chaney soils, 5 to 8 percent slopes, severely eroded | 1,150 | .4 |
| Crockett fine sandy loam, 1 to 3 percent slopes | 26,150 | 7.7 |
| Crockett gravelly sandy loam, 1 to 5 percent slopes | 11,550 | 3.4 |
| Crockett soils, 2 to 5 percent slopes, eroded | 28,290 | 8.3 |
| Crockett soils, 3 to 8 percent slopes, severely eroded | 4,430 | 1.3 |
| Demona loamy fine sand, 1 to 5 percent slopes | 17,640 | 5.1 |
| Fett gravelly soils, 1 to 12 percent slopes | 5,510 | 1.6 |
| Gowen clay loam | 1,830 | .6 |
| Gowen soils, frequently flooded | 6,340 | 1.9 |
| Heiden clay, 1 to 3 percent slopes | 5,600 | 1.7 |
| Heiden clay, 3 to 5 percent slopes, eroded | 19,440 | 5.6 |
| Heiden clay, 5 to 8 percent slopes, eroded | 6,270 | 1.9 |
| Heiden gravelly clay, 3 to 8 percent slopes | 1,270 | .4 |
| Heiden-Ferris complex, 5 to 20 percent slopes, severely eroded | 8,710 | 2.6 |
| Heiden-Wilson complex, 1 to 3 percent slopes | 1,690 | 0.5 |
| Houston Black clay, 1 to 3 percent slopes | 14,150 | 4.1 |
| Houston Black clay, 3 to 5 percent slopes, eroded | 1,980 | .6 |
| Houston Black gravelly clay, 3 to 8 percent slopes | 3,030 | .9 |
| Jedd stony soils, 5 to 20 percent slopes | 6,570 | 1.8 |
| Lewisville silty clay, 0 to 1 percent slopes | 5,830 | 1.6 |
| Lewisville silty clay, 1 to 3 percent slopes | 6,060 | 1.7 |
| Lewisville silty clay, 3 to 5 percent slopes, eroded | 1,260 | .3 |
| Mabank loam, 0 to 1 percent slopes | 4,030 | 1.1 |
| Mabank loam, 1 to 3 percent slopes | 11,280 | 3.2 |
| Menard loam, thin solum variant, 1 to 5 percent slopes | 1,400 | .4 |
| Patilo fine sand, 1 to 8 percent slopes | 16,740 | 4.8 |
| Queeny gravelly loam, 1 to 5 percent slopes | 3,020 | .8 |
| Queeny gravelly loam, 5 to 20 percent slopes | 2,050 | .5 |
| Rosanky loamy fine sand, 1 to 8 percent slopes | 4,970 | 1.4 |
| Seawillow clay loam, 1 to 3 percent slopes | 470 | .2 |
| Seawillow clay loam, 3 to 8 percent slopes, eroded | 2,810 | .8 |
| Seguin loam | 760 | .2 |
| Silstid fine sand, 1 to 5 percent slopes | 9,910 | 2.8 |
| Trinity clay | 5,810 | 1.6 |
| Trinity soils, frequently flooded | 13,360 | 3.8 |
| Uhland soils, frequently flooded | 3,340 | .7 |
| Wilson gravelly loam, 1 to 5 percent slopes | 4,770 | 1.4 |
| Total | 348,160 | 100.0 |

loam, very dark grayish brown (2.5Y 3/2) moist; weak, fine, blocky structure; very hard, very firm; many roots; few earthworm channels; few, fine, strongly cemented concretions of calcium carbonate; few siliceous pebbles; noncalcareous; moderately alkaline; diffuse, smooth boundary.

A12—8 to 24 inches, very dark grayish-brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate, coarse, prismatic structure and medium, angular blocky structure; very hard, very firm; common roots; few pores; few, fine, strongly cemented concretions and particles of calcium carbonate; few pressure faces; few siliceous pebbles; noncalcareous; moderately alkaline; gradual, smooth boundary.

B2—24 to 38 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; moderate, coarse, prismatic structure and medium, angular blocky structure; very hard, very firm; few roots; mottles and streaks of dark grayish brown (2.5Y 4/2) along old cracks; few grooved pressure faces; few, fine, strongly cemented concretions of calcium carbonate; noncalcareous; moderately alkaline; few ferromanganese concretions; clear, wavy boundary.

B3ca—38 to 49 inches, mottled grayish-brown (2.5Y 5/2), yellowish-brown (10YR 5/6), and light olive-brown (2.5Y 5/4) clay loam; weak, fine and medium, angular blocky structure; very hard, very firm; few roots; few very dark grayish brown (10YR 3/2) streaks; about 2 percent, by volume, weakly and strongly cemented concretions of calcium carbonate and particles of limestone; noncalcareous; moderately alkaline; clear, smooth boundary.

C—49 to 60 inches, mottled yellowish-brown (10YR 5/6) and grayish-brown (10YR 5/2) shaly clay; blocky structure; very hard, very firm; few roots along cleavage planes; few very dark grayish brown (10YR 3/2 )streaks or fillings in old cracks; few soft masses and concretions of calcium carbonate; noncalcareous; moderately alkaline.

The A horizon is 16 to 30 inches thick. It ranges from very dark grayish brown to grayish brown and from neutral to moderately alkaline.

The B2 horizon is 11 to 20 inches thick and is dark grayish brown, light olive brown, or light yellowish brown. The B3ca horizon is mottled in brown, yellow, and gray and is from 0 to 2 percent, by volume, visible carbonates.

The C horizon is shaly clay and thin strata of silty clay loam. In some places the strata are 0 to 5 percent ferromanganese concretions.

**Behring clay loam, 1 to 3 percent slopes** (BeB).—This gently sloping soil is on smooth uplands. Areas are not uniform in shape and range from 20 to 100 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of Burleson, Heiden, and Houston Black soils that make up less than 20 percent of any mapped area. Also included are areas of Behring soils that have a clay surface layer. These areas make up about 15 percent of the mapped acreage.

*Figure 7.*—Savannah vegetation on Arenosa and Patilo soils.

This soil is used mainly for crops and as improved pasture. Most of the cultivated acreage is in forage sorghum and grain sorghum. Capability unit IIe–1; pasture and hay group 7A; Blackland range site.

**Behring clay loam, 3 to 5 percent slopes, eroded** (BeC2).—This gently sloping soil is on uplands. Most areas are long and narrow and are 10 to 80 acres in size. The surface is dissected by gullies that are 1 foot to 4 feet deep, 5 to 10 feet wide, and 200 feet apart.

The surface layer is dark grayish-brown clay loam about 16 inches thick that has cracks as much as 1 inch wide and has a few concretions of calcium carbonate. The next layer is dark grayish-brown clay about 20 inches thick. Below this is mottled dark grayish-brown, light olive-brown, and yellowish-brown clay about 9 inches thick. The underlying material is mottled yellowish-brown and grayish-brown shaly clay.

Included with this soil in mapping are small areas of Heiden soils that make up less than 5 percent of any mapped area. Also included are areas of eroded soils that have a thinner clay surface layer than that of this Behring soil.

Most areas of this soil are formerly cultivated fields that are now used as range. A few areas are used for crops and as improved pasture. Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–3; pasture and hay group 7A; Blackland range site.

**Behring clay loam, 5 to 8 percent slopes, eroded** (BeD2).—This sloping soil is on uplands. Areas are long and narrow and are 10 to 100 acres in size. The surface is dissected by gullies that are 3 to 5 feet deep, 5 to 20 feet wide, and 100 to 300 feet apart.

The surface layer is grayish-brown clay loam about 10 inches thick over grayish-brown clay about 8 inches thick. The next layer is dark grayish-brown clay about 14 inches thick. Below this is 18 inches of yellowish-brown clay loam that has thin strata of pale-brown, calcareous clay loam. The underlying material is grayish-brown shaly clay and thin strata of yellowish-brown clay.

Included with this soil in mapping are areas of Ferris and Heiden soils and areas of eroded soils that have a thinner clay loam surface layer than that of this Behring soil. Also included are areas of soils that are similar to this Behring soil, except that they are calcareous. Included areas make up less than 30 percent of any mapped area.

This soil is used mostly as range. A few areas are used for crops and as improved pasture. Runoff is medium, and the hazard of erosion is moderate. Capability unit IVe–2; pasture and hay group 7B; Blackland range site.

## Bosque Series

The Bosque series consists of deep, nearly level soils on bottom lands. These soils formed in loamy, calcareous, alluvial material.

In a representative profile the surface layer is dark grayish-brown calcareous clay loam about 25 inches thick. The underlying material is pale-brown, friable,

calcareous clay loam that extends to a depth of 60 inches.

Bosque soils are well drained. Permeability is moderate, and available water capacity is high.

The soils in frequently flooded areas are mostly in native pasture and pecan orchards. Occasionally flooded areas are used mainly for crops.

Representative profile of Bosque clay loam, 0.75 mile south of the Luling Foundation Farm headquarters at Luling on U.S. Highway 90, in a field:

Ap—0 to 4 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky structure; hard, friable; many fine roots; many earthworm channels; few broken snail shells; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—4 to 25 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, subangular blocky and granular structure; hard, friable; many fine roots; many earthworm channels; few broken snail shells; calcareous; moderately alkaline; clear, smooth boundary.

C—25 to 60 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; hard, friable; few roots; few fine lenses of very pale brown (10YR 7/3) silt loam; calcareous; moderately alkaline.

The A horizon is 20 to 50 inches thick. It is dark grayish brown or very dark grayish brown and ranges from clay loam to loam. The C horizon is brown, pale brown, or grayish brown and ranges from loam to clay loam.

**Bosque clay loam** (Bo).—This nearly level soil is on flood plains along the San Marcos River. Slopes range from 0 to 1 percent. Most areas are crescent shaped and lie in the bends of the river. In places, secondary flood channels dissect the soil areas. This soil is flooded once every 5 to 7 years, but flooding lasts only a few hours. It has the profile described as representative of the series.

Included with this soil in mapping are small areas of Seguin and Trinity soils that make up less than 15 percent of any mapped area.

This soil is well suited to all crops commonly grown in the county, and most areas are cultivated. Runoff is slow, and the hazard of erosion is slight. Capability unit I–1; pasture and hay group 2A; Loamy Bottomland range site.

**Bosque soils, frequently flooded** (Bp).—This mapping unit is made up of nearly level soils on flood plains. Areas are long and narrow and are parallel to the stream channel along the San Marcos River. Slopes are 0 to 1 percent. Bosque soils make up about 65 percent of the mapping unit. The remaining 35 percent is soils that are similar to Bosque soils, except that they have more silt throughout the profile. The soils in this mapping unit are flooded at least once each year, and flooding lasts 1 or 2 days following heavy rains. Soil patterns are not uniform, and they occur without regularity. The surface layer ranges from clay loam to loam because deposition by floodwater causes surface alteration.

These Bosque soils have a surface layer of dark grayish-brown calcareous loam about 35 inches thick. The next layer is brown calcareous loam that has lenses of silt loam and threads of calcium carbonate and extends to a depth of 60 inches.

The soils in this mapping unit are well suited to use as range, and most areas are in native or improved pasture and pecan orchards (fig. 8). Runoff is slow, and the hazard of erosion is slight. Capability unit Vw–1; pasture and hay group 2A; Loamy Bottomland range site.

## Branyon Series

The Branyon series consists of deep, nearly level to gently sloping soils on old terraces. These soils formed in calcareous clayey alluvium.

In a representative profile the surface layer is dark-gray calcareous clay about 44 inches thick. Below this is gray calcareous clay about 28 inches thick that has many fine slickensides. The next layer is light-gray clay that extends to a depth of 96 inches.

Branyon soils are moderately well drained. These soils take in water rapidly when they are dry and very slowly when they are wet. Available water capacity is high.

These soils are used mostly for crops. A few areas are used as improved pasture.

Representative profile of Branyon clay, 0 to 1 percent slopes, 4,000 feet northeast of a railroad crossing in Reedville on Farm Road 1984, then 4,000 feet southeast on a county road to the intersection of railroad tracks, then 2,000 feet south of the road, in a cultivated field:

Ap—0 to 4 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, granular structure; extremely hard, very firm, sticky and plastic; few roots; few fine concretions of ferromanganese; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—4 to 44 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; parallelepipeds part to moderate, medium, angular blocky structure; extremely hard, very firm, sticky and plastic; few fine roots, mostly on surfaces of peds; common, coarse, grooved slickensides; few fine concretions of calcium carbonate; few fine concretions of ferromanganese; calcareous; moderately alkaline; gradual, wavy boundary.

A12—44 to 72 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; parallelepipeds part to moderate, medium, angular blocky structure; very hard, very firm; sticky and plastic; few roots; few dark-gray streaks from above; many fine slickensides; few fine concretions of calcium carbonate; few fine concretions of ferromanganese; calcareous; moderately alkaline; gradual, wavy boundary.

AC1—72 to 86 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; few, medium, distinct, brown (10YR 5/3) mottles; moderate, medium, angular blocky structure; very hard, very firm, sticky and plastic; few dark-gray streaks from above; few soft masses and concretions of calcium carbonate; few fine concretions of ferromanganese; calcareous; moderately alkaline; gradual, wavy boundary.

AC2—86 to 96 inches, light-gray (10YR 7/2) clay, light brownish gray (10YR 6/2) moist; few, medium, distinct, brown (10YR 5/3) mottles; moderate, medium, angular blocky structure; very hard, extremely firm, sticky and plastic; few, thin, dark-gray streaks from above; common soft masses and concretions of calcium carbonate; few fine concretions of ferromanganese; calcareous; moderately alkaline.

The Ap and A11 horizons are 20 to 60 inches thick and are dark gray or very dark gray. The A12 horizon ranges in thickness from 4 to 17 inches within a horizontal distance of 40 inches.

The AC horizon is 10 to 50 inches thick and ranges from

*Figure 8.*—**Area of Bosque soils used for pecan orchards and pasture.**

light gray to light yellowish brown. This horizon is clay or silty clay and has few to common brown, yellow, or olive mottles. It is 0 to 15 percent, by volume, siliceous or limestone gravel.

In some profiles a IIC horizon is below a depth of 60 inches. This horizon ranges from grayish brown to light yellowish brown and has yellowish and reddish splotches or streaks in places. It ranges from clay to loam and is 10 to 50 percent, by volume, siliceous or limestone gravel in places.

**Branyon clay, 0 to 1 percent slopes** (BrA).—This nearly level soil is on broad, old terraces. Areas are irregular in shape and are 100 to 600 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Burleson and Lewisville soils that make up less than 5 percent of any mapped area.

This soil is used mainly for crops. A few small areas are used for improved pasture. Runoff is slow, and the hazard of erosion is slight. Capability unit IIw–2; pasture and hay group 7A; Blackland range site.

**Branyon clay, 1 to 3 percent slopes** (BrB).—This gently sloping soil is on broad, old terraces. Areas are long and narrow and are 30 to 100 acres in size. Slopes are 1 to 2.5 percent.

The surface layer is dark-gray, calcareous clay about 20 inches thick. Below this is about 17 inches of gray, calcareous clay that has a few calcium carbonate concretions. The next layer is light-gray, calcareous clay about 16 inches thick. The underlying material is light yellowish-brown silty clay that is about 30 percent soft masses of calcium carbonate and about 40 percent, by volume, limestone gravel ¼ inch to 3 inches in diameter.

Included with this soil in mapping are small areas of Burleson and Lewisville soils that make up less than 5 percent of any mapped area.

This soil is used mainly for crops. A few small areas are in improved pasture. Runoff is medium, and the hazard of erosion is moderate. Capability unit IIe–1; pasture and hay group 7A; Blackland range site.

## Brazos Variant

The Brazos variant consists of deep, nearly level soils on bottom lands. These soils formed in slightly acid, sandy, alluvial sediment.

In a representative profile the surface layer is dark yellowish-brown, neutral fine sand about 3 inches thick. The next layer is light yellowish-brown, slightly acid fine sand about 33 inches thick. The underlying ma-

terial is very pale brown, slightly acid fine sand that has very thin strata of darker-colored fine sand material.

These soils are excessively drained. Permeability is rapid, and available water capacity is very low.

These soils are used mainly as range. A few areas are used as improved pasture.

Representative profile of Brazos fine sand, siliceous variant, 1 mile west on Farm Road 713 from its intersection with Texas Highway 304 in Delhi, then 3,600 feet south of the road, in a pasture:

A1—0 to 3 inches, dark yellowish-brown (10YR 4/4) fine sand, dark yellowish brown (10YR 3/4) moist; weak, granular and subangular blocky structure; slightly hard, very friable; many roots; neutral; abrupt, smooth boundary.

C1—3 to 36 inches, light yellowish-brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; thin strata of darker-colored fine sand material; slightly acid; clear, smooth boundary.

C2—36 to 60 inches, very pale brown (10YR 8/4) fine sand, very pale brown (10YR 7/4) moist; single grained; loose; very thin strata of darker-colored fine sand material; bedding planes are evident; slightly acid.

The A horizon is 3 to 10 inches thick. It ranges from brown or dark yellowish brown to reddish yellow and is neutral or slightly acid. The C horizon ranges from very pale brown to light yellowish brown. In many profiles this horizon has thin strata of darker-colored fine sand material that contains more organic matter than the rest of the horizon.

These soils are about 5 percent clay and silt. They are variants of the Brazos series in that they are not likely to be sands of mixed minerals, which is typical of the Brazos series. They differ in use and management from those Brazos sands that consist of mixed minerals.

**Brazos fine sand, siliceous variant** (Bs).—This nearly level soil is on flood plains along streams that drain sandy soils. It is frequently flooded during spring. Areas are long and narrow. They are 50 to 500 feet wide and are several miles long in places. Slopes are less than 1 percent.

Included with this soil in mapping are small areas of Uhland soils that make up less than 5 percent of any mapped area.

This soil is mostly in range, but a few areas are in improved pasture. Runoff is slow, and the hazard of erosion is slight. Capability unit Vw–2; pasture and hay group 3A; Sandy Bottomland range site.

## Burleson Series

The Burleson series consists of deep, nearly level to gently sloping soils on uplands and old terraces. These soils formed in calcareous clay.

In a representative profile the surface layer is dark-gray and very dark gray clay about 24 inches thick. The next layer is gray clay about 30 inches thick. Below this is grayish-brown clay.

Burleson soils are moderately well drained. Permeability is very slow when these soils are wet. Available water capacity is high.

These soils are used mainly for crops. A few areas are used as improved pasture and range.

Representative profile of Burleson clay, 1 to 3 percent slopes, 5.2 miles southwest on Farm Road 20 from its intersection with U.S. Highway 183 in Lockhart, then 100 feet west of the road, in a cultivated field:

Ap—0 to 4 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, granular structure and medium, subangular blocky structure; extremely hard, very firm; about 10 percent surface cover of round chert; scattered calcium carbonate concretions; mildly alkaline; abrupt, smooth boundary.

A1—4 to 24 inches, very dark gray (2.5Y 3/0) clay, black (2.5Y 2/0) moist; strong, coarse, blocky structure; extremely hard, very firm; mildly alkaline; gradual, smooth boundary.

AC1—24 to 54 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, medium, subangular blocky structure; very hard, very firm; very dark gray (10YR 3/1) streaks in filled cracks; prominent intersecting slickensides; calcareous; moderately alkaline; gradual, wavy boundary.

AC2—54 to 60 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, subangular blocky structure; extremely hard, very firm; few calcium carbonate concretions; prominent intersecting slickensides; few, weakly cemented, black concretions; calcareous; moderately alkaline.

The gilgai microrelief is basins and knolls 10 to 20 feet apart. The microknolls are 6 to 12 inches higher than the microdepressions. The A horizon is 12 to 50 inches thick and ranges from dark gray to very dark gray. The AC horizon ranges from grayish brown or gray to brown and is mildly alkaline to moderately alkaline.

**Burleson clay, 0 to 1 percent slopes** (BuA).—This nearly level soil is on broad uplands and old terraces in oval areas 10 to 30 acres in size. Slopes average about 0.5 percent, and surfaces are concave. In undisturbed areas the surface has a gilgai microrelief.

The surface layer is very dark gray blocky clay about 48 inches thick. The next layer is grayish-brown calcareous clay that has a few calcium carbonate concretions.

Included with this soil in mapping are small areas of Houston Black and Mabank soils that make up less than 10 percent of any mapped area.

This soil is well suited to most crops commonly grown in the county. Most areas are cultivated, but a few areas are in improved pasture and range. Runoff is slow, and the hazard of erosion is slight. Capability unit IIw–2; pasture and hay group 7A; Blackland range site.

**Burleson clay, 1 to 3 percent slopes** (BuB).—This gently sloping soil is on broad uplands and old terraces. Areas are irregular in shape and are 20 to 50 acres in size. Slopes average about 1.5 percent. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Houston Black, Mabank, and Wilson soils on small knolls or in depressions. Also included were spots that have a dark-colored surface layer less than 12 inches thick, some places in which the surface layer is calcareous, and a few places that have clay loam texture to a depth of 4 inches. Included areas make up less than 10 percent of any mapped area.

This soil is used mostly for crops. Some areas are planted to improved pasture, and a few areas are in native range. Runoff is slow, and the hazard of erosion is moderate. Capability unit IIe–1; pasture and hay group 7A; Blackland range site.

## Chaney Series

The Chaney series consists of deep, gently sloping to undulating soils on uplands. These soils formed in slightly acid loamy and sandy material.

In a representative profile the surface layer is brown loamy fine sand about 8 inches thick. Below this is 4 inches of pale-brown loamy fine sand. The next layer is mottled brown and red clay about 8 inches thick over mottled, red sandy clay and sandy clay loam about 36 inches thick. Below this is mottled, reddish-yellow sandy clay loam that extends to a depth of 60 inches.

Chaney soils are moderately well drained. Permeability is slow, and available water capacity is medium.

These soils are used mostly as range. Many areas are in improved pasture, and some small areas are cultivated.

Representative profile of Chaney loamy fine sand, 1 to 5 percent slopes, 5.2 miles northeast on Farm Road 1322 from its intersection with U.S. Highway 183 in Luling, then 3.7 miles east on a county road, 2.5 miles north and northwest on a county road, and 150 feet south of a cemetery, in a pasture:

A1—0 to 8 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak, granular structure; slightly hard, very friable; neutral; clear, smooth boundary.

A2—8 to 12 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak, granular structure; slightly hard, very friable; slightly acid; abrupt, smooth boundary.

B21t—12 to 20 inches, mottled brown (7.5YR 4/4) and red (2.5YR 4/8) clay; few, fine, faint, light brownish-gray (10YR 6/2) mottles; weak, coarse, blocky structure; extremely hard, very firm; common fine roots; few fine pores; few cracks filled with surface material; distinct clay films on peds; neutral; gradual, smooth boundary.

B22t—20 to 30 inches, red (2.5YR 5/8) sandy clay, red (2.5YR 4/8) moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; strong, coarse, blocky structure; extremely hard, very firm; few fine pores; distinct clay films on peds; medium acid; gradual, smooth boundary.

B23t—30 to 56 inches, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; extremely hard, firm to friable; few thin clay films on peds; medium acid; abrupt, smooth boundary.

B3—56 to 60 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; many, medium, distinct pale-brown (10YR 6/3) mottles; moderate, medium, subangular blocky structure; clay films along root channels; slightly acid.

The A horizon is 6 to 18 inches thick and is brown, light brown, pale brown, very pale brown, or grayish brown. It ranges from fine sandy loam to loamy fine sand and is neutral or slightly acid. In some places this horizon is as much as 25 percent, by volume, sandstone fragments. The A2 horizon is brown, pale brown, very pale brown, or light yellowish brown.

The B2t horizon is red, dark red, yellowish red, or brownish yellow. It ranges from clay to sandy clay and is slightly acid or medium acid. This horizon and the B3t horizon have mottles in shades of gray, brown, yellow, or red.

Depth to the C horizon ranges from 34 inches to more than 84 inches. This horizon ranges from clay to sandy clay loam, and in some places it has interbedded sandy shale and sandstone.

Chaney loamy fine sand, valleys (CbB) is wet for longer periods than is defined as within the range for the series. This soil is in valleys and is saturated for a period of about 30 days during most years. This difference does not affect use, behavior, and management of this soil.

**Chaney loamy fine sand, 1 to 5 percent slopes** (CaC).—This gently sloping soil is on upland ridges. Areas are irregular to oval in shape and are 25 to 80 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are Demona soils in depressions, Jedd soils on stony outcrops, and Rosanky soils on small knolls. These included soils make up less than 15 percent of any mapped area.

Areas of this soil are used mainly for livestock forage. Most areas are in range and in improved and unimproved pasture. A few areas are cultivated and used for forage sorghum and small grain for grazing. A few small areas are used for truck crops. Runoff is slow, and the hazard of erosion is slight. A perched water table is in the lower part of the surface layer for 2 or 3 days after heavy rains. Capability unit IIIe–6; pasture and hay group 9A; Sandy Loam range site.

**Chaney loamy fine sand, valleys** (CbB).—This gently sloping soil is on the lower slopes of upland valleys. Areas are irregular in shape and are 100 to 250 acres in size. Slopes range from 1.5 to 3 percent, and surfaces are concave.

The surface layer is brown, slightly acid loamy fine sand about 7 inches thick. Below this is light yellowish-brown, slightly acid loamy fine sand about 4 inches thick. The next layer is mottled yellowish-red clay about 14 inches thick and mottled light brownish-gray, yellowish-brown, and red sandy clay about 17 inches thick. Below this is yellowish-red sandy clay loam about 7 inches thick. The underlying material is reddish-yellow sandy clay loam.

Included with this soil in mapping are areas of Crockett, Demona, and Wilson soils. Demona soils make up as much as 10 percent of some mapped areas. Crockett and Wilson soils are in areas less than 5 acres in size.

This soil is used mostly as range. A few formerly cultivated areas are now idle or in improved pasture, and a few areas are in forage sorghum and truck crops. Runoff is slow. The hazard of erosion is slight. This soil is saturated for a period of about 30 days during most years. Capability unit IIIe–6; pasture and hay group 9A; Sandy Loam range site.

**Chaney soils, 2 to 6 percent slopes, eroded** (CcC2).—These gently sloping to sloping soils are on uplands. Areas are irregular in shape and are 20 to 100 acres in size. Surfaces are dissected by rills and gullies that are about 2 feet deep and 200 feet apart. The surface layer is fine sandy loam in eroded areas and loamy fine sand in unaltered areas. Soil patterns are not uniform, and they occur without regularity.

The surface layer is brown fine sandy loam about 8 inches thick. Below this is very pale brown fine sandy loam about 4 inches thick. The next layer is 22 inches of red sandy clay that has many, fine, light brownish-gray and yellowish-brown mottles over 12 inches of yellowish-red sandy clay. The underlying material is light brownish-gray sandy clay.

Included with these soils in mapping are areas of Crockett and Rosanky soils that make up less than 15 percent of any mapped acreage.

Areas of these soils are used mostly for livestock forage. Most areas are in range and native and improved pasture. A few areas are cultivated, and a few small areas are in truck crops. Runoff is medium. The hazard of erosion is severe. Capability unit IVe–1; pasture and hay group 8A; Sandy Loam range site.

**Chaney soils, 5 to 8 percent slopes, severely eroded** (CcD3).—These sloping soils are on uplands in areas 15 to 50 acres in size. Most areas are irregular in shape and are severely eroded. Numerous gullies 3 to 15 feet deep dissect the surface at intervals of less than 100 feet. These gullies form a network that connects to one or more main channels, and they make up 20 percent of the mapped area. Soil patterns are not uniform, and they occur without regularity. The surface layer is variable. In areas between the gullies, the surface layer is 5 to 18 inches thick. In areas next to gullies, 50 to 100 percent of the surface layer has been removed by erosion. These areas make up 60 percent of the mapped area. In many areas strongly cemented sandstone rocks less than 4 feet in diameter occur, and in some areas small broken sandstone fragments are on the surface.

The surface layer is about 8 inches of brown fine sandy loam or loamy fine sand, depending upon the degree of erosion. Below this is very pale brown fine sandy loam about 6 inches thick. The next layer is about 17 inches of red sandy clay that has a few, fine, yellowish-brown mottles. Below this is reddish-yellow sandy clay loam about 21 inches thick. The underlying material is mottled reddish-yellow and very pale brown sandy clay.

Included with these soils in mapping are areas of Crockett and Rosanky soils that are in about the same position as the Chaney soils. These soils make up less than 30 percent of the mapped area.

These soils are mostly in brushy range and unimproved pasture. A few small areas have been root plowed, have had gullies filled, and have been planted in introduced grasses. Runoff is medium. The hazard of erosion is severe. Capability unit VIe–1; pasture and hay group 8B; Sandy Loam range site.

## Crockett Series

The Crockett series consists of deep, gently sloping to strongly sloping soils on uplands. These soils formed in shaly clay.

In a representative profile the surface layer is brown fine sandy loam about 12 inches thick. Below this is dark-brown and yellowish-brown clay about 26 inches thick. The next layer is light yellowish-brown sandy clay loam about 16 inches thick. The underlying material is mixed brownish-yellow clay loam and light-gray shaly clay loam.

Crockett soils are moderately well drained. Permeability is very slow, and available water capacity is high.

These soils are used mainly as pasture or range, but a few areas are cultivated.

Representative profile of Crockett fine sandy loam, 1 to 3 percent slopes, 5.4 miles northeast on Farm Road 672 from its intersection with U.S. Highway 183 at the northern city limits of Lockhart, then 50 feet east of the road, in a pasture:

A1—0 to 12 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, granular structure; hard, very friable; many fine roots; neutral; abrupt, wavy boundary.

B21t—12 to 18 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; many, fine, prominent, reddish-brown (5YR 4/4) mottles and a few, fine, faint, grayish-brown (10YR 5/2) mottles; weak, coarse, blocky structure; extremely hard, very firm; many fine roots; scattered, weakly cemented, black concretions; neutral; clear, smooth boundary.

B22t—18 to 24 inches, dark-brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; few, fine, faint, reddish-brown (5YR 4/4) mottles; weak, coarse, blocky structure; extremely hard, very firm; few fine roots; mildly alkaline; clear, smooth boundary.

B23t—24 to 38 inches, yellowish-brown (10YR 5/4) clay, dark yellowish brown (10YR 4/4) moist; moderate, coarse, blocky structure; extremely hard, very firm; mildly alkaline; clear, smooth boundary.

B3—38 to 54 inches, light yellowish-brown (10YR 6/4) sandy clay loam, yellowish brown (10YR 5/4) moist; moderate, medium, subangular blocky structure; very hard, firm; few soft masses of calcium carbonate; few, weakly cemented, black concretions; mildly alkaline; abrupt, smooth boundary.

C—54 to 60 inches, mixed brownish-yellow (10YR 6/8) clay loam and light-gray (10YR 7/2) weakly cemented shaly clay loam; massive; hard, friable; calcareous; moderately alkaline.

The A horizon is 4 to 15 inches thick and ranges from brown or yellowish brown to dark brown. It is sandy loam, gravelly sandy loam, or clay loam and ranges from 15 to 35 percent coarse fragments.

The B2t horizon is 20 to 40 inches thick. It ranges from clay to sandy clay. This horizon is dominantly red, brown, and yellow and has mottles in shades of red, brown, yellow, and gray. The degree and distinctness of mottling changes considerably within a few feet.

The B3 horizon is 10 to 20 inches thick. It is brown, yellowish brown, or light yellowish brown and is as much as 15 percent soft masses and concretions of calcium carbonate.

The C horizon is brownish yellow, brown, dark brown, pale brown, reddish brown, or yellowish brown.

**Crockett fine sandy loam, 1 to 3 percent slopes** (CfB).—This gently sloping soil is on ridgetops. Areas are irregular in shape and are 50 to 200 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Behring, Chaney, Fett, Mabank, and Wilson soils that make up less than 30 percent of any mapped area. Also included are some areas of soils that have a loam surface layer and some that have a surface layer that is as much as 20 percent coarse fragments. Other areas of soils that have a surface layer more than 15 inches thick are included, and in some profiles a thin leached layer 2 to 3 inches thick is in the lower part of the surface layer.

This soil is used mostly for livestock forage, and most areas are in pasture and range. Small areas are planted to improved pasture, and a few small areas are cultivated. Runoff is slow, and the hazard of erosion is slight. Capability unit IIIe–4; pasture and hay group 8A; Claypan Prairie range site.

**Crockett gravelly sandy loam, 1 to 5 percent slopes** (CgC).—This gently sloping and gently undulating soil is on uplands in oval areas 25 to 150 acres in size.

The surface layer is brown gravelly sandy loam about 12 inches thick. The next layer is about 5 inches of reddish-brown clay that has fine yellowish-brown and light brownish-gray mottles. Below this is about 18 inches of brown clay that has yellowish-brown and

light brownish-gray mottles over about 10 inches of light yellowish-brown clay that has light grayish-brown mottles. The next layer is mottled pale-brown and yellowish-brown sandy clay.

Included with this soil in mapping are areas of Fett and Rosanky soils that make up less than 30 percent of any mapped area. Also included are areas of soils that have a gray surface layer less than 20 inches thick. These soils make up less than 10 percent of the mapped area. Areas of soils that have a loam surface layer are also included.

This soil is well suited to use as improved pasture, and a few areas are in improved pasture. Most areas are in pasture and range, and a few small areas are planted to crops used mainly by livestock. Runoff is slow, and the hazard of erosion is slight. Capability unit IVe–1; pasture and hay group 8A; Claypan Prairie range site.

**Crockett soils, 2 to 5 percent slopes, eroded** (CrC2).—These gently undulating soils are on uplands. Some areas are oval, others are long, and some are irregular in shape. They range from 30 to 150 acres in size but are dominantly about 50 acres. The surface is dissected by a few rills and gullies 100 to 300 feet apart. The gullies are 1 to 3 feet deep and have vertical sides. Soil patterns are not uniform. Some areas of these soils have a loam surface layer, and some have a fine sandy loam surface layer. In an average of 20 to 30 percent of the mapped areas, 75 percent or more of the surface layer on both sides of the gullies has been removed. The surface layer is more than 20 inches thick at the base of most slopes where surface accumulation has occurred.

The surface layer is yellowish-brown fine sandy loam or loam about 7 inches thick. The next layer is about 5 inches of dark reddish-brown clay that has yellowish-brown and light brownish-gray mottles. Below this is about 18 inches of brown clay that has yellowish-brown and grayish-brown mottles over about 18 inches of yellowish-red clay that has light brownish-gray mottles. The next layer is mottled pale-brown, dark-brown, and yellowish-brown sandy clay.

Included with these soils in mapping are small areas of Behring and Wilson soils that make up less than 10 percent of any mapped area.

These soils are well suited to improved pasture, and a few areas are planted to improved pasture. Most areas are in native pasture and range, but a few areas are cultivated. Runoff is rapid, and the hazard of erosion is severe. Capability unit IVe–1; pasture and hay group 8A; Claypan Prairie range site.

**Crockett soils, 3 to 8 percent slopes, severely eroded** (CrD3).—These gently sloping to sloping soils are on eroded uplands. Areas are long and narrow and are 20 to 100 acres in size. The surface is dissected by gullies that are 3 to 15 feet deep and are less than 100 feet apart. Soil patterns are not uniform. The surface layer ranges from fine sandy loam to loam or clay loam.

The surface layer is brown loam about 4 inches thick. Below this is about 12 inches of yellowish-brown clay that has a few, fine, faint, reddish-brown mottles. The next layer is about 15 inches of brownish-yellow clay that has many, fine, yellowish-brown mottles and a few soft masses of calcium carbonate. Below this is about 17 inches of yellowish-brown clay that has soft masses and concretions of calcium carbonate. The next layer is yellowish-brown clay loam.

Included with these soils in mapping are some areas of Chaney and Heiden soils that make up about 15 percent of some mapped areas. Also included in areas of severe erosion are Crockett soils that have the surface layer removed and the subsoil exposed; in spots the parent material is exposed. These eroded areas make up about 60 percent of some mapped areas.

These soils are used mostly as range. They are too steep and eroded to be cultivated. A few areas have been root plowed, have had gullies filled, and have been planted to improved pasture. Runoff is rapid, and the hazard of erosion is severe (fig. 9). Capability unit VIe–1; pasture and hay group 8B; Claypan Prairie range site.

## Demona Series

The Demona series consists of deep, gently sloping soils on uplands. These soils formed in sandy material.

In a representative profile the surface layer is pale-brown loamy fine sand about 18 inches thick. Below this is very pale brown loamy fine sand about 8 inches thick. The next layer is mottled red, light brownish-gray, and brown, strongly acid clay about 24 inches thick. Below this is mottled strong-brown, yellowish-red, and light brownish-gray, medium acid sandy clay about 10 inches thick.

Demona soils are moderately well drained. Permeability is moderately slow, and available water capacity is medium. A perched water table is in the lower part of the surface layer during periods of high rainfall.

These soils are used mostly as pasture or range, but a few areas are cultivated.

Representative profile of Demona loamy fine sand, 1 to 5 percent slopes, 4 miles southwest on Farm Road 86 from its intersection with Farm Road 713 at McMahan, then 4.25 miles south on a county road, then 1,400 feet east of the road, in a wooded pasture:

A1—0 to 18 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose; slightly acid; abrupt, smooth boundary.

A2—18 to 26 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; slightly acid; abrupt, smooth boundary.

B2t—26 to 50 inches, mixed mottled red (2.5YR 4/6), light brownish-gray (10YR 6/2), and brown (10YR 5/3) clay; weak, coarse, blocky structure; very hard, very firm; fine, weakly cemented, black concretions; strongly acid; abrupt, smooth boundary.

B3—50 to 60 inches, mixed mottled strong-brown (7.5YR 5/6), yellowish-red (5YR 5/8), and light brownish-gray (10YR 6/2) sandy clay loam; moderate, medium, subangular blocky structure; hard, firm to friable; many fine roots; sandy surface material between cleavage planes; few, soft, gypsum crystals; medium acid; abrupt, smooth boundary.

The A horizon is 21 to 38 inches thick. It is light brown, pale brown, very pale brown, brown, grayish brown, or dark grayish brown.

The B2t horizon is 20 to 30 inches thick. It is mottled in shades of yellow, gray, brown, or red. The mottles are mainly red in the upper part and gray in the lower part. This horizon ranges from clay to sandy clay and from slightly acid to strongly acid.

The B3 horizon is 10 to 15 inches thick. It is brownish yellow, reddish yellow, or strong brown and is mottled in shades of red, yellow, and gray.

*Figure 9.*—**Gully erosion on Crockett soils.**

**Demona loamy fine sand, 1 to 5 percent slopes** (DeC). —This gently sloping soil is on uplands. Areas are long and narrow and are 20 to 300 acres in size.

Included with this soil in mapping are areas of Chaney, Patilo, and Silstid soils that make up less than 20 percent of any mapped area. Also included are areas of soils that have a surface layer more than 40 inches thick and areas that have a surface layer less than 20 inches thick.

This soil is used mostly as range. Some areas are in improved pasture, and a few areas are in truck crops. Runoff is slow, and the hazard of erosion is slight. Capability unit IIIe–6; pasture and hay group 9A; Sandy range site.

## Ferris Series

The Ferris series consists of deep, sloping to moderately steep soils on uplands. These soils formed in shaly clay.

In a representative profile the surface layer is grayish-brown clay about 6 inches thick. The next layer is light olive-brown clay about 34 inches thick. Below this is light olive-brown clay, about 14 inches thick, that has yellowish-brown mottles. The underlying material is light olive-brown shaly clay.

Ferris soils are well drained. Permeability is very slow, and available water capacity is high. Runoff is rapid.

In Caldwell County, Ferris soils are mapped only in a complex with Heiden soils.

Representative profile of Ferris clay in an area of Heiden-Ferris complex, 5 to 20 percent slopes, severely eroded, 9.4 miles north of the county courthouse in Lockhart on U.S. Highway 183, then 1,500 feet west of the highway, in a pasture:

A1—0 to 6 inches, grayish-brown (2.5Y 5/2) clay, dark grayish brown (2.5Y 4/2) moist; moderate, medium, subangular blocky structure; extremely hard, very firm; mulch of fine granules on surface; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

AC1—6 to 40 inches, light olive-brown (2.5Y 5/4) clay; olive brown (2.5Y 4/4) moist; moderate, medium, subangular blocky structure; very hard, very firm; few roots; streaks of surface material in filled cracks; many intersecting slickensides in the lower part; bits of broken chert; many, weakly cemented, black concretions; cracks 1 inch to 3 inches wide to a depth of 40 inches; calcareous; moderately alkaline; clear, wavy boundary.

AC2—40 to 54 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; fine yellowish-brown (10YR 5/6) mottles; strong, medium, subangular blocky structure; very hard, very firm; intersecting slickensides; thin lenses of brown (10YR 5/3) clay loam material; calcareous; moderately alkaline; clear, wavy boundary.

C—54 to 60 inches, light olive-brown (2.5Y 5/4) shaly clay, olive brown (2.5Y 4/4) moist; massive; fine yellowish-brown (10YR 5/6) mottles; very hard, very firm; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 inches to more than 60 inches in thickness. It ranges from 0 to 5 percent, by volume, soft masses and concretions of visible calcium carbonate. The A horizon is grayish brown or brown. The AC horizon ranges from yellowish brown to light olive brown.

## Fett Series

The Fett series consists of deep, gently sloping to strongly sloping soils on uplands. These soils formed in a gravelly mantle of ancient outwash over calcareous shaly clay.

In a representative profile the surface layer is about 9 inches of brown gravelly sandy loam that is about 30 percent siliceous pebbles. Below this is about 5 inches of very pale brown very gravelly sandy loam that is about 80 percent siliceous pebbles. The next layer is about 16 inches of mottled yellowish-red, light brownish-gray, and yellowish-brown, medium acid very gravelly clay that is about 70 percent siliceous pebbles. Below this is about 40 inches of light brownish-gray gravelly clay that has red and yellowish-brown mottles and is about 10 percent chert pebbles. The next layer is brownish-yellow sandy clay that has light brownish-gray mottles and is about 10 percent siliceous pebbles.

Fett soils are somewhat poorly drained. Permeability is very slow, and available water capacity is low.

These soils are used mostly as pasture and range. A few areas are in improved pasture.

Representative profile of Fett gravelly soils, 1 to 12 percent slopes, 7.4 miles south of the county courthouse in Lockhart on U.S. Highway 183, then 400 feet east of the highway, in a pasture:

A1—0 to 9 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, very friable; many roots; 30 percent, by volume, siliceous pebbles; slightly acid; abrupt, smooth boundary.

A2—9 to 14 inches, very pale brown (10YR 7/3) very gravelly sandy loam, pale brown (10YR 6/3) moist; weak, fine, granular structure; slightly hard, very friable; many roots; 80 percent, by volume, siliceous pebbles; slightly acid; abrupt, wavy boundary.

B21t—14 to 30 inches, prominently mottled yellowish-red (5YR 5/8), light brownish-gray (10YR 6/2), and yellowish-brown (10YR 5/8) very gravelly clay; moderate, coarse, blocky structure; extremely hard, very firm; many roots; 70 percent siliceous pebbles; evident clay films on peds and pebbles; medium acid; abrupt, wavy boundary.

B22t—30 to 70 inches, light brownish-gray (10YR 6/2) gravelly clay, grayish brown (10YR 5/2) moist; many, distinct, coarse, yellowish-brown (10YR 5/8) and red (2.5YR 4/8) mottles; moderate, medium and fine, angular blocky structure; hard, firm; 10 percent chert pebbles; medium acid; clear, smooth boundary.

B3—70 to 84 inches, brownish-yellow (10YR 6/6) sandy clay, yellowish brown (10YR 5/6) moist; common, medium, distinct, light brownish-gray (10YR 6/2) mottles; moderate, medium and fine, angular blocky structure; hard, firm; an estimated 10 percent siliceous pebbles or stones in discontinuous strata; medium acid.

The A1 horizon is 7 to 18 inches thick and is grayish brown or brown. This horizon ranges from gravelly or very gravelly sandy loam to gravelly or very gravelly loamy sand and from neutral to medium acid.

The upper part of the B2t horizon is prominently or distinctly mottled in shades of red, yellow, gray, or brown. This horizon ranges from gravelly or very gravelly clay to gravelly sandy clay. It ranges from 35 to 70 percent gravel and from neutral to strongly acid. The lower part of the B2t horizon and the B3 horizon are 5 to 40 percent siliceous pebbles and stones and 25 to 40 percent clay. In some places these horizons have secondary accumulations of calcium carbonate at a depth of 50 to 80 inches. The B3 horizon ranges from moderately alkaline to medium acid.

**Fett gravelly soils, 1 to 12 percent slopes** (FeE).—These gently sloping to strongly sloping soils are on broad uplands in oval areas 20 to 300 acres in size. The surface layer ranges from gravelly sandy loam to very gravelly sandy loam or loamy sand. Soil patterns are not uniform, and they occur without regularity.

Included with these soils in mapping are spots of Chaney and Crockett soils and depressional areas of Mabank soils. Also included are areas of soils that have a surface layer more than 20 inches thick. Included areas make up less than 20 percent of any mapped area.

These soils are used mostly as pasture and range. A few areas are in improved pasture. Several areas, 5 to 10 acres in size, have been stripped for roadbuilding material. Runoff is medium, and the hazard of erosion is slight. A perched water table is in some places during winter and spring. Capability unit VIs–1; pasture and hay group 8A; Gravelly range site.

## Gowen Series

The Gowen series consists of deep, nearly level soils on bottom lands. These soils formed in loamy alluvial material.

In a representative profile the surface layer is dark grayish-brown clay loam and silty clay about 26 inches thick. The underlying material is light olive-brown sandy clay loam that has thin strata of fine sandy loam and clay loam material.

Gowen soils are well drained. Permeability is moderate, and available water capacity is high.

These soils are subject to flooding. Most areas are used for crops and as improved pasture.

Representative profile of Gowen clay loam in an area of Gowen soils, frequently flooded, 2.5 miles south on Farm Road 3158 from its intersection with Farm Road 713 in McMahan, then 2,600 feet west on a field road, in a pasture, on the flood plain of Tenny creek:

A11—0 to 14 inches, dark grayish-brown (2.5Y 4/2) clay loam, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, subangular blocky structure; hard, firm; many fine roots; few, fine, weakly cemented, black concretions; neutral; clear, smooth boundary.

A12—14 to 20 inches, dark grayish-brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong, fine, subangular blocky structure; very hard, very firm; few roots; few pores; few, fine, weakly cemented, black concretions; many worm channels; neutral; clear, smooth boundary.

A13—20 to 26 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, firm; few roots; few pores; few, weakly cemented, black concretions; neutral; abrupt, smooth boundary.

C—26 to 50 inches, light olive-brown (2.5Y 5/4) sandy clay loam, olive brown (2.5Y 4/4) moist; few, fine, yellowish-brown mottles; massive; hard, friable; thin strata of fine sandy loam and clay loam material; neutral.

The A horizon ranges from 20 to 32 inches in thickness. It is dark grayish brown, dark gray, or brown and is dominantly clay loam, but ranges from silty clay to clay loam.

The C horizon is dark grayish brown, yellowish brown, or light olive brown and is stratified. It is dominantly clay loam or sandy clay loam and has strata, less than 4 inches thick, that range from silty clay to fine sandy loam. This horizon ranges from neutral to moderately alkaline.

**Gowen clay loam** (Go).—This nearly level soil is on flood plains along local streams. Areas are long and narrow and are 30 to 150 acres in size. Slopes are less than 1 percent. This soil is in slightly higher areas than other Gowen soils and is only occasionally flooded.

The surface layer is dark grayish-brown clay loam about 15 inches thick. The next layer is brown clay loam about 12 inches thick. The underlying material is dark grayish-brown clay loam and has strata of clay loam, silt loam, and fine sandy loam.

Included with this soil in mapping are small areas of Trinity and Uhland soils and small spots of soils that are similar to Trinity soils, except that they are noncalcareous. Included soils make up less than 10 percent of any mapped area.

This soil is used mostly for crops or as improved pasture. Runoff is slow, and the hazard of erosion is slight. Capability unit IIw–1; pasture and hay group 2A; Loamy Bottomland range site.

**Gowen soils, frequently flooded** (Gs).—These nearly level soils are on bottom lands that are frequently flooded. Areas are long and narrow. They are 500 feet to ½ mile wide and are several miles long. Slopes are less than 1 percent. The surface is undulating where deposition occurs during flooding. Soil patterns are not uniform. Some areas have a clay loam surface layer, and other areas have a silty clay, sandy clay loam, or silty clay loam surface layer. A Gowen clay loam in an area of these soils has the profile described as representative of the series.

Included with these soils in mapping are some areas of soils that are similar to Trinity soils and some areas of Uhland soils. Included areas make up less than 5 percent of any mapped area.

These soils are used for grazing. Many areas have a dual use as improved pasture and pecan orchards, for which the soils are well suited. Runoff is slow, and the hazard of erosion is slight. Capability unit Vw–3; pasture and hay group 2A; Loamy Bottomland range site.

## Heiden Series

The Heiden series consists of deep, gently sloping to moderately steep soils on uplands. These soils formed in shaly clay material.

In a representative profile the surface layer is dark grayish-brown calcareous clay about 26 inches thick. The next layer is about 28 inches of light olive-brown calcareous clay that has brownish-yellow and dark grayish-brown mottles. The underlying material is grayish-brown calcareous clay.

Heiden soils are well drained. Permeability is very slow, and available water capacity is high.

These soils are used mostly for crops and as pasture. A few areas are used as range.

Representative profile of Heiden clay, 3 to 5 percent slopes, eroded, 1.5 miles east on Farm Road 672 from its intersection with U.S. Highway 183 in Lockhart, then 2.8 miles north on a county road, then 300 feet west of the road, in a pasture:

A11—0 to 8 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong, fine, granular and subangular blocky structure; very hard, very firm; few calcium carbonate concretions; thin surface cover of fine brown (10YR 4/3) granules; calcareous; moderately alkaline; clear, wavy boundary.

A12—8 to 26 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; 40 percent, by volume, dark-brown (10YR 4/3) splotches and mottles; moderate, coarse, subangular blocky structure; extremely hard, very firm; few concretions and soft masses of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

AC—26 to 54 inches, light olive-brown (2.5Y 5/4) clay, olive brown (2.5Y 4/4) moist; common brownish-yellow (10YR 6/8) and dark grayish-brown (10YR 4/2) mottles; moderate, medium, subangular blocky structure; extremely hard, very firm; thin streaks of very dark grayish brown (10YR 3/2) in filled cracks; distinct intersecting slickensides; calcareous; moderately alkaline; abrupt, wavy boundary.

C—54 to 60 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm; distinct intersecting slickensides; weakly cemented gypsum masses; soft fine masses of calcium carbonate; calcareous; moderately alkaline.

In undisturbed areas the gilgai microrelief consists of basins and knolls 10 to 30 feet apart. The microknolls are 6 to 18 inches higher and have a thinner A horizon than the microdepressions. In some areas as much as 80 percent of the surface has a gravel cover.

The A horizon is 8 to 26 inches thick and is dark gray, dark grayish brown, or very dark grayish brown. In places the upper 10 inches of this horizon is as much as 20 percent, by volume, gravel. The AC horizon is 20 to 40 inches thick. It is dark grayish brown, light olive brown, olive brown, or brown and has brown, yellow, gray, or olive mottles. This horizon has few to common concretions and soft masses of segregated carbonates.

The C horizon is grayish brown, light grayish brown, or pale brown, and in places it has brown, gray, yellow, or olive mottles. This horizon is clay or shaly clay and has few to common segregated carbonates.

**Heiden clay, 1 to 3 percent slopes** (HeB).—This gently sloping soil is on upland ridges in areas 10 to 150 acres in size.

The surface layer is dark grayish-brown calcareous clay about 24 inches thick. In undisturbed areas the surface is covered by a mulch of fine granules. The next layer is about 24 inches of dark grayish-brown calcareous clay that has many yellowish-brown mottles, many intersecting slickensides, and few to many concretions and soft masses of calcium carbonate. The underlying material is mottled light brownish-gray and yellowish-brown, calcareous shaly clay that has common soft masses of calcium carbonate.

Included with this soil in mapping are small areas of Behring and Houston Black soils. Also included are spots of soils that are similar to this Heiden soil, ex-

cept that they have a light-colored surface layer or a surface layer that is less than 7 inches thick. Included areas make up less than 15 percent of any mapped area.

This soil is used mostly for crops or as improved pasture. It is well suited to all crops commonly grown in the county. A few areas are used as pasture or range. Runoff is medium, and the hazard of erosion is slight. Capability unit IIe–1; pasture and hay group 7A; Blackland range site.

**Heiden clay, 3 to 5 percent slopes, eroded** (HeC2).—This gently undulating soil is on uplands. Areas are irregular in shape and are 30 to 150 acres in size. A few gullies 1 foot to 3 feet deep dissect the surface at intervals of 200 to 300 feet. This soil has the profile described as representative of the series.

Included with this soil in mapping are small eroded spots of soils next to the gullies that are similar to Heiden clay, except that they have a light-colored surface layer. Included areas make up less than 15 percent of any mapped area.

This soil is used mostly for crops and as improved pasture. It is suited to all crops commonly grown in the county. Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–3; pasture and hay group 7A; Blackland range site.

**Heiden clay, 5 to 8 percent slopes, eroded** (HeD2).—This sloping soil is on uplands in long, narrow areas 10 to 40 acres in size. Shallow gullies mostly 10 to 15 feet wide and 4 to 6 feet deep dissect the surface in most areas at intervals of 200 to 300 feet.

The surface layer is dark grayish-brown calcareous clay about 14 inches thick. Below this is about 18 inches of brown calcareous clay that has many light yellowish-brown mottles. The next layer is about 24 inches of light olive-brown calcareous clay that has yellow and light brownish-gray mottles, prominent slickensides, and many soft masses of calcium carbonate.

Included with this soil in mapping are areas of eroded soils that have a light-colored surface layer. The included soils make up less than 30 percent of any mapped area.

This soil is used mostly as pasture. A few small areas are used for crops, and a few areas are in range. Runoff is medium, and the hazard of erosion is severe. Capability unit IVe–2; pasture and hay group 7B; Blackland range site.

**Heiden gravelly clay, 3 to 8 percent slopes** (HgD).—This undulating soil is on uplands. Areas are irregular in shape and are 30 to 70 acres in size. A few deep and shallow gullies dissect the surface. From 25 to 80 percent of the surface is covered with gravel ½ inch to 3 inches in diameter.

The surface layer is about 8 inches of very dark grayish brown calcareous clay and is about 15 percent, by volume, gravel. The next layer is dark grayish-brown calcareous clay about 16 inches thick that has many olive-brown mottles. Below this is about 20 inches of light yellowish-brown calcareous clay that has yellowish-brown and grayish-brown mottles. The underlying layer is light grayish-brown calcareous shaly clay that has a few soft masses of calcium carbonate.

Included with this soil in mapping are small areas of Behring, Ferris, Houston Black, and Wilson soils that make up less than 15 percent of any mapped area.

This soil is mostly in native pasture. A few areas are in improved pasture. A few small areas are in crops, but the gravelly surface makes cultivation of row crops difficult. Runoff is medium, and the hazard of erosion is severe. Capability unit IVe–2; pasture and hay group 7B; Blackland range site.

**Heiden-Ferris complex, 5 to 20 percent slopes, severely eroded** (HhF3).—This mapping unit is made up of sloping to moderately steep soils in elongated areas on uplands. It is about 50 to 80 percent Heiden clay, and the rest is Ferris soils. Most areas are 20 to 90 acres in size, are 400 to 600 feet wide, and are as much as ½ mile long. The surface is dissected by gullies that are 50 to 200 feet apart, 3 to 8 feet deep, and 10 to 20 feet wide. Areas of these soils are so intricately intermingled that the soils cannot be shown separately at the scale mapped.

The Heiden soils are in gullies and in areas 50 to 100 feet on both sides of the gullies. These soils have a surface layer of dark grayish-brown clay about 12 inches thick. The next layer is about 22 inches of brown clay that has yellowish-brown mottles. Below this is light olive-brown clay that has yellow and light brownish-gray mottles.

A Ferris soil in an area of this complex has the profile described as representative of the series.

Included with these soils in mapping are areas of Houston Black soils that make up less than 10 percent of any mapped area. Also included are small areas of soils that have a gravelly surface layer.

Most areas in this complex are used as pasture and range. A few areas have been root plowed, have had gullies filled, and have been planted in introduced grasses. The soils are well suited to use as improved pasture. Runoff is rapid, and the hazard of erosion is severe (fig. 10). Capability unit VIe–2; pasture and hay group 7B; Eroded Blackland range site.

**Heiden-Wilson complex, 1 to 3 percent slopes** (HmB).—This mapping unit is made up of gently sloping soils on ridges. It is about 50 to 70 percent Heiden clay and about 30 to 50 percent Wilson loam. Soils are in alternating strips that are not uniform in shape, are 50 to 150 feet wide, and are parallel to the slope. Areas of these soils are so intricately intermingled that the soils cannot be shown separately at the scale mapped.

The Heiden soil is on microridges. This soil has a surface layer of dark grayish-brown calcareous clay about 22 inches thick. The next layer is about 21 inches of dark grayish-brown clay that has yellowish-brown mottles. The underlying material is grayish-brown calcareous shaly clay that has a few soft masses of calcium carbonate.

The Wilson soil is in microvalleys. This soil has a surface layer of grayish-brown loam about 5 inches thick. Below this is grayish-brown clay about 31 inches thick. The underlying material is gray clay.

Included with these soils in mapping are small areas of soils that are mottled reddish-brown in the lower part and areas that have a very dark gray surface layer less than 12 inches thick. Also included are formerly cultivated areas of Heiden soils that have a

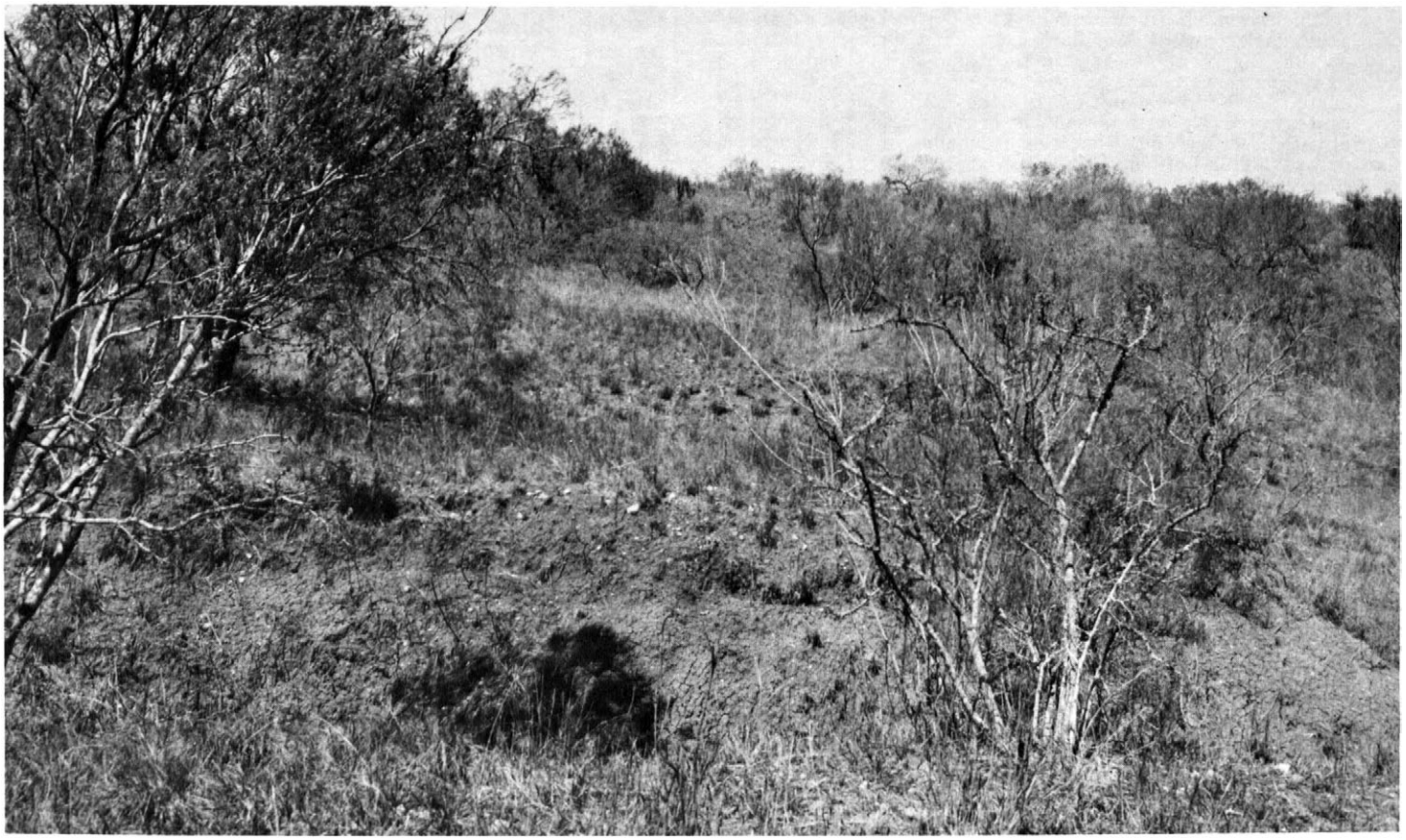

*Figure 10.*—Gullied area of Heiden-Ferris complex.

loam surface layer and of Wilson soils that have a calcareous surface layer.

The soils in this complex are suited to cultivated crops or improved pasture. Most areas were cultivated but are now in improved pasture. A few areas are in range. Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–2; pasture and hay group 7A; Blackland range site.

## Houston Black Series

The Houston Black series consists of deep, gently sloping soils on uplands. These soils formed in calcareous clay. In undisturbed areas the gilgai microrelief is basins and knolls that are 15 to 30 feet apart and 6 to 18 inches from the top of the knoll to the bottom of the basin.

In a representative profile the surface layer is dark-gray calcareous clay about 16 inches thick over gray calcareous clay about 28 inches thick that has slickensides in the lower part. The next layer is about 16 inches of grayish-brown calcareous clay. It has streaks of material from the surface in filled cracks, and it has a few concretions.

Houston Black soils are moderately well drained. Permeability is very slow, and available water capacity is high.

These soils are used mostly for crops, but a few areas are used as pasture.

Representative profile of Houston Black clay, 1 to 3 percent slopes, 1,200 feet east of the northeast corner of Maxwell, in a cultivated field:

Ap—0 to 4 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, granular structure; extremely hard, very firm; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—4 to 16 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine and medium, angular blocky structure; extremely hard, very firm; shiny faces on peds that are tilted more than 10 degrees from the horizontal; numerous vertical cracks; few black concretions; calcareous; moderately alkaline; clear, wavy boundary.

A12—16 to 44 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, medium, angular blocky structure; extremely hard, very firm; shiny faces on peds that are tilted more than 10 degrees from the horizontal; intersecting slickensides in the lower part; many vertical cracks; few calcium carbonate concretions; few, weakly cemented, black concretions; calcareous; moderately alkaline; gradual, wavy boundary.

AC—44 to 60 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; extremely hard, very firm; dark-gray streaks in filled cracks; intersecting slickensides; few calcium carbonate concretions; few, weakly cemented, black concretions; calcareous; moderately alkaline; clear, wavy boundary.

The solum ranges from 60 inches to more than 100 inches in thickness. The A horizon is 12 to 60 inches thick and is gray, dark gray, or very dark gray. This horizon is thinnest on the ridges and thickest in the basins. In some places 25 to 100 percent of the surface is covered with gravel, and the surface layer to a depth of 20 inches is as much as 35 percent gravel. The AC horizon is grayish brown, dark gray, olive, or yellow and is mottled in shades of yellow, brown, or gray. This horizon is as much as 10 percent, by volume, concretions and soft masses of calcium carbonate.

**Houston Black clay, 1 to 3 percent slopes** (HoB).—This gently sloping soil is on smooth uplands. Areas are irregular in shape and are 30 to 125 acres in size. The surface is dissected by gullies 10 to 20 feet wide and 200 feet apart. This soil has the profile described as representative of the series.

Included with this soil in mapping are small spots of Burleson and Heiden soils that make up less than 10 percent of any mapped area. Also included are a few areas of Houston Black soils that have slopes of less than 1 percent.

This soil is used mostly for crops, and it is well suited to all crops commonly grown in the county. A few areas are in improved pasture. Runoff is slow, and the hazard of erosion is slight. Capability unit IIe–1; pasture and hay group 7A; Blackland range site.

**Houston Black clay, 3 to 5 percent slopes, eroded** (HoC2).—This gently undulating soil is in areas 30 to 120 acres in size. The shape of these areas is not uniform.

The surface layer is dark-gray calcareous clay about 14 inches thick. The next layer is grayish-brown calcareous clay about 25 inches thick. Below this is dark-gray calcareous clay that has grayish-brown mottles.

Included with this soil in mapping are small areas of Heiden clay and areas of soils that have no gullies. Included areas make up less than 15 percent of any mapped area.

This soil is used mostly for crops, and it is suited to all crops commonly grown in the county. A few areas are in improved pasture. Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–3; pasture and hay group 7A; Blackland range site.

**Houston Black gravelly clay, 3 to 8 percent slopes** (HpD).—This undulating soil is on uplands in areas 30 to 100 acres in size. The shape of these areas is not uniform.

The surface layer is about 18 inches of very dark gray gravelly clay that is about 30 percent chert gravel (fig. 11). The next layer is dark-brown calcareous clay about 12 inches thick. Below this is grayish-brown calcareous clay that has yellowish-brown mottles and a few soft masses of calcium carbonate.

Included with this soil in mapping are a few areas of Houston Black soils that have slopes of less than 3 percent and areas of soils that have no gravelly surface layer. Included areas make up less than 20 percent of any mapped area.

This soil is mostly in pasture or range. The gravelly

*Figure 11.*—Area of Houston Black gravelly clay.

surface layer makes cultivation difficult. Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–2; pasture and hay group 7B; Blackland range site.

## Jedd Series

The Jedd series consists of moderately deep, sloping to moderately steep soils on uplands. These soils formed in weakly consolidated sandstone.

In a representative profile the surface layer is about 12 inches of brown gravelly sandy loam that is about 40 percent, by volume, pebbles. About 50 percent of the surface is covered with sandstone stones. The next layer is about 5 inches of light-brown very gravelly sandy loam that is about 60 percent, by volume, sandstone pebbles. Below this is red strongly acid clay about 11 inches thick. The underlying material is reddish-yellow, very strongly acid, weakly cemented sandstone.

Jedd soils are well drained. Permeability is moderately slow, and available water capacity is very low.

These soils are used mostly as range. A few areas are in improved pasture.

Representative profile of Jedd gravelly sandy loam in an area of Jedd stony soils, 5 to 20 percent slopes, about 4 miles east of Luling on Farm Road 1322 from its junction with U.S. Highway 183, then 3 miles southeast on a county road to its junction with another county road and railroad, in a wooded pasture:

A1—0 to 12 inches, brown (7.5YR 5/4) gravelly sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; slightly hard, very friable; common fine roots; about 40 percent, by volume, angular sandstone pebbles; 50 percent of the surface covered with sandstone stones; slightly acid; abrupt, smooth boundary.

A2—12 to 17 inches, light-brown (7.5YR 6/4) very gravelly sandy loam, light brown (7.5YR 6/4) moist, weak, granular structure; slightly hard, very friable; common fine roots; about 60 percent, by volume, angular sandstone pebbles; slightly acid; abrupt, wavy boundary.

B2t—17 to 28 inches, red (2.5YR 5/8) clay, red (2.5YR 4/8) moist; few, fine, distinct mottles of yellowish brown (10YR 5/8) and a few, fine, faint mottles of yellowish red (5YR 5/8); moderate, medium, subangular blocky structure; very hard, firm; common fine roots; patchy clay films; few sandstone fragments; strongly acid; abrupt, wavy boundary.

C—28 to 60 inches, reddish-yellow (5YR 6/8) weakly cemented sandstone and strata of brownish-yellow (10YR 6/8) fine sandy loam; very strongly acid.

The A horizon ranges from 30 to 80 percent, by volume, coarse fragments. The A1 horizon is 3 to 12 inches thick and is brown or pale brown. It ranges from fine sandy loam or sandy loam to loamy sand and is neutral or slightly acid. This horizon is gravelly, very gravelly, cobbly, or very cobbly in places. The A2 horizon is 3 to 8 inches thick and is light brown, brown, or light yellowish brown. This horizon ranges from fine sandy loam to loamy fine sand and is neutral or slightly acid.

The B2t horizon is 6 to 16 inches thick. This horizon is red or yellowish red and has a few red and yellow mottles in places. It ranges from clay to sandy clay, is gravelly or cobbly in places, and is medium acid or strongly acid.

The C horizon is 20 to 40 inches of weakly consolidated to strongly cemented sandstone and is reddish yellow or light reddish brown. This horizon has a few pockets and strata of fine sandy loam, loamy fine sand, and sandy clay loam.

**Jedd stony soils, 5 to 20 percent slopes** (JsF).—These sloping to moderately steep soils are on uplands in areas 25 to 100 feet higher than soils in surrounding areas. Most areas are oval in shape and are 10 to 300 acres in size. Soil patterns are not uniform. The surface layer is variable. It ranges from gravelly, very gravelly, cobbly, or very cobbly loamy sand to fine sandy loam or sandy loam and is about 50 percent stones.

Included with these soils in mapping are small areas of Rosanky soils. Also included are areas of soils that have a surface layer more than 20 inches thick and areas in which the layer above the underlying material is more than 40 inches thick. Included areas make up less than 20 percent of any mapped area.

These soils are mostly in range. They are too stony and steep for crops. A few small areas are in improved pasture. Runoff is rapid, and the hazard of erosion is slight. Capability unit VIe–3; pasture and hay group 8D; Sandstone Hills range site.

## Lewisville Series

The Lewisville series consists of deep, nearly level to gently sloping soils on old terraces. These soils formed in calcareous clayey and loamy alluvium.

In a representative profile the surface layer is very dark grayish-brown calcareous silty clay about 12 inches thick. The next layer is dark yellowish-brown calcareous silty clay about 12 inches thick over yellowish-brown calcareous silty clay loam about 18 inches thick. Below this is very pale brown calcareous clay loam that has soft masses and concretions of calcium carbonate.

Lewisville soils are well drained. Permeability is moderate, and available water capacity is high.

These soils are used mostly for crops. A few areas are in improved pasture.

Representative profile of Lewisville silty clay, 0 to 1 percent slopes, 1 mile northeast of the school in Maxwell on a county road, then 1.4 miles northwest on another county road, then 1,000 feet northeast of the road, in a cultivated field:

Ap—0 to 4 inches, very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; strong, granular structure; hard, friable; few calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—4 to 12 inches, very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; strong, granular structure; hard, friable; dark-brown (7.5YR 4/2) streaks in filled cracks and worm channels; calcareous; moderately alkaline; gradual, smooth boundary.

B21—12 to 24 inches, dark yellowish-brown (10YR 4/4) silty clay, dark yellowish brown (7.5YR 3/4) moist; strong, granular structure; hard, friable; yellowish-brown (10YR 5/4) material in worm channels; calcareous; moderately alkaline; clear, smooth boundary.

B22—24 to 42 inches, yellowish-brown (10YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) moist; strong, granular structure; hard, friable; yellowish-brown (10YR 5/4) material in worm channels; calcareous; moderately alkaline; clear, smooth boundary.

B3ca—42 to 60 inches, very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; strong, granular structure; hard, friable; about 40 percent, by volume, soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon is 8 to 20 inches thick and is dark grayish

brown and very dark grayish brown. The B horizon is 22 to 50 inches thick and is very pale brown, brown, dark yellowish brown, yellowish brown, or light yellowish brown. This horizon ranges from silty clay to clay loam and from a few to 20 percent, by volume, calcium carbonate concretions.

**Lewisville silty clay, 0 to 1 percent slopes** (LeA).—This nearly level soil is on broad terraces. Areas are irregular in shape and range from 30 to 200 acres in size, but they are dominantly about 75 acres. This soil has the profile described as representative of the series.

Included with this soil in mapping are areas of soils that have a dark surface layer more than 20 inches thick and areas that are less than 35 percent clay. These soils make up less than 30 percent of any mapped area.

This soil is suited to all crops commonly grown in the county, and most areas are cultivated. A few small areas are in improved pasture or small grain and are used for grazing. Runoff is slow, and the hazard of erosion is slight. Capability unit I–1; pasture and hay group 7C; Clay Loam range site.

**Lewisville silty clay, 1 to 3 percent slopes** (LeB).—This gently sloping soil is on terraces in long, narrow areas 10 to 110 acres in size.

The surface layer is dark grayish-brown calcareous silty clay about 16 inches thick. The next layer is yellowish-brown calcareous silty clay about 13 inches thick. Below this is about 14 inches of light yellowish-brown silty clay that is about 10 percent, by volume, strongly cemented masses of calcium carbonate. The next layer is light yellowish-brown clay loam that is about 20 percent, by volume, soft masses of calcium carbonate.

Included with this soil in mapping are small areas of Seawillow soils and areas of soils that have a dark surface layer more than 20 inches thick. Included soils make up less than 30 percent of any mapped area.

This soil is well suited to all crops commonly grown in the county, and most areas are cultivated. Runoff is medium, and the hazard of erosion is moderate. Capability unit IIe–3; pasture and hay group 7C; Clay Loam range site.

**Lewisville silty clay, 3 to 5 percent slopes, eroded** (LeC2).—This gently sloping soil is on terraces in long, narrow areas 10 to 100 acres in size. Gullies 1 foot to 3 feet deep and 15 to 30 feet wide dissect the surface at intervals of 200 feet.

Between the gullies, the surface layer is dark grayish-brown calcareous silty clay about 16 inches thick. The next layer is about 20 inches of brown calcareous silty clay that has a few calcium carbonate concretions. Below this is brown silty clay that is about 20 percent, by volume, soft masses and concretions of calcium carbonate.

Included with this soil in mapping are spots of eroded soils that have a light-colored surface layer. Also included are small areas of soils that are similar to Lewisville soil, except that they are less than 35 percent clay. Included soils make up less than 30 percent of any mapped areas.

This soil is used for crops and as improved pasture. It is suited to all crops commonly grown in the county. Runoff is medium, and the hazard of erosion is moderate. Capability unit IIIe–5; pasture and hay group 7C; Clay Loam range site.

## Mabank Series

The Mabank series consists of deep, nearly level to gently sloping soils on uplands. These soils formed in shaly clay.

In a representative profile the surface layer is grayish-brown loam about 7 inches thick. Below this is very dark gray clay loam about 7 inches thick over about 9 inches of dark-gray clay that has a few reddish-brown mottles. The next layer is gray clay about 16 inches thick that has material from the surface in filled cracks. Below this is about 37 inches of grayish-brown and pale-brown sandy clay that has a few yellowish-brown mottles and soft masses of calcium carbonate. The underlying material is pale-brown shaly clay that has many yellowish-brown mottles.

Mabank soils are somewhat poorly drained. Permeability is very slow, and available water capacity is medium.

These soils are in crops, improved pasture, and brushy range.

Representative profile of Mabank loam, 0 to 1 percent slopes, 2.2 miles south on Texas Highway 304 from its intersection with Farm Road 713 in Delhi, then 1,300 feet west of the highway, in a pasture:

A1—0 to 7 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; massive when dry, crushed in the hand breaks to weak, granular structure when moist; hard, friable; slightly acid; abrupt, wavy boundary.

B21tg—7 to 14 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; weak, coarse, blocky structure; very hard, firm; streaks of material from the surface in filled cracks; slightly acid; abrupt, wavy boundary.

B22tg—14 to 23 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few, fine, faint, reddish-brown (5YR 5/3) mottles in the lower part; strong, coarse, blocky structure; extremely hard, very firm; vertical streaks of grayish-brown (10YR 5/2) fine sandy loam material in filled cracks; few small slickensides; neutral; gradual, smooth boundary.

B23tg—23 to 39 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, coarse, blocky structure; very hard, firm; material from the surface in thin vertical cracks; neutral; gradual, smooth boundary.

B31t—39 to 65 inches, grayish-brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky stucture; hard, firm; material from the surface in thin vertical cracks; few soft masses of calcium carbonate; mildly alkaline; clear, smooth boundary.

B32t—65 to 76 inches, pale-brown (10YR 6/3) sandy clay, brown (10YR 5/3) moist; few, fine, yellowish-brown (10YR 5/6) mottles; hard, firm; about 5 percent soft masses of calcium carbonate; few black concretions; mildly alkaline; abrupt, smooth boundary.

C—76 to 84 inches, pale-brown (10YR 6/3) shaly clay, brown (10YR 5/3) moist; many, coarse, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm; few soft masses of calcium carbonate; mildly alkaline.

The A horizon is 4 to 10 inches thick. It is very dark gray or grayish brown and is neutral or slightly acid.

The B2 horizon is very dark gray, gray, light gray, brownish gray, or dark gray. It ranges from clay loam to clay and from slightly acid to mildly alkaline. In most profiles, some part of this horizon has fine yellowish-brown and reddish-brown mottles.

The B3 horizon is grayish brown, pale brown, light

brownish gray, light gray, pale olive, or yellowish brown. It is mottled in shades of gray, yellow, or brown. This horizon from place to place contains different amounts of calcium carbonate, gypsum, and black concretions, and in many places it is calcareous.

The C horizon ranges from sandy loam to shaly clay and has gray, yellow, and brown mottles.

**Mabank loam, 0 to 1 percent slopes** (MaA).—This nearly level soil is on broad uplands in oval areas 10 to 40 acres in size. It has the profile described as representative of the series.

Included with this soil in mapping are areas of Burleson, Crockett, and Wilson soils that make up less than 10 percent of any mapped area. Also included are areas of Mabank soils that have a surface layer of fine sandy loam and make up about 40 percent of the total mapped acreage. Areas of soils that are similar to Mabank soils but have a surface layer more than 20 inches thick are also included.

This soil is in improved pasture, cultivated crops, and range. It is suitable for crops if careful management is used to maintain soil tilth. It is well suited to improved pasture. Runoff is slow, and the hazard of erosion is slight. A perched water table is in the lower part of the surface layer in places after heavy rains. Capability unit IIIw–1; pasture and hay group 8A; Claypan Prairie range site.

**Mabank loam, 1 to 3 percent slopes** (MaB).—This gently sloping soil is on smooth uplands. Areas are irregular in shape and are 20 to 80 acres in size. The surface is convex on ridges and concave along drainageways.

The surface layer is dark grayish-brown, slightly acid loam about 6 inches thick. Below this is very dark gray, slightly acid clay about 18 inches thick. The next layer is dark-gray, mildly alkaline clay about 22 inches thick. Below this is about 36 inches of grayish-brown, mildly alkaline sandy clay that has a few calcium carbonate concretions. The next layer is pale-brown shaly clay that has a few yellowish-brown mottles.

Included with this soil in mapping are small areas of Burleson, Crockett, Heiden, and Wilson soils that make up less than 10 percent of any mapped area. Also included are areas of soils that have a surface layer of fine sandy loam and make up about 30 percent of the mapped areas.

This soil is in improved pasture, cultivated crops, and range. Runoff is medium, and the hazard of erosion is slight. Capability unit IIIe–1; pasture and hay group 8A; Claypan Prairie range site.

## Menard Variant

The Menard variant consists of deep, gently sloping soils on old terraces. These soils formed in gravelly calcareous alluvium.

In a representative profile the surface layer is dark-brown loam about 6 inches thick. The next layer is about 18 inches of reddish-brown sandy clay loam that is 15 percent, by volume, limestone gravel. The underlying material is light yellowish-brown loamy fine sand and soft limy earth that is 60 to 80 percent, by volume, round limestone and siliceous gravel.

Menard soils are well drained. Permeability is moderate, and available water capacity is medium.

These soils are used mostly as pasture and range. A few areas are cultivated.

Representative profile of Menard loam, thin solum variant, 1 to 5 percent slopes, 1.2 miles east on U.S. Highway 80 from its intersection with Farm Road 671 in Stairtown, then 0.5 mile south on a private road, in a gravel pit:

A1—0 to 6 inches, dark-brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, coarse, blocky structure parting to weak granular structure; very hard, firm; many fine roots; few, round, limestone and siliceous gravel; calcareous; moderately alkaline; diffuse, smooth boundary.

B2t—6 to 24 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; few, coarse, yellowish-red (5YR 4/8) mottles in the lower part; moderate, medium, subangular blocky structure; very hard, firm; 15 percent, by volume, round limestone and siliceous gravel less than 3 inches in diameter; many grass roots that penetrate peds; surface material in many pores and channels; calcareous; moderately alkaline; clear, smooth boundary.

IICca—24 to 120 inches, light yellowish-brown (10YR 6/4) very gravelly loamy fine sand and soft limy earth; yellowish brown (10YR 5/4) moist; massive; about 60 to 80 percent, by volume, round limestone and siliceous gravel; calcareous; moderately alkaline.

The A horizon is 6 to 8 inches thick and is dark brown or very dark brown. The Bt horizon is 13 to 28 inches thick and is dark red or reddish brown. This horizon ranges from clay loam to sandy clay loam, and it is gravelly in places (fig. 12).

These soils are variants of the Menard series in that common to many pebbles are in the B horizon; the solum ranges from 19 to 36 inches in thickness, but more than 50 percent are less than the minimum 30 inches thick; and loamy skeletal calcic horizons are in the upper boundary at a depth of less than 36 inches.

**Menard loam, thin solum variant, 1 to 5 percent**

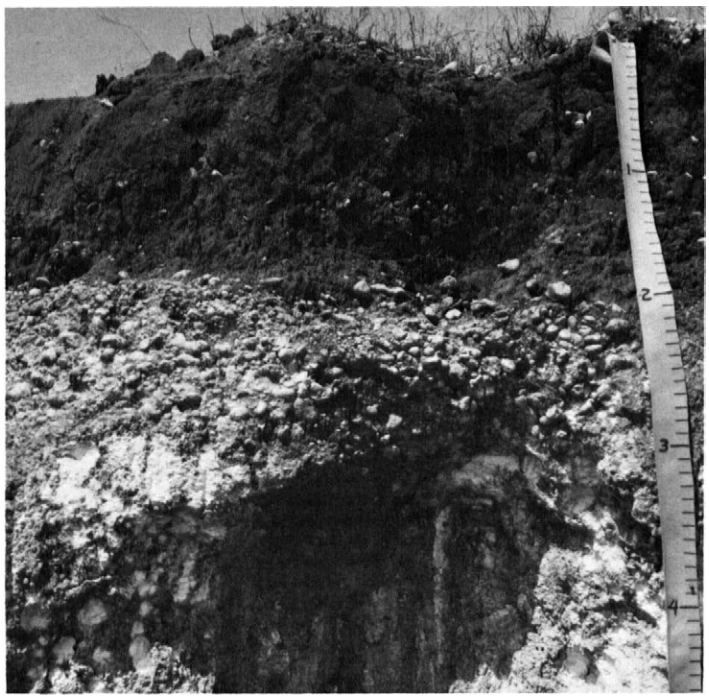

*Figure 12.*—**Profile of Menard loam, thin solum variant, 1 to 5 percent slopes, showing gravelly substratum.**

**slopes** (MeC).—This gently sloping soil is on terraces in oval areas 50 to 200 acres in size.

Included with this soil in mapping are areas of Mabank soils in depressional areas and Queeny soils on narrow escarpments. These soils make up less than 15 percent of any mapped area. Areas of soils that have a light-colored surface layer are also included.

This soil is used mostly as pasture and range. Most of the acreage has been cultivated. A few areas are in improved pasture. Runoff is medium, and the hazard of erosion is moderate. The gravelly substratum is a good source of roadbuilding material. Capability unit IVe–4; pasture and hay group 8C; Sandy Loam range site.

## Patilo Series

The Patilo series consists of deep, gently sloping and undulating soils on uplands. These soils formed in acid sandy material.

In a representative profile the surface layer is light brownish-gray fine sand about 13 inches thick. Below this is very pale brown fine sand about 37 inches thick. The next layer is mottled yellowish-brown and red sandy clay loam about 9 inches thick over mottled red and pinkish-gray, strongly acid sandy clay about 6 inches thick. Below this is mottled yellowish-red and strong-brown, strongly acid fine sandy loam.

Patilo soils are moderately well drained. Permeability is moderately slow, and available water capacity is low.

These soils are used mostly as range. A few areas are in improved pasture, and some small areas are cultivated.

Representative profile of Patilo fine sand, 1 to 8 percent slopes, 4.1 miles south on Farm Road 3158 from its intersection with Farm Road 713 in McMahan, then 1 mile south on a county road, then 2.9 miles southeast on another county road, then 1,200 feet west of the road, in a pasture:

A1—0 to 13 inches, light brownish-gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; single grained; loose; many roots; neutral; clear, smooth boundary.

A2—13 to 50 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; many roots; neutral; abrupt, wavy boundary.

B21t—50 to 59 inches, mixed mottled yellowish-brown (10YR 5/6) and red (2.5YR 4/8) sandy clay loam; few, fine, grayish-brown (10YR 5/2) mottles; moderate, medium, subangular blocky structure; very hard, firm; many roots; many distinct clay films; few, fine, sandstone fragments; strongly acid; abrupt, smooth boundary.

B22t—59 to 65 inches, mixed mottled red (2.5YR 4/6) and pinkish-gray (5YR 6/2) sandy clay; strong, medium, subangular blocky structure; very hard, firm; few roots; common distinct clay films; strongly acid; abrupt, smooth boundary.

B3t—65 to 74 inches, mixed mottled yellowish-red (5YR 4/8) and strong-brown (7.5YR 5/8) fine sandy loam; moderate, fine, subangular blocky structure; hard, friable; few roots; clay films between cleavage planes; few black concretions; strongly acid.

The A1 horizon is 13 to 48 inches thick and is very pale brown or light brownish gray. It ranges from fine sand to loamy fine sand. The A2 horizon is 8 to 40 inches thick and is brown or very pale brown. It ranges from fine sand to loamy fine sand. The Bt horizon is mottled in shades of brown, red, yellow, or gray. It is 19 to 35 percent clay.

**Patilo fine sand, 1 to 8 percent slopes** (PaD).—This gently sloping and undulating sandy soil is on uplands in oval areas 100 to 400 acres in size.

Included with this soil in mapping are small areas of Arenosa, Demona, and Silstid soils. Also included are small areas of Jedd soils on round knolls and areas of soils that are similar to Patilo soils, except that they have a slightly thinner surface layer. Included areas make up less than 30 percent of any mapped acreage.

This soil is mostly in range. A few areas are in improved pasture, and a few small areas are cultivated and are mainly in truck crops. Capability unit IIIe–7; pasture and hay group 9B; Deep Sand range site.

## Queeny Series

The Queeny series consists of very shallow to shallow, gently sloping to moderately steep soils on terraces. These soils formed in gravelly alluvium.

In a representative profile the surface layer is about 7 inches of very dark grayish brown gravelly loam that is 25 percent, by volume, small rounded limestone and siliceous gravel. The underlying material is a gravel bed that reaches to a depth of 72 inches. It is strongly cemented and has calcium carbonate in the upper 4 inches. In the lower part it is 80 percent limestone gravel ¼ inch to 3 inches in diameter and thin interbedded layers of brownish-yellow and grayish limestone sand.

Queeny soils are well drained. Permeability is moderate, and available water capacity is very low.

These soils are used mainly as native pasture, but a few areas are cultivated. They are a good source of gravel.

Representative profile of Queeny gravelly loam, 1 to 5 percent slopes, 0.6 mile south on Farm Road 1322 from its intersection with Farm Road 20 in Lockhart, then 1.5 miles southeast on a county (Seawillow) road, then 200 feet east of the road, in a gravel pit:

A1—0 to 7 inches, very dark grayish brown (10YR 3/2) gravelly loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, granular structure; hard, friable; many fine roots; about 25 percent, by volume, rounded limestone and siliceous gravel ¼ inch to 2 inches in diameter; few angular fragments of calcium carbonate; few earthworm casts on surface; calcareous; moderately alkaline; abrupt, wavy boundary.

IICcam—7 to 72 inches, gravel bed that is strongly cemented by calcium carbonate in the upper 4 inches; few fine roots in crevices; approximately 80 percent, by volume, round limestone gravel ¼ inch to 3 inches in diameter; thin interbedded layers of brownish-yellow and grayish limestone sand; very dark grayish brown loam from above horizon in a few crevices; soft masses of powdery calcium carbonate 1 inch to several feet in diameter; boulder-size gravelly conglomerate scattered throughout.

The A horizon is 5 to 12 inches thick. It is very dark grayish brown, grayish brown, or dark brown and ranges from 15 to 25 percent gravel. The IICcam horizon ranges from 8 feet to more than 15 feet in thickness and from 50 to 80 percent gravel, by volume.

**Queeny gravelly loam, 1 to 5 percent slopes** (QuC).—This gently sloping soil is on ancient terrace ridges.

Most areas are long and narrow or oval in shape and are 15 to 40 acres in size. This soil has the profile described as representative of the series.

Included with this soil in mapping in some areas are small spots of Lewisville, Menard, and Seawillow soils and areas of Queeny soils that have slopes of less than 1 percent. Included areas make up less than 15 percent of any mapped area.

This soil is used mainly as pasture. A few small areas are used for crops. The gravel from several gravel pits on this soil is used for roadbuilding. Runoff is medium, and the hazard of erosion is slight. Capability unit IVs–1; pasture and hay group 14A; Chalky Ridge range site.

**Queeny gravelly loam, 5 to 20 percent slopes** (QuF).—This sloping to moderately steep soil is on ancient terrace escarpments. Areas are long and narrow or are irregular in shape and are 10 to 50 acres in size.

The surface layer is about 5 inches of dark grayish-brown loam that is about 25 percent limestone and siliceous gravel as much as 3 inches in diameter. The underlying material is a bed of limestone and siliceous gravel that is cemented with calcium carbonate in the upper part. It is about 80 percent gravel and is stratified with thin layers of fine sand and limy material.

Included with this soil in mapping are areas of Heiden, Lewisville, Menard, and Seawillow soils and areas of soils that have a light-colored surface layer. In places thick beds of conglomerate as much as 6 feet in diameter are exposed on the surface. Included areas make up less than 45 percent of the total mapped acreage, and less than 15 percent of a mapped area is a given included soil.

This soil is used only as pasture and range. Steep slopes and the thin surface layer make it unsuitable for cultivated crops. Runoff is rapid, and the hazard of erosion is moderate. Capability unit VIs–2; pasture and hay group 14A; Chalky Ridge range site.

## Rosanky Series

The Rosanky series consists of deep, gently sloping to sloping and undulating soils on uplands. These soils formed in acid sandstone.

In a representative profile the surface layer is about 9 inches of pale-brown loamy fine sand and broken sandstone fragments. Below this is about 9 inches of brownish-yellow loamy fine sand and broken sandstone fragments. The next layer is red, strongly acid clay and sandy clay loam about 26 inches thick. Below this is yellowish-red, medium acid fine sandy loam about 17 inches thick that has many reddish-yellow mottles. The underlying material is mixed, mottled yellow, reddish-yellow, and strong-brown fine sandy loam about 7 inches thick over gray and yellowish-brown, stratified, weakly consolidated sandstone.

Rosanky soils are well drained. Permeability is moderately slow, and available water capacity is medium.

These soils are used mostly as range, but a few areas are cultivated.

Representative profile of Rosanky loamy fine sand, 1 to 8 percent slopes, about 5 miles northeast of Luling on Farm Road 1322, then 4 miles east on Farm Road 1386, then 600 feet south of the road, in a pasture:

A1—0 to 9 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak, granular and subangular blocky structure; slightly hard, very friable; many roots; about 20 percent, by volume, broken sandstone fragments; slightly acid; abrupt, smooth boundary.

A2—9 to 18 inches, brownish-yellow (10YR 6/6) loamy fine sand, yellowish brown (10YR 5/6) moist; single grained; loose; about 15 percent, by volume, broken sandstone fragments; slightly acid; abrupt, smooth boundary.

B21t—18 to 34 inches, red (2.5YR 5/8) clay, red (2.5YR 4/8) moist; strong, medium, blocky structure; very hard, firm; thin, yellowish-brown, discontinuous strata in the lower part; few fragments of broken sandstone; strongly acid; clear, smooth boundary.

B22t—34 to 44 inches, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; thin yellowish-brown (10YR 5/6) lenses; few, fine, red (2.5YR 4/6) mottles in the lower part; moderate, medium, subangular blocky structure; very hard, friable; few roots; few fragments of shaly sandstone; clay films along cleavage planes; strongly acid; gradual, smooth boundary.

B3—44 to 61 inches, yellowish-red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; many, coarse, reddish-yellow (7.5YR 6/8) mottles that increase as depth increases; moderate, medium, subangular blocky structure; hard, friable; few roots; medium acid; clear, smooth boundary.

C1—61 to 68 inches, mixed mottled yellow (10YR 7/6), reddish-yellow (7.5YR 7/8), and strong-brown (7.5YR 5/6) fine sandy loam; massive; hard, friable; medium acid; abrupt, wavy boundary.

C2—68 to 74 inches, gray and yellowish-brown (10YR 5/6) stratified weakly consolidated sandstone; very hard and brittle, very firm; medium acid.

The A1 horizon is 8 to 18 inches thick and is pale brown or dark brown. It ranges from a few to 25 percent, by volume, broken sandstone fragments and is neutral or slightly acid. The A2 horizon is 4 to 10 inches thick and is brownish yellow, brown, or light brown. It ranges from a few to 25 percent, by volume, broken sandstone fragments and is neutral or slightly acid.

The B2t horizon is 22 to 54 inches thick and is red or yellowish red. It is medium acid or strongly acid. This horizon has yellowish-brown mottles in places, and in the upper part it ranges from clay to sandy clay. The B3 horizon is yellowish red or yellowish brown and has mottles in shades of red, yellow, or brown. It ranges from sandy clay loam to fine sandy loam and is medium acid or strongly acid.

The C horizon is gray, yellowish brown, yellow, red, or strong brown and has mottles in shades of brown, red, yellow, or gray. It is made up of strata of sandy clay loam, fine sandy loam, and loamy fine sand and ranges from slightly acid to strongly acid.

**Rosanky loamy fine sand, 1 to 8 percent slopes** (RoD).—This gently sloping to sloping and undulating soil is on uplands in oval areas 30 to 200 acres in size.

Included with this soil in mapping are small areas of Chaney and Jedd soils. Also included are areas of soils that are similar to Rosanky soil, except that some have a surface layer less than 5 inches thick and others have a surface layer more than 20 inches thick. Included areas make up less than 30 percent of any mapped area.

This soil is well suited to improved pasture. Most areas are in range, and a few areas are cultivated. Many formerly cultivated areas have been planted to improved pasture. Runoff is medium, and the hazard of erosion is moderate. Capability unit IVe–4; pasture and hay group 9A; Sandy Loam range site.

## Seawillow Series

The Seawillow series consists of deep, gently sloping to sloping soils on terraces. These soils formed in calcareous loamy alluvium.

In a representative profile the surface layer is grayish-brown calcareous clay loam about 7 inches thick. The next layer is about 15 inches of light yellowish-brown calcareous clay loam that is 20 percent soft masses and concretions of calcium carbonate. The underlying material is very pale brown calcareous loam that is about 30 percent soft masses and concretions of calcium carbonate.

Seawillow soils are well drained. Permeability is moderate, and available water capacity is medium.

These soils are used mostly as pasture, and a few areas are used as range.

Representative profile of Seawillow clay loam, 3 to 8 percent slopes, eroded, 1.2 mile south on Farm Road 1322 from its intersection with Farm Road 20 in Lockhart, then 2.4 miles southeast on a county (Seawillow) road, then 100 feet west of the road, in a pasture:

A1—0 to 7 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate, fine, granular structure; hard, friable; many fine roots; many worm casts; about 35 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear, wavy boundary.

B2ca—7 to 22 inches, light yellowish-brown (10YR 6/4) clay loam, yellowish brown (10YR 5/4) moist; moderate, fine, granular structure; hard, friable; common fine roots; 20 percent, by volume, soft masses and concretions of calcium carbonate; about 40 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual, smooth boundary.

Cca—22 to 54 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; weak, fine, granular structure in the upper few inches and massive in the lower part; hard, friable; 30 percent soft masses and concretions of calcium carbonate; about 50 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The A horizon is 6 to 8 inches thick and is grayish brown, brown, or yellowish brown. The B horizon is 11 to 18 inches thick and is brown, light yellowish brown, or brownish yellow. It is as much as 20 percent soft masses and concretions of calcium carbonate. The Cca horizon is brown, yellowish brown, or very pale brown. This horizon ranges from silty clay loam to loam and from 40 to 70 percent calcium carbonate equivalent.

**Seawillow clay loam, 1 to 3 percent slopes** (SeB).—This gently sloping soil is on old terrace ridges. Areas are oval and are 10 to 25 acres in size.

The surface layer is brown, calcareous clay loam about 8 inches thick. The next layer is light yellowish-brown, calcareous clay loam about 12 inches thick. The underlying material is very pale brown, calcareous clay loam and is about 40 percent soft masses of calcium carbonate.

Included with this soil in mapping are areas of Lewisville soils. Also included are areas of soils that are similar to Seawillow soil, except that they have a dark-colored surface layer, and areas of soils that have a silty clay texture. Included areas make up less than 15 percent of any mapped area.

This soil is used mostly as pasture, but a few areas are cultivated. Runoff is medium, and the hazard of erosion is slight. Capability unit IIe–3; pasture and hay group 7C; Clay Loam range site.

**Seawillow clay loam, 3 to 8 percent slopes, eroded** (SeD2).—This gently sloping to sloping soil is on old bench terraces. Areas are long and narrow and are 10 to 35 acres in size. In most areas rills and shallow gullies dissect the surface at intervals of 200 to 500 feet. This soil has the profile described as representative of the series.

This soil is better suited to pasture than to most other uses. Most areas are in pasture, but a few small areas are cultivated. Runoff is medium, and the hazard of erosion is moderate. Capability unit IVe–3; pasture and hay group 7C; Clay Loam range site.

## Seguin Series

The Seguin series consists of deep, nearly level soils on bottom lands. These soils formed in loamy calcareous alluvium.

In a representative profile the surface layer is grayish-brown calcareous loam about 18 inches thick. Below this is about 25 inches of brown, calcareous friable loam that has threads of calcium carbonate. The next layer is very pale brown calcareous loam that extends to a depth of 84 inches.

Seguin soils are well drained. Permeability is moderate, and available water capacity is high.

These soils are used mostly for crops. A few areas are in improved pasture and pecan orchards.

Representative profile of Seguin loam, 1.25 miles southeast of Martindale on a county road, then 50 feet south of the road, in a cultivated field:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, granular structure; hard, friable; many broken snail shells; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 18 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, granular structure; hard, friable; many broken snail shells; calcareous; moderately alkaline; abrupt, smooth boundary.

B21—18 to 43 inches, brown (10YR 5/3) loam, brown (10YR 4/3) moist; strong, fine, granular and subangular blocky structure; hard, friable; many fine threads of calcium carbonate; few broken snail shells; calcareous; moderately alkaline; clear, smooth boundary.

B22—43 to 57 inches, very pale brown (10YR 7/4) loam; light yellowish brown (10YR 6/4) moist; strong, fine, granular structure; hard, friable; many threads and a few concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3—57 to 84 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; moderate, fine, granular structure; hard, friable; calcareous; moderately alkaline.

The A horizon is 10 to 18 inches thick and is brown or grayish brown. The B horizon is 40 inches to more than 60 inches thick. It is brown or very pale brown and ranges from loam to silty clay loam in texture. Calcium carbonate equivalent of the fine material ranges from 40 to 60 percent.

**Seguin loam** (Sg).—This nearly level soil is on low terraces, mostly along the San Marcos River. Areas are about 30 feet higher in elevation than the normal water level of the river, and they have no dominant shape. Slopes are less than 1 percent. Old sloughs dissect the surface and give a weakly undulating aspect to the topography. This soil is flooded as often as once every 4 or 5 years, but flooding lasts only a few hours.

Included with this soil in mapping are small areas of Bosque and Lewisville soils that make up less than 10 percent of any mapped area. Also included are soils that are similar to Seguin loam, except that some have a light-colored surface layer and others have a grayish-brown surface layer less than 7 inches thick. These included soils make up less than 30 percent of any mapped area.

This soil is used mostly for cultivated crops and for dual use as improved pasture and pecan orchards. Runoff is slow, and the hazard of erosion is slight. Capability unit I–1; pasture and hay group 2A; Loamy Bottomland range site.

## Silstid Series

The Silstid series consists of deep, gently sloping soils on uplands. These soils formed in sandy or loamy material.

In a representative profile the surface layer is pale-brown, slightly acid fine sand about 25 inches thick. Below this is very pale brown, slightly acid fine sand about 12 inches thick. The next layer is brownish-yellow and reddish-yellow, medium acid sandy clay loam about 15 inches thick that has many red mottles in the lower part. Below this is reddish-yellow, medium acid sandy clay loam that has many brown and red mottles.

Silstid soils are well drained. Permeability is moderate, and available water capacity is low.

These soils are used mostly as range. A few small areas are in cultivated crops or improved pasture.

Representative profile of Silstid fine sand, 1 to 5 percent slopes, 3.1 miles south on Texas Highway 304 from its intersection with Farm Road 713 in Delhi, then 0.5 mile south on a county road, then 1.5 miles in a northwesterly direction on another county road and 1.8 miles southeast of the road, in a wooded pasture:

A1—0 to 25 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; slightly acid; clear, smooth boundary.

A2—25 to 37 inches, very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) moist; single grained; loose; common fine roots; slightly acid; clear, smooth boundary.

B21t—37 to 42 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; few, fine, distinct, red (2.5YR 4/8) mottles; moderate, fine and medium, subangular blocky structure; very hard, friable; few fine roots; patchy clay films on vertical surfaces of peds; medium acid; clear, smooth boundary.

B22t—42 to 52 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; many, coarse, distinct, red (2.5YR 4/8) mottles; moderate, medium, subangular blocky structure; few fine roots; clay films on faces of peds; medium acid; gradual, wavy boundary.

B23t—52 to 84 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; many, medium, distinct, brown (10YR 5/3) and a few, fine, distinct, red (2.5YR 4/6) mottles; moderate, medium, granular and moderate, fine, subangular blocky structure; hard, friable; few roots; few grayish-brown (10YR 5/2) clay films; common white (10YR 8/2) pockets of loamy fine sand albic material in the lower part; medium acid.

The A horizon and the B horizon range from 60 inches to more than 80 inches in thickness. The A1 horizon is 6 to 30 inches thick. It is pale-brown or grayish-brown fine sand to loamy fine sand. The A2 horizon is 6 to 20 inches thick and is very pale brown or light brown. The Bt horizon is brownish yellow, reddish yellow, or strong brown and is mottled in shades of red, yellow, or brown. This horizon ranges from clay loam to fine sandy loam.

**Silstid fine sand, 1 to 5 percent slopes** (ShC).—This gently sloping soil is on uplands in long, narrow areas 50 to 200 acres in size.

Included with this soil in mapping are small areas of Demona and Patilo soils that make up less than 15 percent of any mapped area. Also included are areas of soils that are similar to Silstid soil, except that they have a surface layer less than 20 inches thick, and areas of soils that have gray mottles below the sandy surface layer. These areas make up less than 20 percent of any mapped area.

This soil is well suited to improved pasture. Most areas are used as range. A few areas are in improved pasture, and a few small areas are cultivated to truck crops. Runoff is slow, and the hazard of erosion is slight. Capability unit IIIe–6; pasture and hay group 9A; Sandy range site.

## Trinity Series

The Trinity series consists of deep, nearly level soils on bottom lands. These soils formed in calcareous, clayey, alluvial sediment.

In a representative profile the surface layer is dark-gray calcareous clay about 41 inches thick. Below this is dark grayish-brown calcareous clay.

Trinity soils are moderately well drained. Permeability is very slow, and available water capacity is high.

These soils are used for crops and as native pasture.

Representative profile of Trinity clay in an area of Trinity soils, frequently flooded, 1 mile east on Farm Road 672 from its intersection with U.S. Highway 183 in Lockhart, then 100 feet north of the road, in a field:

Ap—0 to 4 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; strong, fine, granular structure; very hard, firm; many fine roots; few broken snail shells; calcareous; moderately alkaline; abrupt, smooth boundary.

A11—4 to 41 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, blocky structure parting to fine, angular blocky; extremely hard, very firm; few fine roots; few, fine, broken shell fragments; shiny faces on peds; few small slickensides; calcareous; moderately alkaline; gradual, smooth boundary.

A12—41 to 60 inches, dark grayish-brown (2.5YR 4/3) clay, very dark grayish brown (2.5Y 3/2) moist; moderate, medium, subangular blocky structure; very hard, very firm; few concretions and fine threads of calcium carbonate; streaks of dark-gray (10YR 4/1) material in thin, filled cracks; many, weakly cemented, black concretions; calcareous; moderately alkaline.

The A horizon is 40 inches to more than 60 inches thick. It is dark gray, dark grayish brown, or black and ranges from clay to silty clay. In places stratification is at a depth of less than 10 inches.

**Trinity clay** (Tr).—This nearly level soil is on flood plains along local streams. Areas are long and narrow and are 10 to 300 acres in size. Slopes are less than 1 percent. Old sloughs dissect the surface in many places, and they carry floodwater annually in some places. This soil is slightly higher in elevation than

other Trinity soils and is flooded less frequently. It is flooded as often as once every year and as infrequently as once every 7 years.

The surface layer is dark-gray calcareous clay about 24 inches thick. The next layer is about 30 inches of dark-gray calcareous clay and has small slickensides and a few calcium carbonate concretions.

Included with this soil in mapping are small spots of Gowen and Houston Black soils and areas of Trinity clay, frequently flooded. Also included are areas of soils that are noncalcareous in the surface layer. Included soils make up less than 10 percent of any mapped area.

This soil is used mostly for crops and as improved pasture. It is well suited to all crops commonly grown in the county. Runoff is slow, and the hazard of erosion is slight. Some scouring occurs in places when the soil is flooded. Capability unit IIw–3; pasture and hay group 1A; Clayey Bottomland range site.

**Trinity soils, frequently flooded** (Ts).—These nearly level soils are on flood plains along local streams. Areas are long and narrow in shape. They are 100 feet to ½ mile wide and several miles long. Slopes are less than 1 percent. A Trinity clay in an area of these soils has the profile described as representative of the series. These soils are flooded several times each year, and constant scouring and deposition during flooding have caused surface alteration. Soil patterns are not uniform. The surface layer is clay or silty clay but there are included areas of clay loam and silt loam.

Included with these soils in mapping are small areas of Gowen soils and areas of soils similar to Trinity soils, except that they are noncalcareous. Included soils make up less than 15 percent of the mapped area.

These soils are used as pasture, and they are well suited to this use. A few areas are in pecan orchards. Runoff is slow, and the hazard of erosion is slight. Capability unit Vw–3; pasture and hay group 1A; Clayey Bottomland range site.

## Uhland Series

The Uhland series consists of deep, nearly level soils on bottom lands. These soils formed in loamy, alkaline, alluvial material.

In a representative profile the surface layer is grayish-brown clay loam about 6 inches thick. The next layer is about 16 inches of yellowish-brown fine sandy loam that has a few grayish-brown mottles. Below this is brown fine sandy loam that has a few yellowish-brown and grayish-brown mottles.

Uhland soils are somewhat poorly drained. A water table is within 20 inches of the surface during spring. Permeability is moderately slow, and available water capacity is medium.

These soils are used as pasture.

Representative profile of Uhland soils, frequently flooded, 6.4 miles northeast on Farm Road 1322, from its intersection with U.S. Highway 183 in Luling, then 3.5 miles east on a county road, then 3.5 miles northwest on another county road, then 75 feet south of the road, adjacent to Copperas Creek bottom, in a pasture:

A1—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; very hard, firm; many roots; few, fine, weakly cemented concretions of ferromanganese; mildly alkaline; abrupt, smooth boundary.

IIC1—6 to 22 inches, yellowish-brown (10YR 5/4) fine sandy loam, dark yellowish brown (10YR 4/4) moist; few, fine, grayish-brown (10YR 5/2) mottles; massive; slightly hard, friable; many fine roots; common fine bedding planes; few weakly cemented concretions of ferromanganese; mildly alkaline; clear, smooth boundary.

IIC2—22 to 60 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; few yellowish-brown (10YR 5/4) and grayish-brown (10YR 5/2) mottles; massive; slightly hard, very friable; common fine bedding planes; mildly alkaline.

The A horizon is brown or grayish brown. It ranges from clay loam to fine sandy loam and from slightly acid to moderately alkaline. The IIC horizon is yellowish brown or brown and has common yellow, gray, and brown mottles throughout. This horizon ranges from loam to fine sandy loam. In places it has alternating strata that range from sandy clay to loamy fine sand.

**Uhland soils, frequently flooded** (Us).—These nearly level soils are on narrow flood plains along local streams. Areas are 200 to 1,000 feet wide and are mostly several miles long. They range from 50 to 350 acres in size. Slopes are less than 1 percent. Mapped areas are not uniform. Some areas have a clay loam surface layer, and other areas have a fine sandy loam surface layer. These differences are due to scouring and deposition during flooding.

Included with these soils in mapping are small areas of Brazos and Gowen soils that make up less than 10 percent of any mapped area. Also included are areas of soils that have no gray mottles at a depth of less than 10 inches and areas of soils that have a loamy fine sand surface layer. These included areas are common near the head of streams and make up as much as 30 percent of the mapped area.

These soils are used as pasture. A few areas are in native pecan orchards. Runoff is slow, and the hazard of erosion is slight. These soils are frequently flooded during spring and occasionally flooded during other seasons. A water table is at a depth of less than 20 inches during spring. Capability unit Vw–1; pasture and hay group 2A; Loamy Bottomland range site.

## Wilson Series

The Wilson series consists of deep, gently undulating soils on uplands. These soils formed in shaly clay.

In a representative profile the surface layer is very dark gray gravelly loam about 15 inches thick. The next layer is dark-gray and gray clay about 29 inches thick. Below this is grayish-brown clay that has yellowish-brown mottles.

Wilson soils are somewhat poorly drained. Permeability is very slow, and available water capacity is high.

These soils are used mostly as pasture, but a few areas are cultivated.

Representative profile of Wilson gravelly loam, 1 to 5 percent slopes, about 10 miles north of Lockhart on U.S. Highway 183, then 2.3 miles east on Texas Highway 21, then 400 feet north of the highway, in a pasture:

A1—0 to 15 inches, very dark gray (10YR 3/1) gravelly loam, black (10YR 2/1) moist; moderate, medium,

subangular blocky structure; hard, friable; 30 percent gravel, 1 inch to 4 inches in size; neutral; abrupt, wavy boundary.

B21tg—15 to 36 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, medium, blocky structure; extremely hard, very firm; many roots; streaks of material from the surface in filled cracks; clay films on peds; mildly alkaline; gradual, wavy boundary.

B22tg—36 to 44 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, medium, subangular blocky structure; very hard, very firm; streaks of material from the surface in filled cracks; many black concretions; mildly alkaline; clear, smooth boundary.

B23t—44 to 60 inches, grayish-brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; many, medium, yellowish-brown (10YR 5/6) mottles; moderate, medium, subangular blocky structure; very hard, very firm; mildly alkaline.

The A horizon is 4 to 20 inches thick. It ranges from 15 to 40 percent gravel and is black, dark gray, very dark gray, or grayish brown. The B2t horizon is dark gray, gray, grayish brown, or very dark gray. It ranges from clay to clay loam and is neutral or mildly alkaline. In some places the lower part of this horizon has calcium carbonate concretions and yellowish-brown mottles. In other places this horizon has discontinuous strata of gravel, 1 inch to 4 inches in size.

**Wilson gravelly loam, 1 to 5 percent slopes** (WgC).—This gently undulating soil is on uplands. Areas are irregular in shape and are 50 to 300 acres in size.

Included with this soil in mapping are areas of Burleson, Houston Black, and Mabank soils that make up less than 20 percent of any mapped area. Also included are areas of soils that have a grayish-brown color at a depth of less than 10 inches and areas of Wilson soils that have slopes of less than 1 percent.

This soil is well suited to use as improved pasture. The gravelly surface restricts the use of implements for cultivation. Most areas are used as pasture, and a few areas are in improved pasture. Runoff is slow to medium, and the hazard of erosion is moderate. Capability unit IVe–1; pasture and hay group 7H; Claypan Prairie range site.

## *Use and Management of the Soils*

Major uses, limitations, and management needs of the soils of Caldwell County are discussed in this section. The system of capability grouping used by the Soil Conservation Service is explained, and the management of the soils by capability units is discussed. Predicted yields of the principal crops are given. The management of soils for pasture and hay, as range, and as wildlife habitat are discussed. The properties and features that affect engineering practices are given mainly in tables.

### Management of Cultivated Soils

General soil management practices that increase yields or maintain a high level of yield are needed on the cultivated soils of Caldwell County. Controlling erosion, conserving soil moisture, and maintaining soil tilth and fertility are the main objectives of good management.

The type and intensity of management needed depends upon the kind of soil and the kind of farming operation. A primary aid in managing soil is a good cropping system. A good cropping system is one that maintains or improves the physical condition of the soil; protects the soil during such critical periods as heavy rains, flooding, or drought; aids in the control of weeds, insects, and plant disease; and provides an adequate economic return.

A good cropping system consists of growing crops in a sequence or rotation in which soil-improving crops balance soil-depleting ones. Soil-improving crops are those such as grain sorghum and small grain that leave a large amount of residue. Cotton is a soil-depleting crop.

Crops in this county normally respond economically to some type of fertilization. The use of commercial fertilizers should be based on crop needs determined by soil tests. The amount and type of fertilizer needed vary according to the nature of the soil, the crop to be grown, the yield desired, the previous land use or cropping season, and the amount of available moisture.

#### *Capability grouping*

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, forest trees, or engineering.

In the capability system, all kinds of soils are grouped at three levels: the class, the subclass, and the unit. These 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, 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, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuitable for cultivation and limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use largely to pasture, range, woodland, or wildlife habitat (None in Caldwell County)

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or to use for esthetic purposes. (None in Caldwell County)

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 some parts of the United States but not in Caldwell County, shows that the chief limitation is climate that is too cold or too dry.

Class I has no subclasses because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in it are subject to little or no erosion. These soils have other limitations, however, that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreational purposes.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–3 or IIIe–5. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Caldwell County are described, and suggestions for the use and management of the soils are briefly discussed. The capability unit designations for all the soils in the county can be found in the "Guide to Mapping Units" at the back of this survey. All of the units in the system are not represented by the soils in Caldwell County; therefore, the numerals are not consecutive.

#### CAPABILITY UNIT I–1

This unit consists of deep, nearly level loams, clay loams, or silty clays. Permeability is moderate, and available water capacity is high. The hazard of erosion is slight.

Cotton, grain sorghum, small grain, and forage sorghum are the main crops. Maintaining or improving soil tilth and productivity are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue. Fertilizer is needed for good plant growth.

#### CAPABILITY UNIT IIe–1

This unit consists of deep, gently sloping clays and clay loams. Permeability is slow to very slow, and available water capacity is high. The hazard of erosion is slight to moderate.

Cotton, grain sorghum, small grain, and forage sorghum are the main crops. Maintaining or improving soil tilth, conserving moisture, and controlling erosion are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture. Grassed waterways and diversion terraces are needed to control runoff.

#### CAPABILITY UNIT IIe–2

Only Heiden-Wilson complex, 1 to 3 percent slopes, is in this unit. These deep, gently sloping soils have a loam to clay surface layer. Permeability is very slow, and available water capacity is high. The hazard of erosion is slight.

Most areas of these soils are cultivated. A few areas are in abandoned fields, improved pasture, or range. Forage sorghum, small grain, and grain sorghum are the main crops, but a small acreage is planted to cotton.

Controlling erosion, maintaining soil tilth, and conserving moisture are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue. Keeping the residue on the surface helps to reduce surface crusting and to improve tilth. Terracing and contour farming help to control erosion and conserve moisture. Grassed waterways and diversion terraces are needed to control runoff.

#### CAPABILITY UNIT IIe–3

This unit consists of deep, gently sloping silty clays to clay loams. Permeability is moderate, and available water capacity is medium to high. The hazard of erosion is moderate.

Cotton and grain sorghum are the main crops. Conserving moisture and controlling erosion are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture. Grassed waterways and diversion terraces are needed to control runoff.

#### CAPABILITY UNIT IIw–1

Gowen clay loam is the only soil in this unit. This deep, nearly level soil is on bottom lands. Permeability is moderate, and available water capacity is high. The hazard of erosion is slight.

Cotton, grain sorghum, small grain, and forage sorghum are the main crops. Maintaining or improving soil tilth and productivity are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue. Fertilizer is needed for good plant growth.

CAPABILITY UNIT IIw–2

This unit consists of deep, nearly level clays. Permeability is very slow, and available water capacity is high. The hazard of erosion is slight.

Cotton and grain sorghum are the main crops. Small acreages of forage sorghum and small grain are also grown. Maintaining or improving soil tilth and conserving moisture are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue.

CAPABILITY UNIT IIw–3

Trinity clay is the only soil in this unit. This nearly level soil is on bottom lands. Permeability is very slow, and available water capacity is high. The hazard of erosion is slight.

Cotton and grain sorghum are the main crops. Small acreages of forage sorghum and small grain are also grown. Maintaining or improving soil tilth and conserving soil moisture are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue.

CAPABILITY UNIT IIIe–1

Mabank loam, 1 to 3 percent slopes, is the only soil in this unit. This deep soil is very slowly permeable. Available water capacity is medium, and the hazard of erosion is slight.

Cotton and grain sorghum are the main crops. Small acreages of forage sorghum and small grain are also grown. Maintaining or improving soil tilth, conserving moisture, and controlling erosion are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture.

CAPABILITY UNIT IIIe–2

Houston Black gravelly clay, 3 to 8 percent slopes, is the only soil in this unit. This deep soil is very slowly permeable. Available water capacity is high, and the hazard of erosion is moderate.

Cotton and grain sorghum are the main crops. Small acreages of forage sorghum and small grain are also grown. Maintaining or improving soil tilth, conserving moisture, and controlling erosion are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture. Grassed waterways and diversion terraces help to control runoff.

CAPABILITY UNIT IIIe–3

This unit consists of deep, gently sloping and gently undulating clays and clay loams. Permeability is very slow, and available water capacity is high. The hazard of erosion is moderate.

Cotton and grain sorghum are the main crops. Small acreages of forage sorghum and small grain are also grown. Maintaining soil tilth, conserving moisture, and controlling erosion are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture.

CAPABILITY UNIT IIIe–4

Crockett fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. This deep, gently sloping soil is very slowly permeable. Available water capacity is high, and the hazard of erosion is slight.

Forage sorghum is the main crop, but a small acreage is planted to grain sorghum. Controlling erosion, conserving moisture, and maintaining soil tilth are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture. Grassed waterways and diversion terraces help to control runoff.

CAPABILITY UNIT IIIe–5

Lewisville silty clay, 3 to 5 percent slopes, eroded, is the only soil in this unit. This deep, gently sloping soil is moderately permeable. Available water capacity is medium to high, and the hazard of erosion is moderate.

Cotton and grain sorghum are the main crops. Small acreages of forage sorghum and small grain are also grown. Controlling erosion and conserving moisture are important where this soil is cultivated. Terracing and contour farming help to control erosion and conserve moisture.

CAPABILITY UNIT IIIe–6

This unit consists of deep, gently sloping fine sands and loamy fine sands. Permeability is moderate to slow, and available water capacity is low to medium. The hazard of erosion is slight.

Forage sorghum, peanuts, truck crops, and watermelon are the main crops, but a small acreage is planted to corn. Maintaining or improving fertility and conserving moisture are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue and one that has legumes grown in rotation. Fertilizer is needed for good plant growth.

CAPABILITY UNIT IIIe–7

Patilo fine sand, 1 to 8 percent slopes, is the only soil in this unit. This deep soil is gently sloping and undulating. Permeability is moderately slow, and available water capacity is low. The hazard of erosion is slight.

Peanuts, truck crops, and watermelon are the main crops, but a small acreage is planted to forage crops. Conserving moisture and maintaining fertility are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue. Fertilizer is needed for good plant growth.

CAPABILITY UNIT IIIw–1

Mabank loam, 0 to 1 percent slopes, is the only soil in this unit. This deep soil is nearly level. Permeability is very slow, and available water capacity is medium. The hazard of erosion is slight.

Cotton, forage sorghum, and grain sorghum are the main crops. Maintaining or improving soil tilth is important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue.

CAPABILITY UNIT IVe–1

This unit consists of deep fine sandy loams, loamy fine sands, and gravelly loams to sandy loams. These gently sloping to sloping and gently undulating soils are slowly permeable. Available water capacity is medium to high, and the hazard of erosion is moderate to severe.

Forage sorghum is the main crop, but a small acreage is planted to grain sorghum. Controlling erosion, conserving moisture, and maintaining soil tilth are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture. Grassed waterways and diversion terraces help to control runoff.

CAPABILITY UNIT IVe–2

This unit consists of deep, sloping and undulating clays to clay loams and gravelly clays. Permeability is slow to very slow, and available water capacity is high. The hazard of erosion is moderate to severe.

Forage sorghum is the main crop, but a small acreage is planted to cotton and grain sorghum. Controlling erosion, conserving moisture, and maintaining tilth are important where these soils are cultivated. A suitable cropping system is one that produces a large amount of crop residue. Terracing and contour farming help to control erosion and conserve moisture. Grassed waterways and diversion terraces help to control runoff.

CAPABILITY UNIT IVe–3

Seawillow clay loam, 3 to 8 percent slopes, eroded, is the only soil in this unit. This deep soil is gently sloping to sloping. Permeability is moderate, and available water capacity is medium. The hazard of erosion is moderate.

Forage sorghum and small grain are the main crops, but a small acreage is planted to cotton and grain sorghum. Controlling erosion, conserving moisture, and maintaining fertility are important where these soils are cultivated. Terracing and contour farming help to control erosion and conserve moisture. A suitable cropping system is one that produces a large amount of crop residue. Fertilizer is needed for good plant growth. Grassed waterways and diversion terraces help to control runoff.

CAPABILITY UNIT IVe–4

This unit consists of deep, gently sloping to sloping and undulating loams and loamy fine sands. Permeability is moderate to moderately slow, and available water capacity is medium. The hazard of erosion is moderate.

Forage sorghum is the main crop, but a small acreage is planted to corn and grain sorghum. Controlling erosion, conserving moisture, and maintaining fertility are important where this soil is cultivated. A suitable cropping system is one that produces a large amount of crop residue. Close-growing crops help to control erosion and maintain soil tilth. Grassed waterways and diversion terraces help to control runoff.

CAPABILITY UNIT IVs–1

Queeny gravelly loam, 1 to 5 percent slopes, is the only soil in this unit. This gently sloping soil is very shallow and shallow to gravel beds. Permeability is moderate, and available water capacity is very low. The hazard of erosion is slight.

These soils are not well suited to cultivated crops. A few areas are planted to grain sorghum, but most areas are used as pasture.

CAPABILITY UNIT Vw–1

This unit consists of deep, nearly level clay loams on bottom lands. Permeability is moderate to moderately slow, and available water capacity is medium to high. The hazard of erosion is slight.

These soils are flooded at least once each year. They are well suited to use as pasture or range, but they are not suited to cultivated crops.

CAPABILITY UNIT Vw–2

Brazos fine sand, siliceous variant, is the only soil in this unit. This deep, nearly level, sandy soil is on bottom lands. Permeability is rapid, and available water capacity is very low. The hazard of erosion is slight.

This soil is flooded at least once each year. It is suited to use as pasture or range, but it is not suited to cultivation.

CAPABILITY UNIT Vw–3

This unit consists of deep, nearly level clays to clay loams on bottom lands. Permeability is moderate to very slow, and available water capacity is high. The hazard of erosion is slight.

These soils are flooded each year. They are suited to use as pasture or range, but they are not suited to cultivation.

CAPABILITY UNIT VIe–1

This unit consists of deep, gently sloping to sloping clay loams to loamy fine sands. Permeability is slow to very slow, and available water capacity is medium to high. The hazard of erosion is severe.

These soils are severely eroded, and many areas have deep and shallow gullies. The soils are suited to use as range or pasture, but they are not suited to cultivation.

CAPABILITY UNIT VIe–2

Only Heiden-Ferris complex, 5 to 20 percent slopes, severely eroded, is in this unit. These deep clay soils are sloping to moderately steep. Permeability is very slow, and available water capacity is high. The hazard of erosion is severe.

These soils are severely eroded, and many areas have deep and shallow gullies. The soils are suited to use as range and pasture, but they are not suited to cultivation.

CAPABILITY UNIT VIe–3

Jedd stony soils, 5 to 20 percent slopes, are the only soils in this unit. These moderately deep soils are sloping to moderately steep. They have a surface layer of gravelly or cobbly loam, fine sandy loam, or sandy loam. Permeability is slow, and available water capacity is very low. The hazard of erosion is slight.

These soils are suited to use as pasture or range, but they are not suited to cultivation.

CAPABILITY UNIT VIs-1

This unit consists of deep, gently sloping to strongly sloping and undulating fine sands, gravelly sandy loams, or loamy sands. Permeability is very slow to very rapid, and available water capacity is low. The hazard of erosion is slight.

These soils are suited to use as pasture or range, but they are not suited to cultivation.

CAPABILITY UNIT VIs-2

Queeny gravelly loam, 5 to 20 percent slopes, is the only soil in this unit. This very shallow to shallow soil is sloping to moderately steep. Permeability is moderate, and available water capacity is very low. The hazard of erosion is moderate.

This soil is not suited to cultivation. It is suited to use as pasture or range.

### *Predicted yields*

The predicted average yields per acre that can be expected of the principal dryfarmed crops grown in Caldwell County under a high level of management are given in table 2. The predictions are based on information gathered through interviews with farmers, soil scientists, county agricultural workers, and others who have observed or maintained yield records in the county. Soils that are used only as range or for recreational purposes are not listed in this table. Crops other than those shown in table 2 are grown in the county, but they are not listed because their acreage is small or reliable data on yields are not available.

The predicted yields given in table 2 can be expected if the following management practices are used:

1. Rainfall is effectively used and conserved.
2. Crop residue is managed to maintain soil tilth.
3. Tillage is minimal but timely.
4. Insect, disease, and weed control measures are consistently used.
5. Fertilizer is applied according to soil test and crop needs.
6. Suited crop varieties are used at optimum seeding rates.
7. A cropping sequence that maintains an adequate supply of organic material is used.
8. Terraces and other engineering structures are used and maintained where needed.

TABLE 2.—*Predicted average acre yields of principal dryfarmed crops*

[Absence of a yield figure indicates that the crop is not suited to the soil or is not commonly grown on it]

| Soil | Cotton (lint) | Corn | Grain sorghum | Oats |
|---|---|---|---|---|
| | *Lb* | *Bu* | *Lb* | *Bu* |
| Behring clay loam, 1 to 3 percent slopes | 375 | 45 | 4,000 | 60 |
| Behring clay loam, 3 to 5 percent slopes, eroded | 300 | 35 | 3,500 | 55 |
| Behring clay loam, 5 to 8 percent slopes, eroded | 250 | 30 | 2,500 | 55 |
| Bosque clay loam | 450 | 55 | 4,000 | 65 |
| Branyon clay, 0 to 1 percent slopes | 450 | 50 | 4,750 | 70 |
| Branyon clay, 1 to 3 percent slopes | 450 | 45 | 4,500 | 70 |
| Burleson clay, 0 to 1 percent slopes | 400 | 45 | 4,000 | 60 |
| Burleson clay, 1 to 3 percent slopes | 400 | 40 | 4,000 | 60 |
| Chaney loamy fine sand, 1 to 5 percent slopes | 300 | 25 | 2,250 | |
| Chaney soils, 2 to 6 percent slopes, eroded | 250 | 25 | 2,000 | |
| Chaney loamy fine sand, valleys | | 35 | | |
| Crockett fine sandy loam, 1 to 3 percent slopes | 200 | 30 | 2,000 | 45 |
| Crockett gravelly sandy loam, 1 to 5 percent slopes | 250 | 25 | 2,000 | 35 |
| Crockett soils, 2 to 5 percent slopes, eroded | 200 | 25 | 1,750 | 40 |
| Gowen clay loam | 475 | 50 | 4,500 | 75 |
| Heiden clay, 1 to 3 percent slopes | 400 | 50 | 4,250 | 60 |
| Heiden clay, 3 to 5 percent slopes, eroded | 350 | 45 | 3,250 | 55 |
| Heiden clay, 5 to 8 percent slopes, eroded | 300 | 30 | 2,000 | 45 |
| Heiden gravelly clay, 3 to 8 percent slopes | 300 | 35 | 2,500 | 55 |
| Heiden-Wilson complex, 1 to 3 percent slopes | 375 | 40 | 3,500 | 55 |
| Houston Black clay, 1 to 3 percent slopes | 450 | 45 | 4,500 | 70 |
| Houston Black clay, 3 to 5 percent slopes, eroded | 350 | 45 | 3,500 | 60 |
| Lewisville silty clay, 0 to 1 percent slopes | 350 | 50 | 3,250 | 65 |
| Lewisville silty clay, 1 to 3 percent slopes | 275 | 40 | 3,000 | 65 |
| Lewisville silty clay, 3 to 5 percent slopes, eroded | 250 | 35 | 2,750 | 55 |
| Mabank loam, 0 to 1 percent slopes | 375 | 35 | 3,000 | 45 |
| Mabank loam, 1 to 3 percent slopes | 375 | 30 | 2,500 | 45 |
| Menard loam, thin solum variant, 1 to 5 percent slopes | 275 | 30 | 2,750 | 50 |
| Queeny gravelly loam, 1 to 5 percent slopes | | | 1,250 | 10 |
| Rosanky loamy fine sand, 1 to 8 percent slopes | | 30 | | |
| Seawillow clay loam, 1 to 3 percent slopes | 250 | 35 | 2,500 | 55 |
| Seawillow clay loam, 3 to 8 percent slopes, eroded | 200 | 30 | 1,500 | 35 |
| Seguin loam | 350 | 50 | 3,250 | |
| Silstid fine sand, 1 to 5 percent slopes | 250 | 35 | 2,000 | |
| Trinity clay | 475 | 50 | 4,500 | 75 |
| Wilson gravelly loam, 1 to 5 percent slopes | 300 | 35 | 2,500 | 40 |

## Use of the Soils for Pasture and Hay

Most farms in Caldwell County have some improved pasture, and many are used entirely as improved pasture. Other farms are used for both crops and pasture. Improved pasture is also used in combination with range.

Well-managed pastures and hay meadows aid in maintaining an economical, balanced forage program. The essential maintenance in pasture and hay management is grazing or cutting vegetation at intervals that will insure adequate plant cover for soil protection and adequate leaf surface for effective plant growth and development.

Such management practices as applying fertilizers, controlling weeds, and rotation grazing are also important in maintaining and improving vegetation. Fertilizers should be applied at rates based on a soil test and in quantities necessary for plant needs and desired forage production. Weed control is not so necessary on well-managed, properly grazed pastures as it is on poorly managed, overgrazed ones. An excellent ground cover of grass prevents the growth of undesirable plants by shading and crowding them out. Weed control management applied too late can be detrimental to improved pasture plants.

A well-managed pasture mostly has one dominant kind of perennial grass per pasture, has adequate fencing and cross fencing for proper rotation, has an adequate fertility level, and is free of weeds. Forage production fluctuates during the growing season, and the stocking rate should be adjusted so that the dominant grass is kept at the proper height.

### *Pasture and hay groups*

The soils of Caldwell County have been placed in 14 pasture and hay groups according to their suitability for the production of forage. The soils in each group are enough alike to be suited to the same grasses, to have similar limitations and hazards, to require similar management, and to have similar productivity and other responses to management. Thus, the pasture and hay group is a convenient grouping of soils for many statements about management. These groups are identified by Arabic numerals and uppercase letters, for example 1A. The numerals and names generally are assigned locally, but the system of grouping is statewide. Not all of the groups in the system are represented by the soils in Caldwell County; therefore, the numerals are not consecutive.

The names of the soils in any group can be found in the "Guide to Mapping Units" at the back of this survey.

#### PASTURE AND HAY GROUP 1A

This group consists of deep, nearly level clays on flood plains of local streams. All areas of these soils are subject to flooding unless they are protected. The soils crack and take in water rapidly when dry, but they expand and are very slowly permeable when wet. Available water capacity is high.

Seedbed preparation is difficult. The soils become puddled if they are grazed when wet. Nitrogen and phosphorus are needed for sustained forage production.

The potential is high for the production of such grasses as improved bermudagrass, johnsongrass, Kleingrass–75, and medio bluestem.

#### PASTURE AND HAY GROUP 2A

This group consists of deep, loamy, nearly level soils on bottom lands. Some areas of these soils are subject to flooding, unless they are protected. Permeability is moderate to moderately slow, and available water capacity is medium to high.

These soils are productive. Light summer rains provide quick forage production response, but nitrogen and phosphorus are needed for sustained forage production.

These soils are best suited to improved bermudagrass, johnsongrass, and Kleingrass–75.

#### PASTURE AND HAY GROUP 3A

Brazos fine sand, siliceous variant, is the only soil in this group. This deep, sandy, nearly level soil is on bottom lands. Some areas are subject to flooding unless they are protected. Permeability is rapid, and available water capacity is very low.

Applications of nitrogen, phosphorus, and potassium are needed at planned intervals throughout the growing season for sustained forage production.

This soil is best suited to summer forage production. Improved bermudagrass and lovegrass provide maximum forage yields.

#### PASTURE AND HAY GROUP 7A

This group consists of deep, loamy to clayey, nearly level to gently sloping soils. These soils crack and take in water rapidly when dry, but they expand and are slowly to very slowly permeable when wet. Available water capacity is high.

Seedbed preparation is difficult. Nitrogen and phosphorus are needed for sustained forage production.

These soils are suited to summer and winter forage production. Improved bermudagrass, johnsongrass, Kleingrass–75, and medio bluestem provide maximum forage yields.

#### PASTURE AND HAY GROUP 7B

This group consists of deep, clayey, gently sloping to moderately steep soils. These soils crack and take in water rapidly when dry, but they expand and are slowly to very slowly permeable when wet. Available water capacity is high.

Seedbed preparation is difficult. Nitrogen and phosphorus are needed for sustained forage production.

These soils are best suited to summer forage production. Improved bermudagrass and medio bluestem provide maximum forage yields.

#### PASTURE AND HAY GROUP 7C

This group consists of deep, loamy to clayey, nearly level to sloping soils. Permeability is moderate, and available water capacity is medium to high.

Nitrogen and phosphorus are needed for sustained forage production.

These soils are suited to summer and winter forage production. Improved bermudagrass, johnsongrass, and Kleingrass–75 provide maximum forage yields.

PASTURE AND HAY GROUP 7H

Wilson gravelly loam, 1 to 5 percent slopes, is the only soil in this group. This deep, gently sloping soil has a crust on the surface when it is dry. Permeability is very slow, and available water capacity is high.

Seedbed preparation is difficult. Nitrogen and phosphorus are needed for sustained forage production.

This soil is best suited to summer forage production. Improved bermudagrass and medio bluestem provide maximum forage yields.

PASTURE AND HAY GROUP 8A

This group consists of deep, nearly level to strongly sloping soils that have a loamy to sandy and gravelly sandy surface layer. Permeability is slow to very slow, and available water capacity is low to high.

Nitrogen and phosphorus are needed for sustained forage production.

These soils are best suited to summer forage production. Improved bermudagrass, Kleingrass–75, and medio bluestem provide maximum forage yields (fig. 13).

PASTURE AND HAY GROUP 8B

This group consists of deep, gently sloping to sloping, loamy to sandy soils. Permeability is slow to very slow, and available water capacity is medium to high.

Shaping of eroded areas is necessary in most places before grasses are planted. Nitrogen, phosphorus, and potassium are needed for establishment of grass and for sustained forage production.

These soils are best suited to summer forage production. Improved bermudagrass and medio bluestem provide maximum forage yields and aid in the control of erosion.

PASTURE AND HAY GROUP 8C

Menard loam, thin solum variant, 1 to 5 percent slopes, is the only soil in this group. This deep soil is gently sloping. Permeability is moderate, and available water capacity is medium.

Nitrogen and phosphorus are needed for sustained forage production.

This soil is suited to summer and winter forage production. Improved bermudagrass and gordo bluestem provide maximum forage yields.

PASTURE AND HAY GROUP 8D

Jedd stony soils, 5 to 20 percent slopes, are the only soils in this group. These moderately deep soils are sloping to moderately steep. The surface is covered with sandstone fragments that range in size from pebbles to stones. Permeability is slow, and available water capacity is very low.

The fragments on the surface make seedbed preparation difficult. Nitrogen, phosphorus, and potassium are needed for sustained forage production.

These soils are best suited to summer forage production. Improved bermudagrass and weeping lovegrass provide maximum forage yields.

*Figure 13.*—**Medio bluestem on Crockett soils.**

PASTURE AND HAY GROUP 9A

This group consists of deep, gently sloping to sloping and undulating, sandy soils. Permeability is moderate to slow, and available water capacity is low to medium.

Applications of nitrogen, phosphorus, and potassium are needed at planned intervals throughout the growing season for sustained forage production.

These soils are best suited to summer forage production. Improved bermudagrass and weeping lovegrass provide maximum forage yields.

PASTURE AND HAY GROUP 9B

This group consists of deep, gently sloping and undulating, sandy soils. Permeability is very rapid to moderately slow, and available water capacity is low.

Applications of nitrogen, phosphorus, and potassium are needed at planned intervals throughout the growing season for sustained forage production.

These soils are best suited to summer forage production. Weeping lovegrass provides maximum forage yields.

PASTURE AND HAY GROUP 14A

This group consists of shallow to very shallow, gravelly loamy soils that are underlain by gravel. These soils are gently sloping to moderately steep. Permeability is moderate, and available water capacity is very low.

Seedbed preparation is difficult on steep slopes. Nitrogen and phosphorus are needed for sustained forage production.

These soils are best suited to summer forage production. Gordo bluestem and King Ranch bluestem provide maximum forage yields.

## Range

Range is land on which the climax, or potential, plant community consists mainly of grasses, grasslike plants, forbs, and woody plants that are suitable for grazing and that are available in sufficient quantity to justify grazing use.

Interpretations for the soils in Caldwell County that are used as range are given in this section. Also given are descriptions of the potential plant communities that are important in the use and management of range.

About 11 percent of Caldwell County is in range. This area is used primarily for the production of native vegetation that is grazed by livestock and by deer and other wildlife. Additional benefits provided by land used as range are recreation, scenery, open space, wood products, and water yield from runoff, as well as underground water storage and flow.

The largest area of soils in range are the sandy or deep sandy soils in a savanna of post oak and grasses in the eastern part of the county. The soils in range in the remaining part of the county are mainly clayey to loamy.

The success of the stockman in producing forage for livestock and protecting the soil from erosion and soil blowing depends largely on management that provides good forage and keeps plants abundant and vigorous. This is done mainly by managing the time and intensity of grazing and by applying needed treatment to reestablish plants, or by modifying the natural plant community for each soil.

### *Range sites and condition classes*

Soils differ in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range is in similar condition, make up a range site.

Range sites are kinds of rangeland that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind and amount of climax vegetation. The climax vegetation consists of the plants that were growing on a given soil when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that tend to decrease in relative amount under close grazing. They generally are the tallest and most productive perennial grasses and forbs and the most palatable to livestock.

Increasers are plants in the climax vegetation that increase in relative amount as the more desirable decreaser plants are reduced by close grazing. They are commonly shorter than decreasers and are generally less palatable to livestock.

Invaders are plants that cannot compete with plants in 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 grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes 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. It is 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 less than 25.

Range condition is judged according to standards that apply to the particular range site. It expresses the present kind and amount of vegetation in relation to the climax plant community for that site.

Potential forage production depends on the range site. Current forage production depends on the range condition and the moisture available to plants during their growing season.

A primary objective of good management is to keep the range in excellent or good condition. If this is done, water is conserved, yields are improved or maintained, and the soils are protected. The major concern in range management is recognition of important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Plant 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 range that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

### *Descriptions of the range sites*

In the following paragraphs, the range sites of Caldwell County are described, and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential average annual acre yield of air-dry herbage in both wet and dry years for each site where it is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

#### BLACKLAND RANGE SITE

This range site is made up of deep, nearly level to sloping and undulating, loamy to clayey and gravelly clayey soils. The hazard of erosion is slight to severe. Permeability is moderate to very slow, and available water capacity is medium to high.

If this site is in climax condition, it is a true prairie that has a few large live oak, elm, and hackberry trees along the draws and in a few motts. Many palatable forbs and legumes are native to the site. Little bluestem is the dominant grass and makes up 50 percent, by weight, of the plant community. Indiangrass makes up 20 percent, and Texas wintergrass makes up 5 percent. Vine-mesquite contributes 5 percent to the yield, and numerous other grasses that occur less frequently or in smaller amounts make up 10 percent. Perennial forbs make up 5 percent of the production and woody plants 5 percent.

If the site is continuously heavily grazed by cattle, little bluestem, indiangrass, big bluestem, switchgrass, Maximilian sunflower, and Engelmanndaisy decrease in the plant community. Such plants as silver bluestem, Texas wintergrass, tall dropseeds, side-oats grama, and less palatable forbs increase. If overgrazing is prolonged, buffalograss, annual forbs, and annual grasses invade and eventually dominate the site, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 7,000 pounds in wet years to 3,500 pounds in dry years. Approximately 95 percent of this production is from plants that furnish forage for livestock.

#### CHALKY RIDGE RANGE SITE

This range site is made up of very shallow to shallow, gently sloping to moderately steep, gravelly loamy soils. The hazard of erosion is slight to moderate. Permeability is moderate, and available water capacity is very low.

The climax vegetation is a mixture of tall and mid grasses and scattered live oak trees. Little bluestem makes up about 50 percent, by weight, of the annual production. Indiangrass makes up about 15 percent, and side-oats grama makes up 15 percent. Fall witchgrass contributes 5 percent to the total yield, other grasses 5 percent, perennial forbs 5 percent, and live oak 5 percent.

If the site is continuously heavily grazed by livestock, little bluestem and indiangrass decrease in the plant community. Texas wintergrass, side-oats grama, and silver bluestem increase. If overgrazing is prolonged, annual weeds and threeawn invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 1,500 pounds in dry years. Approximately 90 percent of this production is from plants that furnish forage for livestock.

#### CLAYEY BOTTOMLAND RANGE SITE

This range site is made up of deep, nearly level, clayey soils on flood plains. The site receives extra water when adjoining sites are flooded. The hazard of erosion is slight. Permeability is very slow, and available water capacity is high.

The climax vegetation is a mixture of grasses, forbs, shrubs, and such trees as elm, pecan, and hackberry. Little bluestem makes up about 30 percent, by weight, of the annual production, and Virginia wildrye makes up 20 percent. Switchgrass and indiangrass each make up 15 percent, and vine-mesquite contributes 5 percent to the yield. Perennial and annual forbs make up 5 percent, and trees and shrubs make up 10 percent. The climax plant community varies and depends upon the location of the soil and the amount of flooding.

If the site is continuously heavily grazed by livestock, such grasses as switchgrass and indiangrass decrease in the plant community. Such grasses as vine-mesquite and meadow dropseed increase. If overgrazing is prolonged, buffalograss, annual weeds, and annual grasses invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 10,000 pounds in wet years to 5,000 pounds in dry years. Approximately 80 percent of this production is from plants that furnish forage for cattle.

#### CLAY LOAM RANGE SITE

This range site is made up of deep, nearly level to sloping, loamy to clayey soils. The hazard of erosion is slight to moderate. Permeability is moderate, and available water capacity is medium to high.

If this site is in climax condition, it is a prairie or an open savannah that has a few hackberry, elm, or pecan trees along the drainageways. Little bluestem makes up 40 percent, by weight, of the total annual yield. Indiangrass and big bluestem each make up 15 percent, and switchgrass and Florida paspalum each make up 10 percent. Canada wildrye contributes 5 percent to the production, and annual weeds and annual grasses contribute 5 percent.

If the site is continuously heavily grazed by livestock, big bluestem, little bluestem, indiangrass, switchgrass, Florida paspalum, and palatable forbs decrease. Side-oats grama, silver bluestem, Texas wintergrass, tall dropseeds, and less palatable forbs increase.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 5,500 pounds in wet years to 3,000 pounds in dry years. Ap-

proximately 95 percent of this production is from plants which furnish forage for livestock.

#### CLAYPAN PRAIRIE RANGE SITE

This range site is made up of deep, nearly level to sloping and gently undulating, loamy and gravelly loamy soils. The hazard of erosion is slight to severe. Permeability is very slow, and available water capacity is medium to high. These soils become hard, compacted, and poorly aerated when they dry.

If this site is in climax condition, it is a true prairie that has a few large oaks. Elm and oaks occur along draws and creeks and in motts scattered throughout the site. Little bluestem makes up about 30 percent, by weight, of the annual production. Big bluestem makes up 20 percent; switchgrass 15 percent; indiangrass 15 percent; vine-mesquite 10 percent; Texas wintergrass 5 percent; and annual weeds and annual grasses 5 percent.

If the site is continuously heavily grazed by livestock, little bluestem, switchgrass, and indiangrass decrease in the plant community, and such plants as Texas wintergrass and vine-mesquite increase. If overgrazing is prolonged, annual weeds and grasses invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, the average annual acre yield of air-dry herbage ranges from 5,000 pounds in wet years to 3,000 pounds in dry years. Approximately 95 percent of this production is from plants that furnish forage for livestock.

#### DEEP SAND RANGE SITE

This range site is made up of deep, gently sloping and undulating, sandy soils. The hazard of erosion is slight. Permeability is very rapid to moderately slow, and available water capacity is low.

The climax vegetation is a mixture of a thin stand of grasses, forbs, and such trees as bluejack oak, blackjack oak, and post oak. Sand lovegrass makes up 10 percent of the total annual production, and other lovegrasses make up 5 percent. Purpletop contributes 10 percent to the yield, indiangrass 10 percent, switchgrass 10 percent, scribner panicum 10 percent, fringeleaf paspalum 10 percent, and purple sandgrass 10 percent. Forbs make up 15 percent of the production and oak trees 10 percent.

If the site is continuously heavily grazed by livestock, indiangrass and sand lovegrass decrease in the plant community. Such plants as annual grasses, fringeleaf paspalum, and three-awn increase. If overgrazing is prolonged, annual weeds and annual grasses invade and make up a substantial part of the production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,000 pounds in wet years to 1,000 pounds in dry years. The forage is of low quality for livestock (fig. 14).

#### ERODED BLACKLAND RANGE SITE

Only Heiden-Ferris complex, 5 to 20 percent slopes, severely eroded, is in this site. These are deep, sloping to moderately steep, clayey soils. The hazard of erosion is severe. Permeability is very slow, and available water capacity is high.

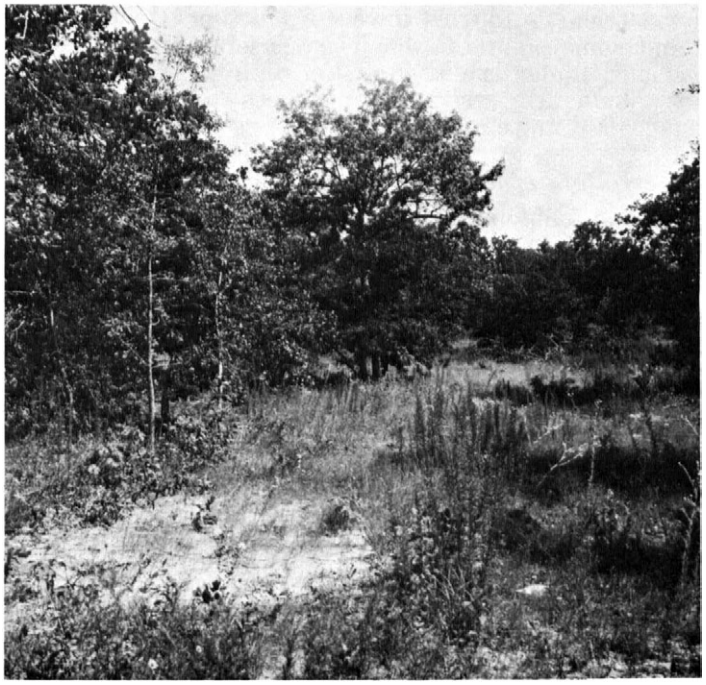

*Figure 14.*—**Area of Patilo soils in Deep Sand range site.**

If this site is in climax condition, it is a tall grass prairie. The site potential has been altered by cultivation and erosion. The site, however, will support a productive plant community. Little bluestem makes up about 30 percent, by weight, of the annual production, indiangrass 10 percent, and big bluestem 10 percent. Virginia wildrye and Canada wildrye contribute 5 percent to the yield, switchgrass 5 percent, Florida paspalum 5 percent, side-oats grama 5 percent, tall dropseed 5 percent, silver bluestem 5 percent, Texas wintergrass 5 percent, and vine-mesquite 5 percent. Forbs make up 5 percent of the production and trees and shrubs 5 percent.

If this site is continuously heavily grazed by livestock, big bluestem, little bluestem, and indiangrass decrease in the plant community. Such plants as tall dropseed, Texas wintergrass, and side-oats grama increase.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 4,000 pounds in wet years to 2,500 pounds in dry years. Approximately 90 percent of this production is from plants that furnish forage for livestock.

#### GRAVELLY RANGE SITE

Fett gravelly soils, 1 to 12 percent slopes, are the only soils in this site. These deep, gently sloping to strongly sloping soils have a gravelly loamy surface layer. The hazard of erosion is slight. Permeability is very slow, and available water capacity is low.

The climax vegetation is an open stand of post oak, mid and tall grasses, and forbs. Little bluestem makes up about 45 percent, by weight, of the annual production, brownseed paspalum 15 percent, beaked panicum 10 percent, tall dropseed 10 percent, low-growing pani-

cums 5 percent, and switchgrass 5 percent. Post oak contributes 10 percent to the yield.

If the site is continuously heavily grazed by livestock, little bluestem, switchgrass, and tall dropseed decrease in the plant community. Such grasses as sand lovegrass, brownseed paspalum, and low-growing panicums and oak trees increase. If overgrazing is prolonged, annual weeds and annual grasses invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 4,000 pounds in wet years to 1,500 pounds in dry years. Approximately 70 percent of this production is from plants that furnish forage for livestock.

#### LOAMY BOTTOMLAND RANGE SITE

This range site consists of deep, nearly level, loamy soils on flood plains. Permeability is moderate to moderately slow, and available water capacity is medium to high.

The climax vegetation is trees, shrubs, grasses, and forbs. Little bluestem makes up 20 percent, by weight, of the annual production, indiangrass 20 percent, switchgrass 20 percent, and Virginia and Canada wildrye 10 percent. Annual and perennial forbs contribute 10 percent to the yield and such woody plants as pecan, willow, and elm trees and shrubs 20 percent.

If the site is continuously heavily grazed by livestock, little bluestem, indiangrass, and switchgrass decrease in the plant community. Such plants as Texas wintergrass, silver bluestem, annual forbs, and woody plants increase. If overgrazing is prolonged, buffalograss, annual weeds, and annual grasses invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 6,500 pounds in wet years to 3,500 pounds in dry years. Approximately 95 percent of this production is from plants that furnish forage for livestock.

#### SANDY RANGE SITE

This range site consists of deep, gently sloping, sandy soils. Permeability is moderate to moderately slow, and available water capacity is medium to low. The hazard of erosion is slight.

The climax vegetation is a mixture of post oak, blackjack oak, and hickory trees, shrubs, tall and mid grasses, and forbs. Little bluestem makes up about 50 percent, by weight, of the annual production. Indiangrass makes up 10 percent, switchgrass 10 percent, sand lovegrass 5 percent, and beaked panicum 5 percent. Perennial and annual forbs contribute 5 percent to the yield and oak trees and shrubs 15 percent.

If the site is continuously heavily grazed by livestock, little bluestem, indiangrass, and switchgrass decrease in the plant community. Such grasses as sand lovegrass, beaked panicum, and low-growing panicums increase. If overgrazing is prolonged, oak trees, annual weeds, and annual grasses invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 4,500 pounds in wet years to 2,500 pounds in dry years. Approximately 75 percent of this production is from plants that furnish forage for livestock.

#### SANDY BOTTOMLAND RANGE SITE

Brazos fine sand, siliceous variant, is the only soil in this site. This deep, nearly level, sandy soil is on bottom lands. The hazard of erosion is slight. Permeability is rapid, and available water capacity is very low.

The climax vegetation is a mixture of post oak and willow trees, shrubs, tall and mid grasses, and forbs. Switchgrass makes up about 30 percent, by weight, of the annual production. Little bluestem makes up 10 percent, big bluestem 10 percent, indiangrass 10 percent, purpletop 10 percent, and Virginia wildrye 5 percent. Post oak trees contribute 5 percent to the yield, cottonwood and black willow trees 10 percent, shrubs 5 percent, and forbs 5 percent.

If the site is continuously heavily grazed by livestock, switchgrass, little bluestem, big bluestem, and indiangrass decrease in the plant community. Such plants as fringeleaf paspalum, lovegrass, oak, and shrubs increase. If overgrazing is prolonged, trees, annual weeds, and annual grasses invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 6,000 pounds in wet years to 3,000 pounds in dry years. Approximately 80 percent of this production is from plants that furnish forage for livestock.

#### SANDY LOAM RANGE SITE

This range site consists of deep, gently sloping to sloping and undulating, sandy to loamy soils. Permeability is moderate to slow, and available water capacity is medium.

The climax vegetation is post oak trees, yaupon and other shrubs, grasses, and forbs. Little bluestem makes up about 50 percent, by weight, of the annual production. Indiangrass makes up 10 percent, switchgrass 5 percent, beaked panicum 10 percent, and purpletop 5 percent. Woody plants contribute 15 percent to the yield and forbs 5 percent.

If this site is continuously heavily grazed by livestock, indiangrass, little bluestem, and switchgrass decrease in the plant community, oak trees and shrubs increase, and such grasses as windmill grass, low-growing panicums, and Wright three-awn and forbs increase or invade. If overgrazing is prolonged, annual weeds and annual grasses invade and make up a substantial part of the annual production, and the total production is greatly reduced.

Where this site is in excellent condition, potential annual acre-yield of air-dry herbage ranges from 5,000 pounds in wet years to 3,000 pounds in dry years. Approximately 70 percent of this production is from plants that furnish forage for livestock.

#### SANDSTONE HILLS RANGE SITE

Jedd stony soils, 5 to 20 percent slopes, are the only soils in this site. These are moderately deep, sloping to moderately steep, gravelly loamy soils. The hazard of

erosion is slight. Permeability is slow, and available water capacity is very low.

If this site is in climax condition, it has a canopy of trees and an understory of tall and mid grasses. Little bluestem makes up about 40 percent, by weight, of the annual production, and side-oats grama makes up 10 percent. Indiangrass contributes 5 percent to the yield, pinhole bluestem 5 percent, purpletop 5 percent, Texas wintergrass 5 percent, Canada wildrye 5 percent, and vine-mesquite 5 percent. Post oak, blackjack oak, and live oak trees make up 10 percent, shrubs 5 percent, and forbs 5 percent.

If the site is continuously heavily grazed by livestock, little bluestem, side-oats grama, and indiangrass decrease in the plant community, and oak trees, shrubs, and annual forbs invade.

Where this site is in excellent condition, potential annual acre yield of air-dry herbage ranges from 3,500 pounds in wet years to 2,000 pounds in dry years. Approximately 70 percent of this production is from plants that furnish forage for livestock.

## Wildlife

Soils directly influence the kinds and amounts of vegetation and the amount of water available. In this way they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are (1) thickness of soil useful to crops, (2) texture of the surface layer, (3) available water capacity to a depth of 40 inches, (4) wetness, (5) surface stoniness or rockiness, (6) hazard of flooding, (7) slope, and (8) permeability of the soil to air and water.

In table 3 soils of Caldwell County are rated according to their suitability for producing six elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements. A rating of *good* indicates that habitat is generally easily created, improved, and maintained. The soil has few or no limitations that affect management, and satisfactory results can be expected when the soil is used for the prescribed purpose.

A rating of *fair* indicates that habitat can be created, improved, or maintained in most places, but the soil has moderate limitations that affect management or development. A moderate intensity of management and fairly frequent attention may be required for satisfactory results.

A rating of *poor* indicates that habitat can be created, improved, or maintained in most places, but the soil has severe limitations. Management is difficult, expensive, and requires extensive effort. Results are questionable.

A rating of *very poor* indicates that it is either impossible or impractical to create, improve, or maintain habitat on soils in this category. Soil conditions are very severe, and unsatisfactory results are probable.

Each soil is rated in table 3 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, onsite inspection is needed in selecting a site for development as a wildlife habitat.

The six habitat elements rated in table 3 are briefly defined in the following paragraphs.

*Grain and seed crops* are crops that produce annual grain, such as corn, sorghum, millet, and soybeans.

*Grasses and legumes* are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include bahiagrass, ryegrass, and panicgrass; legumes include annual lespedeza, shrub lespedeza, and other clovers.

*Wild herbaceous upland plants* are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, perennial lespedeza, wildbean, pokeweed, and cheatgrass are examples of these plants. On range typical plants are bluestem, grama, perennial forbs, and legumes.

*Shrubs* are nonconiferous shrubs that produce wildlife food in the form of fruit, nuts, buds, or browse. Such plants commonly grow in their natural environment, but they may be planted and developed through wildlife management programs. Typical kinds of plants in the category are oak, dogwood, yaupon, bitterbush, and snowberry.

*Wetland food and cover plants* are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of plants are smartweed, wild millet, spikerush and other rushes, sedges, burreed, tearthumb, and aneilema. Submerged and floating aquatics are not included in this category.

*Shallow water developments* are impoundments or excavations for controlling water, generally not more than five feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submersed aquatics.

Table 3 also rates soils according to their suitability as habitat for such kinds of wildlife in the county as open-land, rangeland, and wetland wildlife. These ratings are related to ratings made for the elements of wildlife habitat. For example, soils rated very poor for shallow water developments are rated very poor for wetland wildlife.

The kinds of wildlife rated in table 3 are briefly described in the following paragraphs.

*Open-land wildlife* consists of birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, dove, meadowlark, field sparrow, cottontail rabbit, and fox are typical examples of open-land wildlife.

*Rangeland wildlife* consists of birds and mammals of natural rangelands. Javelina, chukar, wild turkey, quail, deer, grouse, and raccoon are typical examples of rangeland wildlife (fig. 15).

*Wetland wildlife* consists of birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, geese, rail, shore birds, heron, mink, and muskrat are typical examples of wetland wildlife.

## Recreational Development

Knowledge of soils is necessary for planning, developing, and maintaining areas used for recreation. In

TABLE 3.—*Suitability of the soils for elements of wildlife habitat and for kinds of wildlife*

| Soil series and map symbols | Elements of wildlife habitat | | | | | | Kinds of wildlife | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Shrubs | Wetland food and cover plants | Shallow water developments | Openland | Rangeland | Wetland |
| Arenosa: APC — For Patilo part of APC, see Patilo series. | Poor | Poor | Poor | Poor | Very poor | Very poor | Poor | Poor | Very poor. |
| Behring: | | | | | | | | | |
| BeB, BeC2 | Good | Good | Good | Poor | Very poor | Very poor | Good | Poor | Very poor. |
| BeD2 | Fair | Good | Good | Poor | Very poor | Very poor | Fair | Fair | Very poor. |
| Bosque: Bo, Bp | Fair | Fair | Fair | Good | Very poor | Very poor | Fair | Fair | Very poor. |
| Branyon: BrA, BrB | Fair | Fair | Fair | Fair | Very poor | Very poor | Fair | Fair | Very poor. |
| Brazos variant: Bs. | Poor | Poor | Poor | Poor | Very poor | Very poor | Poor | Poor | Very poor. |
| Burleson: BuA, BuB. | Fair | Fair | Fair | Good | Poor | Poor | Fair | Fair | Poor. |
| Chaney: | | | | | | | | | |
| CaC, CbB | Good | Good | Good | Poor | Poor | Very poor | Good | Fair | Very poor. |
| CcC2, CcD3 | Good | Good | Good | Good | Poor | Very poor | Good | Good | Very poor. |
| Crockett: CfB, CgC, CrC2, CrD3. | Good | Good | Good | Good | Poor | Very poor | Good | Good | Very poor. |
| Demona: DeC | Good | Good | Good | Poor | Very poor | Poor | Good | Fair | Poor. |
| Ferris — Mapped only in a complex with Heiden soils. | Fair | Fair | Fair | Poor | Very poor | Very poor | Fair | Poor | Very poor. |
| Fett: FeE | Poor | Fair | Fair | Fair | Very poor | Very poor | Fair | Fair | Very poor. |
| Gowen: Go, Gs | Good | Good | Good | Good | Very poor | Very poor | Good | Good | Very poor. |
| Heiden: HeB, HeC2, HeD2, HgD, HhF3, HmB. For Ferris part of HhF3, see Ferris series. For Wilson part of HmB, see Wilson series. | Fair | Fair | Fair | Fair | Very poor | Very poor | Fair | Fair | Very poor. |
| Houston Black: HoB, HoC2, HpD. | Fair | Fair | Fair | Fair | Very poor | Very poor | Fair | Fair | Very poor. |
| Jedd: JsF | Poor | Fair | Good | Fair | Very poor | Very poor | Fair | Fair | Very poor. |
| Lewisville: LeA, LeB, LeC2. | Fair | Fair | Fair | Good | Poor | Poor | Fair | Fair | Poor. |
| Mabank: MaA, MaB. | Fair | Fair | Good | Good | Fair | Fair | Fair | Good | Fair. |
| Menard variant: MeC. | Good | Good | Good | Fair | Very poor | Very poor | Good | Fair | Very poor. |
| Patilo: PaD | Poor | Fair | Fair | Poor | Very poor | Very poor | Fair | Poor | Very poor. |

TABLE 3.—*Suitability of the soils for elements of wildlife habitat and for kinds of wildlife*—Continued

| Soil series and map symbols | Elements of wildlife habitat | | | | | | Kinds of wildlife | | |
|---|---|---|---|---|---|---|---|---|---|
| | Grain and seed crops | Grasses and legumes | Wild herbaceous upland plants | Shrubs | Wetland food and cover plants | Shallow water developments | Openland | Rangeland | Wetland |
| Queeny: | | | | | | | | | |
| QuC | Poor | Poor | Fair | Fair | Very poor | Very poor | Poor | Fair | Very poor. |
| QuF | Very poor | Very poor | Poor | Poor | Very poor | Very poor | Poor | Poor | Very poor. |
| Rosanky: RoD | Good | Good | Good | Good | Very poor | Very poor | Good | Good | Very poor. |
| Seawillow: SeB, SeD2. | Good | Good | Good | Good | Very poor | Very poor | Good | Good | Very poor. |
| Seguin: Sg | Good | Good | Good | Good | Very poor | Very poor | Good | Good | Very poor. |
| Silstid: ShC | Fair | Fair | Fair | Poor | Very poor | Very poor | Fair | Poor | Very poor. |
| Trinity: Tr, Ts | Fair | Fair | Fair | Good | Fair | Fair | Fair | Fair | Fair. |
| Uhland: Us | Poor | Fair | Fair | Good | Fair | Poor | Fair | Fair | Fair. |
| Wilson: WgC | Fair | Fair | Good | Good | Poor | Poor | Fair | Good | Poor. |

table 4 the soils of Caldwell County are rated according to limitations that affect their suitability for camp areas, picnic areas, playgrounds, and paths and trails.

The soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can easily be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these activities is required.

***Figure 15.*—Area of dominantly Silstid soils that has been improved as wildlife habitat by removing some brush and building a pond.**

TABLE 4.—*Degree of limitation and soil features affecting recreational development*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

| Soil series and map symbols | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| *Arenosa: APC<br>For Patilo part of APC, see Patilo series. | Severe: fine sand surface layer. | Severe: fine sand surface layer. | Severe: fine sand surface layer. | Severe: fine sand surface layer. |
| Behring: | | | | |
| BeB, BeC2 | Moderate: clay loam surface layer; slow permeability. | Moderate: clay loam surface layer. | Moderate: clay loam surface layer; slow permeability. | Moderate: clay loam surface layer. |
| BeD2 | Moderate: clay loam surface layer; slow permeability. | Moderate: clay loam surface layer. | Severe: slope | Moderate: clay loam surface layer. |
| Bosque: Bo, Bp | Severe: subject to flooding. | Moderate: subject to flooding. | Severe: subject to flooding. | Slight. |
| Branyon: BrA, BrB | Severe: clay surface layer; very slow permeability. | Severe: clay surface layer. | Severe: clay surface layer; very slow permeability. | Severe: clay surface layer. |
| Brazos variant: Bs | Severe: fine sand surface layer; subject to flooding. | Severe: fine sand surface layer; subject to flooding. | Severe: fine sand surface layer; subject to flooding. | Severe: fine sand surface layer; subject to flooding. |
| Burleson: BuA, BuB | Severe: clay surface layer; very slow permeability. | Severe: clay surface layer. | Severe: clay surface layer; very slow permeability. | Severe: clay surface layer. |
| Chaney: | | | | |
| CaC, CbB | Moderate: loamy fine sand surface layer; slow permeability; moderately well drained. | Moderate: loamy fine sand surface layer; moderately well drained. | Moderate: loamy fine sand surface layer; slow permeability. | Moderate: loamy fine sand surface layer; slow permeability. |
| CcC2 | Moderate: slow permeability; moderately well drained. | Moderate: moderately well drained. | Moderate: slow permeability; moderately well drained. | Slight. |
| CcD3 | Moderate: slow permeability; moderately well drained. | Moderate: moderately well drained. | Severe: slope | Slight. |
| Crockett: | | | | |
| CfB, CrC2, CrD3 | Severe: very slow permeability. | Slight | Severe: very slow permeability. | Slight. |
| CgC | Severe: very slow permeability | Moderate: coarse fragments. | Severe: very slow permeability. | Moderate: coarse fragments. |
| Demona: DeC | Moderate: loamy fine sand surface layer; moderately slow permeability. | Moderate: loamy fine sand surface layer. | Moderate: loamy fine sand surface layer; moderately slow permeability. | Moderate: loamy fine sand surface layer. |
| Ferris<br>Mapped only in a complex with Heiden soils. | Severe: clay surface layer. | Severe: clay surface layer. | Severe: clay surface layer. | Severe: clay surface layer. |
| Fett: FeE | Severe: very slow permeability; coarse fragments. | Severe: coarse fragments. | Severe: very slow permeability; coarse fragments. | Severe: coarse fragments. |
| Gowen: Go, Gs | Severe: subject to flooding. | Moderate: subject to flooding. | Moderate: subject to flooding. | Moderate: clay loam surface layer; subject to flooding. |

TABLE 4.—*Degree of limitation and soil features affecting recreational development*—Continued

| Soil series and map symbols | Camp areas | Picnic areas | Playgrounds | Paths and trails |
|---|---|---|---|---|
| *Heiden: HeB, HeC2, HeD2, HgD, HhF3, HmB. For Ferris part of HhF3, see Ferris series. For Wilson part of HmB, see Wilson series. | Severe: clay surface layer; very slow permeability. | Severe: clay surface layer. | Severe: clay surface layer; very slow permeability; slope. | Severe: clay surface layer. |
| Houston Black: HoB, HoC2, HpD. | Severe: clay surface layer; very slow permeability. | Severe: clay surface layer. | Severe: clay surface layer; very slow permeability. | Severe: clay surface layer. |
| Jedd: JsF | Severe: stony | Severe: coarse fragments; stony. | Severe: coarse fragments; stony; slope. | Severe: stony. |
| Lewisville: LeA, LeB, LeC2 | Severe: silty clay surface layer. | Severe: silty clay surface layer. | Severe: silty clay surface layer. | Severe: silty clay surface layer. |
| Mabank: MaA, MaB | Severe: very slow permeability; somewhat poorly drained. | Moderate: somewhat poorly drained. | Severe: very slow permeability; somewhat poorly drained. | Moderate: somewhat poorly drained. |
| Menard variant: MeC | Slight | Slight | Moderate: slope | Slight. |
| Patilo: PaD | Severe: fine sand surface layer. | Severe: fine sand surface layer. | Severe: fine sand surface layer. | Severe: fine sand surface layer. |
| Queeny: QuC | Slight | Slight | Severe: strongly cemented gravel beds at a depth of 5 to 12 inches. | Slight. |
| QuF | Moderate: slope | Moderate: slope | Severe: strongly cemented gravel beds at a depth of 5 to 12 inches. | Slight. |
| Rosanky: RoD | Moderate: loamy fine sand surface layer; moderately slow permeability. | Moderate: loamy fine sand surface layer. | Moderate: loamy fine sand surface layer; moderately slow permeability. | Moderate: loamy fine sand surface layer. |
| Seawillow: SeB, SeD2 | Moderate: clay loam surface layer. | Moderate: clay loam surface layer; slope. | Moderate: clay loam surface layer. | Moderate: clay loam surface layer. |
| Seguin: Sg | Severe: subject to flooding. | Moderate: subject to flooding. | Moderate: subject to flooding. | Slight. |
| Silstid: ShC | Severe: fine sand surface layer. | Severe: fine sand surface layer. | Severe: fine sand surface layer. | Severe: fine sand surface layer. |
| Trinity: Tr, Ts | Severe: clay surface layer; subject to flooding; very slow permeability. | Severe: clay surface layer. | Severe: clay surface layer; subject to flooding; very slow permeability. | Severe: clay surface layer. |
| Uhland: Us | Severe: subject to flooding. | Moderate: subject to flooding. | Severe: subject to flooding. | Moderate: subject to flooding. |
| Wilson: WgC | Severe: very slow permeability; somewhat poorly drained. | Moderate: somewhat poorly drained; coarse fragments. | Severe: very slow permeability; somewhat poorly drained. | Moderate: somewhat poorly drained; coarse fragments. |

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have a mild slope, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slope or stoniness that greatly increases cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or on horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have a slope of less than 15 percent, and have few or no rocks or stones on the surface.

## Engineering Uses of the Soils [2]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the soil properties most important in engineering are permeability, shear strength, compressibility, compaction characteristics, soil drainage condition, shrink-swell potential, grain-size distribution, plasticity, and reaction. Depth to the water table, depth to bedrock, and slope are also important. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7 which show, respectively, several estimated soil properties significant to engineering, interpretations for various engineering uses, and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this survey, can be used to make interpretations in addition to those given in tables 5, 6, and 7, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to a greater depth than those shown in the tables, generally a depth greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have different meanings in soil science than in engineering. Many of the terms commonly used in soil science are defined in the Glossary.

### *Engineering classification systems*

The two systems most commonly used in classifying samples of soils for engineering are the Unified soil classification system [3] used by the SCS engineers, Department of Defense, and others, and the AASHTO system [4], adopted by the American Association of State Highway and Transportation Officials.

In the Unified soil classification system soils are classified according to particle-size distribution, plasticity index, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML. The letters used in class designation mean: G, gravel; S, sand; M, silt; and C, clay. Clean sands are identified

[2] JERRY E. HOLLIGAN, area engineer, Soil Conservation Service, assisted in the preparation of this section.

[3] American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487–69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

[4] American Association of State Highway [and Transportation] Officials. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 v., illus. 1970.

TABLE 5.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. fully the instructions for referring to other series that appear in the first column of this table. The symbol

| Soil series and map symbols | Hydrologic group | Depth to bedrock | Depth from surface | Dominant USDA texture | Classification | | Percentage passing sieve— | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Unified | AASHTO | Coarse fraction greater than 3 inches | No. 4 (4.7 mm) |
| | | *In* | *In* | | | | *Pct* | |
| *Arenosa: APC | A | >72 | 0–84 | Fine sand | SM, SP-SM | A–2–4 | | 100 |
| For Patilo part of APC, see Patilo series. | | | | | | | | |
| Behring: BeB, BeC2, BeD2 | D | >72 | 0–8 | Clay loam | CH, CL | A–7–6 | | 100 |
| | | | 8–24 | Clay | CH, CL | A–7–6 | | 100 |
| | | | 24–49 | Clay, clay loam | CH | A–7–6 | | 90–100 |
| | | | 49–60 | Shaly clay | CH | A–7–6 | | 85–100 |
| Bosque: Bo, Bp | B | >72 | 0–25 | Clay loam | CL | A–7–6, A–6 | | 100 |
| | | | 25–60 | Clay loam | CL | A–6 | | 100 |
| Branyon: BrA, BrB | D | >72 | 0–72 | Clay | CH | A–7 | | 95–100 |
| | | | 72–96 | Clay, silty clay, clay loam, loam, gravelly clay, gravelly loam, gravel. | CH, CL, GC, SC | A–2, A–4, A–6, A–7 | 0–10 | 40–100 |
| Brazos variant: Bs | A | >72 | 0–60 | Fine sand | SP, SP-SM | A–2–4, A–3 | | 100 |
| Burleson: BuA, BuB | D | >72 | 0–4 | Clay | CH, CL | A–7–6 | | 85–95 |
| | | | 4–24 | Clay | CH | A–7–6 | | 90–100 |
| | | | 24–54 | Clay | CH | A–7–6 | | 95–100 |
| | | | 54–60 | Clay | CH | A–7–6 | | 95–100 |
| Chaney: CaC, CbB, CcC2, CcD3. | C | >72 | 0–12 | Loamy fine sand, fine sandy loam. | SM, SM-SC | A–2–4 | 0–8 | 85–100 |
| | | | 12–20 | Clay | CH, CL | A–7–6 | | 90–100 |
| | | | 20–30 | Sandy clay | CH, CL | A–7–6 | | 90–100 |
| | | | 30–60 | Sandy clay loam | CL, SC | A–2, A–6, A–7–6 | | 90–100 |
| Crockett: | | | | | | | | |
| CfB, CrC2, CrD3 | D | >72 | 0–12 | Fine sandy loam | ML, SM | A–2–4, A–4 | | 95–100 |
| | | | 12–54 | Clay, sandy clay loam, clay loam. | CH, CL | A–7–6 | | 95–100 |
| | | | 54–60 | Clay, sandy clay loam, clay loam, and weakly cemented shaly clay loam. | CH, CL | A–7–6 | | 95–100 |
| CgC | D | >72 | 0–12 | Fine sandy loam | SM | A–2–4 | | 55–80 |
| | | | 12–60 | Clay, sandy clay loam | CH, CL | A–7–6 | | 95–100 |
| Demona: DeC | C | >72 | 0–26 | Loamy fine sand | SM, SM–SC | A–2–4 | | 90–100 |
| | | | 26–50 | Clay | CH, CL | A–7–6 | | 90–100 |
| | | | 50–60 | Sandy clay loam | SC | A–2–6, A–6 | | 90–100 |
| Ferris | D | >72 | 0–60 | Clay, shaly clay | CH | A–7–6 | | 95–100 |
| Mapped only in a complex with Heiden soils. | | | | | | | | |
| Fett: FeE | D | >72 | 0–14 | Gravelly or very gravelly sandy loam or loamy sand. | GP, GP-GM | A–1, A–2–4 | 0–10 | 12–22 |
| | | | 14–30 | Very gravelly or gravelly clay or sandy clay. | GC | A–2–7 | 0–10 | 30–45 |
| | | | 30–84 | Sandy clay, clay, gravelly clay. | CH | A–7–6 | 0–5 | 90–100 |

*significant in engineering*

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow care-
> means more than; the symbol < means less than. Absence of data indicates that no estimate was made]

| Percentage passing sieve—Continued | | | Liquid limit | Plasticity index | Permeability | Available water capacity | Reaction | Shrink-swell potential | Corrosivity to— | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | Uncoated steel | Concrete |
| | | | | | *In per hr* | *In per in of soil* | *pH* | | | |
| 100 | 70–100 | 10–20 | ------- | [1] NP | >20 | 0.05–0.08 | 6.6–7.3 | Very low ------ | Low ---------- | Low. |
| 95–100 | 90–100 | 75–95 | 41–55 | 20–30 | 0.06–0.2 | 0.15–0.20 | 6.6–8.4 | Moderate ------ | High ---------- | Low. |
| 95–100 | 90–100 | 75–95 | 45–65 | 25–40 | 0.06–0.2 | 0.15–0.20 | 7.9–8.4 | High ---------- | High ---------- | Low. |
| 85–100 | 85–100 | 75–100 | 51–75 | 30–50 | 0.06–0.2 | 0.15–0.20 | 7.9–8.4 | High ---------- | High ---------- | Low. |
| 85–100 | 80–100 | 75–100 | 51–75 | 30–50 | 0.06–0.2 | 0.05–0.10 | 7.9–8.4 | High ---------- | High ---------- | Low. |
| 100 | 80–100 | 60–85 | 30–41 | 11–21 | 0.6–2.0 | 0.14–0.17 | 7.9–8.4 | Low ---------- | High ---------- | Low. |
| 100 | 95–100 | 60–80 | 30–40 | 11–20 | 0.6–2.0 | 0.15–0.17 | 7.9–8.4 | Low ---------- | High ---------- | Low. |
| 75–100 | 80–100 | 75–100 | 60–90 | 35–65 | <0.06 | 0.15–0.18 | 7.9–8.4 | Very high ----- | Very high ----- | Low. |
| 35–100 | 30–100 | 25–100 | 25–90 | 8–65 | 0.06–2.0 | 0.11–0.18 | 7.9–8.4 | High ---------- | Very high ----- | Low. |
| 100 | 90–95 | 0–10 | 15–27 | NP–4 | 6.0–20 | 0.02–0.07 | 6.1–7.3 | Very low ------ | Low ---------- | Low. |
| 85–95 | 85–95 | 75–85 | 41–60 | 25–40 | <0.06 | 0.15–0.20 | 7.4–7.8 | High ---------- | High ---------- | Low. |
| 90–100 | 85–95 | 80–90 | 51–75 | 30–55 | <0.06 | 0.15–0.20 | 7.4–7.8 | Very high ----- | High ---------- | Low. |
| 95–100 | 75–100 | 85–95 | 55–75 | 40–55 | <0.06 | 0.15–0.20 | 7.9–8.4 | Very high ----- | High ---------- | Low. |
| 95–100 | 75–100 | 85–95 | 55–75 | 40–55 | <0.06 | 0.15–0.20 | 7.3–8.4 | Very high ----- | High ---------- | Low. |
| 83–100 | 80–85 | 21–30 | 20–30 | 2–6 | 2.0–6.0 | 0.05–0.10 | 6.1–7.3 | Very low ------ | Moderate ------ | Moderate. |
| 90–100 | 90–100 | 51–85 | 42–65 | 25–45 | 0.06–0.2 | 0.15–0.18 | 5.6–6.5 | Moderate ------ | High ---------- | Moderate. |
| 90–100 | 90–100 | 51–85 | 42–65 | 25–45 | 0.06–0.2 | 0.15–0.18 | 5.6–6.5 | Moderate ------ | High ---------- | Moderate. |
| 90–100 | 80–100 | 30–85 | 25–45 | 15–30 | 0.06–0.2 | 0.15–0.18 | 5.6–6.5 | Moderate ------ | High ---------- | Moderate. |
| 95–100 | 95–100 | 30–62 | 15–25 | NP–3 | 0.6–2.0 | 0.13–0.17 | 6.6–7.3 | Low ---------- | Moderate ------ | Low. |
| 95–100 | 95–100 | 65–85 | 45–55 | 25–36 | <0.06 | 0.14–0.18 | 6.6–8.4 | High ---------- | High ---------- | Low. |
| 95–100 | 95–100 | 65–85 | 45–55 | 25–36 | <0.06 | 0.08–0.14 | 6.6–8.4 | High ---------- | High ---------- | Low. |
| 50–75 | 30–55 | 15–30 | 15–25 | NP–3 | 0.6–2.0 | 0.09–0.12 | 6.6–7.3 | Low ---------- | Moderate ------ | Low. |
| 95–100 | 95–100 | 65–85 | 45–55 | 25–36 | <0.06 | 0.14–0.18 | 6.6–8.4 | High ---------- | High ---------- | Low. |
| 90–100 | 60–95 | 15–30 | 20–30 | 2–6 | 2.0–6.0 | 0.05–0.10 | 6.1–6.5 | Very low ------ | Moderate ------ | Moderate. |
| 90–100 | 90–100 | 50–85 | 42–65 | 30–45 | 0.2–0.6 | 0.15–0.18 | 5.1–6.5 | Moderate ------ | High ---------- | Moderate. |
| 90–100 | 90–100 | 20–40 | 20–35 | 11–20 | 0.2–0.6 | 0.14–0.18 | 5.6–6.0 | Low ---------- | High ---------- | Moderate. |
| 95–100 | 80–95 | 75–95 | 51–70 | 35–50 | <0.06 | 0.15–0.18 | 7.9–8.4 | Very high ----- | High ---------- | Low. |
| 5–15 | 5–15 | 2–12 | 15–20 | 0–5 | 6.0–20 | <0.05 | 5.6–7.3 | Very low ------ | Low ---------- | Low. |
| 15–50 | 15–40 | 15–28 | 50–75 | 40–50 | 0.06–0.2 | 0.08–0.12 | 5.1–7.3 | Low ---------- | High ---------- | Low. |
| 60–100 | 60–98 | 51–96 | 51–85 | 40–61 | <0.06 | 0.18–0.25 | 5.6–8.4 | High ---------- | High ---------- | Low. |

TABLE 5.—*Estimates of soil properties*

| Soil series and map symbols | Hydrologic group | Depth to bedrock | Depth from surface | Dominant USDA texture | Classification | | Percentage passing sieve— | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Unified | AASHTO | Coarse fraction greater than 3 inches | No. 4 (4.7 mm) |
| | | *In* | *In* | | | | *Pct* | |
| Gowen: Go, Gs | B | >72 | 0–14 | Clay loam | CL | A–6, A–7–6 | | 100 |
| | | | 14–20 | Silty clay | CL | A–6 | | 100 |
| | | | 20–26 | Clay loam | CL | A–6 | | 100 |
| | | | 26–50 | Sandy clay loam | CL | A–6 | | 100 |
| *Heiden: HeB, HeC2, HeD2, HhF3, HmB. For Ferris part of HhF3, see Ferris series. For Wilson part of HmB, see Wilson series. | D | >72 | 0–60 | Clay | CH | A–7–6 | | 95–100 |
| HgD | D | >72 | 0–8 | Gravelly clay | CH | A–7–6 | | 70–80 |
| | | | 8–60 | Clay | CH | A–7–6 | | 95–100 |
| Houston Black: HoB, HoC2 | D | >72 | 0–60 | Clay | CH | A–7–6 | | 95–100 |
| HpD | D | >72 | 0–18 | Gravelly clay | CH, SC | A–7–6 | | 50–75 |
| | | | 18–60 | Clay | CH | A–7–6 | | 95–100 |
| Jedd: JsF | C | 20–40 | 0–17 | Gravelly sandy loam, very gravelly sandy loam. | GM, GP-GM GM-GC, SM, SM-SC, SP-SM | A–1, A–2–4 | 5–70 | 45–91 |
| | | | 17–28 | Clay | CL, SC | A–6, A–7–6 | 0–30 | 90–100 |
| | | | 28–60 | Weakly cemented sandstone. | | | | |
| Lewisville: LeA, LeB, LeC2. | B | >72 | 0–24 | Silty clay | CH, CL | A–7–6 | | 98–100 |
| | | | 24–42 | Silty clay loam | CH, CL | A–6, A–7–6 | | 98–100 |
| | | | 42–60 | Clay loam | CH, CL | A–6, A–7–6 | | 100 |
| Mabank: MaA, MaB | D | >72 | 0–7 | Loam | CL, ML, SC, SM, CL-ML, SM-SC | A–4, A–6 | | 95–100 |
| | | | 7–84 | Clay loam, clay, sandy clay, shaly clay. | CH, CL | A–7–6 | | 95–100 |
| Menard variant: MeC | B | >72 | 0–6 | Loam | CL, SC | A–6 | | 95–100 |
| | | | 6–24 | Sandy clay loam | CL, SC | A–6 | | 95–100 |
| | | | 24–120 | Very gravelly loamy fine sand. | GC | A–2–6 | 0–10 | 35–41 |
| Patilo: PaD | C | >72 | 0–50 | Fine sand | SM, SM-SC, SP-SM | A–2–4 | | 95–100 |
| | | | 50–65 | Sandy clay loam, sandy clay. | SC | A–2–4, A–4, A–2–6, A–6 | | 90–100 |
| | | | 65–74 | Fine sandy loam | SC | A–6 | | 100 |

*significant in engineering*—Continued

| Percentage passing sieve—Continued | | | Liquid limit | Plasticity index | Permeability | Available water capacity | Reaction | Shrink-swell potential | Corrosivity to— | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | Uncoated steel | Concrete |
| | | | | | *In per hr* | *In per in of soil* | *pH* | | | |
| 100 | 85–100 | 70–90 | 30–49 | 11–30 | 0.6–2.0 | 0.15–0.20 | 6.6–7.3 | Moderate | Moderate | Low. |
| 100 | 85–100 | 60–80 | 25–40 | 10–25 | 0.6–2.0 | 0.15–0.20 | 6.6–7.3 | Moderate | Moderate | Low. |
| 100 | 85–100 | 65–80 | 35–40 | 11–25 | 0.6–2.0 | 0.15–0.20 | 6.6–8.4 | Moderate | Moderate | Low. |
| 100 | 85–100 | 70–80 | 30–40 | 10–25 | 0.6–2.0 | 0.15–0.20 | 6.6–8.4 | Moderate | Moderate | Low. |
| 95–100 | 80–100 | 75–100 | 55–80 | 40–55 | <0.06 | 0.15–0.20 | 7.9–8.4 | Very high | High | Low. |
| 70–75 | 65–75 | 51–70 | 55–80 | 40–55 | <0.06 | 0.12–0.15 | 7.9–8.4 | Very high | High | Low. |
| 95–100 | 80–100 | 75–100 | 55–80 | 40–55 | <0.06 | 0.15–0.20 | 7.9–8.4 | Very high | High | Low. |
| 95–100 | 95–100 | 85–100 | 55–110 | 35–90 | <0.06 | 0.15–0.20 | 7.5–8.4 | Very high | High | Low. |
| 50–75 | 45–75 | 40–70 | 55–110 | 35–90 | <0.06 | 0.10–0.14 | 7.5–8.4 | Very high | High | Low. |
| 95–100 | 95–100 | 85–100 | 55–110 | 35–90 | <0.06 | 0.15–0.20 | 7.5–8.4 | Very high | High | Low. |
| 35–90 | 25–87 | 6–23 | 15–30 | 2–6 | 0.6–2.0 | 0.04–0.14 | 5.6–7.3 | Low | Moderate | Moderate. |
| 90–100 | 70–98 | 45–60 | 36–48 | 15–28 | 0.2–0.6 | 0.13–0.17 | 4.5–6.0 | Moderate | High | Moderate. |
| 98–100 | 70–98 | 70–86 | 41–65 | 25–40 | 0.6–2.0 | 0.16–0.20 | 7.9–8.4 | High | High | Low. |
| 95–100 | 65–90 | 65–85 | 35–55 | 20–35 | 0.6–2.0 | 0.16–0.20 | 7.9–8.4 | High | High | Low. |
| 95–100 | 65–90 | 70–90 | 35–55 | 20–35 | 0.6–2.0 | 0.16–0.20 | 7.9–8.4 | High | High | Low. |
| 95–100 | 80–99 | 40–70 | 26–30 | NP–14 | 0.6–2.0 | 0.10–0.15 | 6.1–7.3 | Low | Moderate | Low. |
| 95–100 | 95–100 | 55–85 | 42–65 | 25–40 | <0.06 | 0.12–0.16 | 6.1–7.8 | High | High | Low. |
| 95–100 | 95–100 | 40–60 | 21–35 | 11–20 | 2.0–6.0 | 0.11–0.17 | 7.9–8.4 | Low | Low | Low. |
| 95–100 | 80–100 | 40–60 | 30–40 | 12–22 | 0.6–2.0 | 0.12–0.17 | 7.9–8.4 | Low | High | Low. |
| 27–38 | 20–30 | 15–25 | 30–40 | 15–25 | 2.0–6.0 | 0.08–0.14 | 7.9–8.4 | Low | Low | Low. |
| 95–100 | 89–100 | 8–20 | 20–25 | 2–6 | 6.0–20 | 0.05–0.08 | 6.6–7.3 | Very low | Low | Moderate. |
| 90–100 | 90–100 | 25–50 | 20–35 | 9–20 | 0.2–0.6 | 0.14–0.18 | 5.1–5.5 | Low | Low | Moderate. |
| 100 | 95–100 | 40–50 | 35–40 | 11–20 | 0.6–2.0 | 0.10–0.15 | 5.1–5.5 | Low | Low | Moderate. |

TABLE 5.—*Estimates of soil properties*

| Soil series and map symbols | Hydrologic group | Depth to bedrock | Depth from surface | Dominant USDA texture | Classification | | Percentage passing sieve— | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Unified | AASHTO | Coarse fraction greater than 3 inches | No. 4 (4.7 mm) |
| | | *In* | *In* | | | | *Pct* | |
| Queeny: QuC, QuF | D | 5–12 | 0–7 | Gravelly loam | CL, SC | A–6, A–7 | | 60–95 |
| | | | 7–72 | Strongly cemented gravel beds. | GC, GW-GC, GM, GW-GM, GM-GC | A–2–4, A–2–6 | | 25–42 |
| Rosanky: RoD | C | 60–80 | 0–18 | Loamy fine sand | SM, SM-SC | A–2–4, A–4 | 0–2 | 80–95 |
| | | | 18–34 | Clay | CL | A–6, A–7 | 0–2 | 85–100 |
| | | | 34–68 | Sandy clay loam, fine sandy loam. | CL, SC, ML, SM | A–4, A–6 | | 85–100 |
| | | | 68–74 | Weakly consolidated sandstone. | | | | |
| Seawillow: SeB, SeD2 | B | >72 | 0–22 | Clay loam | CL | A–6, A–7–6 | | 95–100 |
| | | | 22–54 | Loam | CL, CL-ML | A–4, A–6 | | 90–100 |
| Seguin: Sg | B | >72 | 0–84 | Loam | CL | A–6, A–7–6 | | 95–100 |
| Silstid: ShC | A | >72 | 0–37 | Fine sand | SM | A–2–4 | | 95–100 |
| | | | 37–52 | Sandy clay loam | CL, SC | A–2–4, A–4, A–2–6, A–6 | | 95–100 |
| | | | 52–84 | Sandy clay loam | CL, SC | A–2–4, A–4, A–2–6, A–6 | | 95–100 |
| Trinity: Tr, Ts | D | >72 | 0–60 | Clay, silty clay | CH | A–7–6 | | 100 |
| Uhland: Us | B | >72 | 0–60 | Clay loam, fine sandy loam. | CL, CL-ML, SM-SC, SC | A–4, A–6 | | 95–100 |
| Wilson: WgC | D | >72 | 0–15 | Gravelly loam | CL, SC | A–4, A–6, A–7 | 0–5 | 50–85 |
| | | | 15–60 | Clay | CH, CL | A–7–6 | | 95–100 |

[1] NP = nonplastic.

by SW or SP; sands with fines of silt and clay by SM or SC; silt and clay that have a low liquid limit by ML and CL; and silt and clay that have a high liquid limit by MH and CH.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 7; the estimated classification, without group index numbers, is given in table 5 for all soils mapped in the survey area.

*significant in engineering*—Continued

| Percentage passing sieve—Continued | | | Liquid limit | Plasticity index | Permeability | Available water capacity | Reaction | Shrink-swell potential | Corrosivity to— | |
|---|---|---|---|---|---|---|---|---|---|---|
| No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | | | | | | | Uncoated steel | Concrete |
| | | | | | *In per hr* | *In per in of soil* | *pH* | | | |
| 60–75 | 50–70 | 40–55 | 30–49 | 12–24 | 0.6–2.0 | 0.11–0.13 | 7.4–8.4 | Low | Moderate | Low. |
| 17–27 | 10–20 | 5–15 | 21–30 | NP–15 | 2.0–6.0 | | 7.4–8.4 | Very low | Low | Low. |
| 75–90 | 75–85 | 32–42 | 20–27 | 2–5 | 0.6–2.0 | 0.08–0.11 | 6.1–7.3 | Very low | Moderate | Low. |
| 85–100 | 80–100 | 62–72 | 38–48 | 20–26 | 0.2–0.6 | 0.11–0.17 | 5.1–6.0 | Moderate | Moderate | Moderate. |
| 85–100 | 80–100 | 36–60 | 29–40 | 4–19 | 0.2–0.6 | 0.10–0.16 | 5.1–6.5 | Low | Moderate | Moderate. |
| 90–100 | 90–100 | 51–70 | 29–45 | 15–30 | 0.6–2.0 | 0.12–0.20 | 7.9–8.4 | Moderate | Moderate | Low. |
| 90–100 | 85–97 | 51–74 | 20–35 | 5–15 | 0.6–2.0 | 0.12–0.18 | 7.9–8.4 | Low | Moderate | Low. |
| 90–100 | 90–100 | 75–95 | 34–44 | 15–25 | 0.6–2.0 | 0.14–0.17 | 7.9–8.4 | Moderate | Moderate | Low. |
| 95–100 | 85–96 | 15–25 | 18–22 | 1–3 | 6.0–20 | 0.05–0.10 | 6.1–6.5 | Low | Low | Moderate. |
| 95–100 | 80–98 | 30–55 | 20–35 | 9–22 | 0.6–2.0 | 0.12–0.17 | 5.6–6.0 | Low | Moderate | Moderate. |
| 85–100 | 70–95 | 22–55 | 20–35 | 15–22 | 0.6–2.0 | 0.10–0.16 | 5.6–6.0 | Low | Moderate | Moderate. |
| 98–100 | 85–100 | 80–95 | 51–60 | 30–40 | <0.06 | 0.15–0.20 | 7.9–8.4 | Very high | Very high | Low. |
| 90–100 | 90–100 | 45–90 | 15–40 | 4–15 | 0.2–0.6 | 0.10–0.14 | 6.1–8.4 | Low | Moderate | Low. |
| 45–85 | 50–81 | 45–70 | 25–46 | 9–29 | 0.2–0.6 | 0.15–0.20 | 6.6–7.3 | Low | High | Moderate. |
| 95–100 | 95–100 | 70–90 | 41–56 | 25–37 | <0.06 | 0.15–0.20 | 6.6–7.8 | High | High | Moderate. |

***Estimated soil properties significant to engineering***

Several estimated soil properties significant to engineering are given in table 5. These estimates are made for typical soil profiles, by layers sufficiently different to behave in a different way when used for engineering purposes. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. In the following paragraphs the columns in table 5 are explained.

In the column headed "Hydrologic group," the runoff potential from rainfall is given. Four major soil groups are used, and the soils are classified on the basis of intake of water at the end of long-duration storms that occur after prior wetting and opportunity for swelling and without the protective effects of vegetation.

The major soil groups are described in the following paragraphs.

Group A consists of soils that have a high infiltration rate even when thoroughly wetted. These are chiefly deep, well-drained to excessively drained sand, gravel, or both. These soils have a high rate of water transmission and a low runoff potential.

Group B consists of soils that have a moderate infil-

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. the instructions for referring to other series

| Soil series and map symbols | Degree and kind of limitation for— | | | | | |
|---|---|---|---|---|---|---|
| | Septic tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill [1] | Local roads and streets |
| *Arenosa: APC<br>For Patilo part of APC, see Patilo series. | Slight: very rapid permeability; contamination hazard to water supplies in places. | Severe: very rapid permeability. | Severe: fine sand. | Slight | Severe: fine sand; very rapid permeability. | Slight |
| Behring: BeB, BeC2, BeD2 | Severe: slow permeability. | Moderate: slope. | Severe: clay. | Severe: high shrink-swell potential. | Severe: clay. | Severe: high shrink-swell potential; low strength. |
| Bosque: Bo, Bp | Severe: subject to flooding. | Moderate: moderate permeability. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. |
| Branyon: BrA, BrB | Severe: very slow permeability. | Slight | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| Brazos variant: Bs | Severe: subject to flooding. | Severe: rapid permeability; subject to flooding. | Severe: fine sand; subject to flooding. | Severe: subject to flooding. | Severe: rapid permeability; subject to flooding. | Severe: subject to flooding. |
| Burleson: | | | | | | |
| BuA | Severe: very slow permeability. | Slight | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| BuB | Severe: very slow permeability. | Moderate: slope. | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| Chaney: CaC, CbB, CcC2, CcD3. | Severe: slow permeability. | Moderate: slope. | Moderate: sandy clay. | Moderate: moderate shrink-swell potential. | Severe: restricted drainage. | Severe: low strength. |
| Crockett: CfB, CgC, CrC2, CrD3. | Severe: very slow permeability. | Moderate: slope. | Moderate: clay. | Severe: high shrink-swell potential. | Severe: clay. | Severe: high shrink-swell potential. |

*interpretations of the soils*

The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully that appear in the first column of this table]

| Degree and kind of limitation for—Continued | | Suitability as a source of— | | | Soil features affecting— | | |
|---|---|---|---|---|---|---|---|
| Pond reservoir areas | Dikes, levees, and other embankments | Road fill | Sand | Topsoil | Drainage for crops and pastures | Irrigation | Terraces and diversions |
| Severe: very rapid permeability. | Severe: high permeability; medium to high resistance to piping. | Good | Fair: excessive fines. | Poor: fine sand. | Well drained | Very rapid infiltration rate; low available water capacity. | Fine sand. |
| Slight | Moderate: fair slope stability; high compressibility. | Poor: high shrink-swell potential. | Unsuitable | Fair: clay loam; thickness of suitable material. | Moderately well drained. | Slow infiltration rate; high available water capacity. | No adverse features. |
| Moderate | Moderate: fair slope stability; high compressibility. | Fair: low strength. | Unsuitable | Good | Well drained; subject to flooding. | Moderate infiltration rate; high available water capacity. | Subject to flooding. |
| Slight | Moderate: fair slope stability; high compressibility. | Poor: very high shrink-swell potential; poor stability. | Unsuitable | Poor: clay | Moderately well drained. | Very slow infiltration rate; high available water capacity. | Clay. |
| Severe: rapid permeability. | Severe: high permeability; medium to high resistance to piping. | Good | Fair: poorly graded. | Poor: fine sand. | Excessively drained. | Rapid infiltration rate; very low available water capacity. | Fine sand; subject to flooding. |
| Slight | Moderate: fair slope stability. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Moderately well drained. | Very slow infiltration rate; high available water capacity. | No adverse features. |
| Slight | Moderate: fair slope stability. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Moderately well drained. | Very slow infiltration rate; high available water capacity. | No adverse features. |
| Slight | Moderate: fair resistance to piping and erosion. | Poor: low strength. | Unsuitable | Poor: loamy fine sand. | Moderately well drained. | Slow infiltration rate; moderate available water capacity. | Loamy fine sand; slope. |
| Slight | Moderate: fair to poor compaction characteristics. | Poor: high shrink-swell potential. | Unsuitable | Poor: clay; coarse fragments. | Well drained to moderately well drained. | Slope; very slow infiltration rate. | Slope. |

TABLE 6.—*Engineering*

| Soil series and map symbols | Degree and kind of limitation for— | | | | | |
|---|---|---|---|---|---|---|
| | Septic tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill [1] | Local roads and streets |
| Demona: DeC | Severe: moderately slow permeability. | Severe: seepage; moderately rapid permeability of surface layer. | Severe: loamy fine sand. | Moderate: low strength. | Moderate: loamy fine sand. | Moderate: low strength. |
| Ferris<br>Mapped only in a complex with Heiden soils. | Severe: very slow permeability. | Severe: slope. | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| Fett: FeE | Severe: very slow permeability. | Severe: coarse fragments. | Severe: somewhat poorly drained. | Severe: low strength. | Moderate: somewhat poorly drained. | Moderate: somewhat poorly drained. |
| Gowen: Go, Gs | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. |
| *Heiden: | | | | | | |
| HeB, HeC2, HeD2, HmB<br>For Wilson part of HmB, see Wilson series. | Severe: very slow permeability. | Moderate: slope. | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| HgD, HhF3<br>For Ferris part of HhF3, see Ferris series. | Severe: very slow permeability. | Severe: slope; coarse fragments. | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| Houston Black: | | | | | | |
| HoB | Severe: very slow permeability. | Slight | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| HoC2, HpD | Severe: very slow permeability. | Moderate: slope; coarse fragments. | Severe: clay. | Severe: very high shrink-swell potential. | Severe: clay. | Severe: very high shrink-swell potential. |
| Jedd: JsF | Severe: moderately slow permeability; bedrock at a depth of 20 to 40 inches. | Severe: bedrock at a depth of 20 to 40 inches; coarse fragments. | Severe: bedrock at a depth of 20 to 40 inches; stony. | Severe: stony. | Severe: bedrock at a depth of 20 to 40 inches; stony. | Severe: stony. |
| Lewisville: LeA, LeB, LeC2 | Moderate: moderate permeability. | Moderate: moderate permeability; slope. | Moderate: clay loam. | Severe: high shrink-swell potential. | Moderate: clay loam. | Severe: high shrink-swell potential. |

*interpretations of the soils*—Continued

| Degree and kind of limitation for—Continued | | Suitability as a source of— | | | Soil features affecting— | | |
|---|---|---|---|---|---|---|---|
| Pond reservoir areas | Dikes, levees, and other embankments | Road fill | Sand | Topsoil | Drainage for crops and pastures | Irrigation | Terraces and diversions |
| Moderate: moderately slow permeability. | Moderate: erodibility. | Poor: low strength. | Fair: excessive fines. | Poor: loamy fine sand. | Moderately well drained. | Slope; erodible. | Erodible. |
| Slight | Moderate: fair slope stability. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Well drained | Slope; very slow infiltration rate. | Excessive slope. |
| Slight | Moderate: fair slope stability. | Fair: thickness of material. | Unsuitable | Poor: gravelly. | Somewhat poorly drained; very slow permeability in substrata. | Slope | Coarse fragments; slope. |
| Moderate: moderate permeability. | Moderate: high compressibility. | Fair: low strength. | Unsuitable | Fair: clay loam. | Well drained | Subject to flooding. | Subject to flooding. |
| Slight | Moderate: fair compaction characteristics; shear strength. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Well drained | Slope; very slow infiltration rate. | Clay. |
| Slight | Moderate: fair compaction characteristics; shear strength. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Well drained | Slope | Clay; slope. |
| Slight | Moderate: fair compaction characteristics; shear strength. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Moderately well drained. | Very slow infiltration rate. | Clay. |
| Slight | Moderate: fair compaction characteristics; shear strength. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Moderately well drained. | Slope; erodible. | Clay; slope. |
| Severe: bedrock at a depth of 20 to 40 inches. | Moderate: poor resistance to piping and erosion; fair slope stability. | Poor: thickness of material. | Unsuitable | Poor: coarse fragments. | Well drained | Coarse fragments; stony; slope. | Coarse fragments; stony; slope. |
| Moderate: moderate permeability. | Moderate: fair slope stability. | Poor: high shrink-swell potential. | Unsuitable | Poor: silty clay. | Well drained | No adverse features. | No adverse features. |

TABLE 6.—*Engineering*

| Soil series and map symbols | Degree and kind of limitation for— | | | | | |
|---|---|---|---|---|---|---|
| | Septic tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill [1] | Local roads and streets |
| Mabank: MaA, MaB | Severe: very slow permeability. | Slight | Severe: clay; somewhat poorly drained. | Severe: high shrink-swell potential; somewhat poorly drained. | Severe: clay. | Severe: high shrink-swell potential; low strength. |
| Menard variant: MeC | Slight | Severe: moderately rapid permeability below a depth of 24 inches. | Severe: very gravelly sand below a depth of 24 inches. | Slight | Severe: very gravelly below a depth of 24 inches. | Slight |
| Patilo: PaD | Severe: moderately slow permeability. | Severe: seepage; rapid permeability of surface layer. | Severe: instability of sidewall. | Slight | Severe: fine sand. | Slight |
| Queeny: QuC, QuF | Severe: strongly cemented gravel beds at a depth of 5 to 12 inches; contamination hazard. | Severe: strongly cemented gravel beds at a depth of 5 to 12 inches. | Moderate: strongly cemented gravel beds at a depth of 5 to 12 inches. | Slight | Severe: strongly cemented gravel beds at a depth of 5 to 12 inches; contamination hazard. | Moderate: strongly cemented gravel beds at a depth of 5 to 12 inches. |
| Rosanky: RoD | Severe: moderately slow permeability. | Moderate: slope. | Slight | Moderate: moderate shrink-swell potential. | Slight | Moderate: moderate shrink-swell potential. |
| Seawillow: | | | | | | |
| SeB | Slight | Slight | Slight | Moderate: moderate shrink-swell potential. | Slight | Moderate: moderate shrink-swell potential. |
| SeD2 | Slight | Moderate: slope. | Slight | Moderate: moderate shrink-swell potential. | Slight | Moderate: moderate shrink-swell potential. |
| Seguin: Sg | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. |
| Silstid: ShC | Slight | Moderate: moderate permeability. | Moderate: fine sand. | Slight | Slight | Slight |

*interpretations of the soils*—Continued

| Degree and kind of limitation for—Continued | | Suitability as a source of— | | | Soil features affecting— | | |
|---|---|---|---|---|---|---|---|
| Pond reservoir areas | Dikes, levees, and other embankments | Road fill | Sand | Topsoil | Drainage for crops and pastures | Irrigation | Terraces and diversions |
| Slight | Moderate: fair compaction characteristics; shear strength. | Poor: high shrink-swell potential. | Unsuitable | Poor: thickness of loam material. | Somewhat poorly drained; seasonal wetness. | Somewhat poorly drained. | No adverse features. |
| Severe: very gravelly loamy fine sand and moderately rapid permeability below a depth of 24 inches. | Slight | Fair: low strength. | Unsuitable | Poor: thickness of loam material. | Well drained | High infiltration rate; moderate available water capacity. | Very gravelly subsurface material. |
| Severe: seepage; rapid permeability of surface layer. | Severe: poor resistance to piping and erosion. | Good | Fair: excessive fines. | Poor: fine sand. | Moderately well drained. | Very high infiltration rate; low available water capacity. | Fine sand; erodible. |
| Severe: strongly cemented gravel beds at a depth of 5 to 12 inches. | Severe: 5 to 12 inches of borrow material. | Good | Unsuitable | Poor: thickness of gravelly loam material. | Well drained | 5 to 12 inches of gravelly surface soil; very low available water capacity. | Strongly cemented gravel beds at a depth of 5 to 12 inches. |
| Moderate: moderately slow permeability. | Moderate: fair to good compaction characteristics. | Fair: low strength. | Unsuitable | Poor: loamy fine sand. | Well drained | Moderate available water capacity; undulating topography. | Loamy fine sand; undulating topography. |
| Severe: permeable substrata; calcareous material. | Moderate: poor resistance to piping and erosion. | Fair: moderate shrink-swell potential. | Unsuitable | Poor: clay loam to a depth of 6 to 8 inches. | Well drained | Moderate available water capacity. | High content of lime in substratum. |
| Severe: permeable substrata; calcareous material. | Moderate: poor resistance to piping and erosion. | Fair: moderate shrink-swell potential. | Unsuitable | Poor: clay loam to a depth of 6 to 8 inches. | Well drained | Slope | Slope; high content of lime in substratum. |
| Severe: permeable substrata; calcareous material. | Moderate: fair resistance to piping and erosion; medium compressibility. | Fair: low strength. | Unsuitable | Good | Well drained | Subject to flooding. | Subject to flooding. |
| Moderate: moderate permeability. | Moderate: fair resistance to piping and erosion. | Good | Poor: excessive fines. | Poor: fine sand. | Well drained | High infiltration rate; slope. | Fine sand; difficult to grow plants. |

TABLE 6.—*Engineering*

| Soil series and map symbols | Degree and kind of limitation for— | | | | | |
|---|---|---|---|---|---|---|
| | Septic tank absorption fields | Sewage lagoons | Shallow excavations | Dwellings without basements | Sanitary landfill [1] | Local roads and streets |
| Trinity: Tr, Ts | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding; very high shrink-swell potential. |
| Uhland: Us | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. | Severe: subject to flooding. |
| Wilson: WgC | Severe: very slow permeability. | Moderate: slope. | Severe: somewhat poorly drained. | Severe: high shrink-swell potential. | Severe: clay. | Severe: high shrink-swell potential. |

[1] Onsite studies of the underlying strata, water table, and hazards of aquifer pollution and drainage into ground water need

tration rate when thoroughly wetted. These are chiefly moderately deep to deep, moderately well drained to well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission and a moderate runoff potential.

Group C consists of soils that have a slow infiltration rate when thoroughly wetted. These are chiefly clay soils that have a layer that impedes downward movement of water or soils that have moderately fine texture to fine texture. These soils have a slow rate of water transmission and a high runoff potential.

Group D consists of soils that have a very slow infiltration rate when thoroughly wetted. These are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission and a very high runoff potential.

Depth to bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

In the column headed "Depth from surface," the depth is given in inches for the major distinctive layers of the soil profile.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years. This column was not included in table 5, since a seasonal high water table is not a limitation except in the Demona and Mabank soils, which have a temporary perched water table, and in the Uhland soils, which have a water table at a depth of 20 inches during spring.

Soil texture is described in table 5 in the standard terms used by the U.S. Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and other terms used in USDA textural classification are defined in the Glossary.

The percentages of soil material passing the four sizes of sieves are given as the range of material passing the sieves. This information is useful in helping to determine suitability of the soil as a material for construction purposes.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it

*interpretations of the soils*—Continued

| Degree and kind of limitation for—Continued | | Suitability as a source of— | | | Soil features affecting— | | |
|---|---|---|---|---|---|---|---|
| Pond reservoir areas | Dikes, levees, and other embankments | Road fill | Sand | Topsoil | Drainage for crops and pastures | Irrigation | Terraces and diversions |
| Slight | Moderate: fair slope stability; high compressibility. | Poor: very high shrink-swell potential. | Unsuitable | Poor: clay | Moderately well drained; very slow permeability. | Very slow infiltration rate; subject to flooding. | Clay. |
| Moderate: moderately slow permeability. | Moderate: fair slope stability; high compressibility; fair resistance to piping and erosion. | Fair: somewhat poorly drained. | Unsuitable | Fair: clay loam. | Somewhat poorly drained; water table at a depth of 20 inches during spring. | Subject to flooding. | Subject to flooding. |
| Slight | Moderate: fair slope stability; high compressibility. | Poor: high shrink-swell potential. | Unsuitable | Poor: coarse fragments. | Somewhat poorly drained. | Very slow infiltration rate; coarse fragments; slope. | Coarse fragments; slope. |

to be made for landfill more than 5 or 6 feet deep.

to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts. These ratings are not to be construed as the permeability coefficient, or *k*-value, used by engineers.

Available water capacity is the ability of a soil to hold water for use by most plants. It is commonly defined as the numerical difference between the amount of water in the soil at field capacity and the amount of water at the time most crop plants wilt. The rate is expressed as inches of water per inch of soil depth.

Reaction is the degree of acidity or alkalinity of a soil expressed as pH. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluble salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25° C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete. Salinity is no hazard in Caldwell County, and this column was not included in table 5.

Shrink-swell potential is the relative change in volume to be expected of the soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or of material having this rating.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate as well as by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that the probability of soil-induced corrosion damage is low. A rating of *high* means that the probability of damage is high, so that protective measures for steel and a more resistant type of concrete should be used to avoid or minimize damage.

Subsidence is settlement of organic soils or of soils containing semifluid mineral layers. Ratings for subsidence take into account (1) rapid initial loss of elevation resulting from drainage and lowering of the level of the ground water and (2) later and slower loss of elevation that results from oxidation of organic materials. The maximum possible loss of surface elevation is called *potential subsidence*. Subsidence is no hazard in soils in Caldwell County, and this column was not included in the table.

### *Engineering interpretations*

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby

TABLE 7.—*Soil*

[Tests performed by the Texas Highway Department, Austin,

| Soil name and location | Parent material | Texas report number | Depth from surface | Shrinkage | | |
|---|---|---|---|---|---|---|
| | | | | Limit | Lineal | Ratio |
| | | | *In* | *Pct* | *Pct* | |
| Behring clay loam: 1.75 miles southeast of Lytton Springs on Farm Road 1854, then 0.25 mile northeast of the road, in a pasture. (Modal) | Calcareous clays | 69–452R | 0–8 | 13 | 14.4 | 1.92 |
| | | 69–453R | 8–24 | 15 | 15.7 | 1.94 |
| | | 69–454R | 24–38 | 12 | 18.7 | 1.99 |
| | | 69–455R | 38–49 | 14 | 19.9 | 1.95 |
| | | 69–456R | 49–60 | 15 | 20.4 | 1.87 |
| Brazos fine sand, siliceous variant: 1 mile west on Farm Road 713 from its intersection with Texas Highway 304, then 3,600 feet south of the road, in a pasture. (Modal) | Sandy alluvium | 68–396R | 0–18 | 21 | 0 | 1.67 |
| | | 68–397R | 18–60 | 22 | 0 | 1.65 |
| Burleson clay: 5.2 miles south on Farm Road 20 from its intersection with U.S. Highway 183 in Lockhart, then 100 feet west of the road, in a cultivated field. (Modal) | Marl of Cretaceous age | 70–420R | 0–4 | 14 | 14.5 | 1.98 |
| | | 70–421R | 4–24 | 12 | 20.1 | 2.02 |
| | | 70–422R | 24–42 | 11 | 21.0 | 2.02 |
| | | 70–423R | 42–54 | 12 | 20.7 | 2.02 |
| | | 70–424R | 54–60 | 12 | 19.8 | 2.08 |
| Chaney loamy fine sand: 2.5 miles north on Farm Road 671 from its intersection with U.S. Highway 80 in Stairtown, then 0.5 mile southeast on a county road, then 0.8 mile west of the road, in a field. (Modal) | Acid sandy clays | 70–285R | 0–6 | 22 | 1.2 | 1.60 |
| | | 70–286R | 6–12 | 15 | 17.6 | 1.82 |
| | | 70–287R | 12–24 | 16 | 15.4 | 1.83 |
| | | 70–288R | 24–30 | 17 | 13.3 | 1.82 |
| | | 70–289R | 30–56 | 20 | 9.5 | 1.72 |
| | | 70–290R | 56–84 | 24 | 5.1 | 1.59 |
| Crockett fine sandy loam: 5.4 miles northeast on Farm Road 672 from its intersection with U.S. Highway 183 in Lockhart, then 50 feet east of the road, in a pasture. (Modal) | Alkaline clays | 70–414R | 0–12 | 18 | 2.0 | 1.73 |
| | | 70–415R | 12–18 | 13 | 18.0 | 1.95 |
| | | 70–416R | 18–24 | 13 | 17.5 | 1.96 |
| | | 70–417R | 24–38 | 13 | 17.6 | 1.98 |
| | | 70–418R | 38–54 | 14 | 17.6 | 1.98 |
| | | 70–419R | 54–60 | 16 | 15.7 | 1.79 |
| Fett gravelly sandy loam: 5 miles north on U.S. Highway 183 from its intersection with Farm Road 1322 in Luling, then 1.7 miles east on a county road, then 400 feet north of the road, in a pasture. (Modal) | Acid sandy clays | 70–291R | 0–17 | 14 | 2.6 | 1.88 |
| | | 70–292R | 17–42 | 13 | 23.4 | 1.96 |
| | | 70–293R | 42–72 | 11 | 26.4 | 2.05 |
| Gowen clay loam: 2.5 miles south of McMahan on Farm Road 3158, then 1.5 miles west of the road, in the Tenny Creek bottom. (Modal) | Clayey alluvium | 69–316R | 0–8 | 15 | 15.4 | 1.92 |
| | | 69–317R | 8–15 | 14 | 15.1 | 1.91 |
| | | 69–318R | 15–27 | 15 | 11.2 | 1.89 |
| | | 69–319R | 27–48 | 16 | 9.8 | 1.86 |
| Heiden clay: about 3.8 miles southeast of Martindale on U.S. Highway 80 to its junction with Farm Road 1977, then 2,800 feet east of the junction, in a cultivated field. (Modal) | Marl of Cretaceous age | 68–435R | 0–20 | 12 | 22.8 | 2.02 |
| | | 68–436R | 20–36 | 13 | 22.8 | 2.01 |
| | | 68–437R | 36–60 | 12 | 24.5 | 1.98 |
| Jedd gravelly sandy loam: 4.1 miles south of McMahan on Farm Road 3158, then 1 mile south on a county road, then 2.9 miles southeast on another county road, then 200 feet west of the road, in a pasture. (Modal) | Acid sandy clay loam | 70–307R | 0–12 | 15 | 1.0 | 1.87 |
| | | 70–308R | 12–24 | 18 | 10.5 | 4.76 |

*test data*

Texas. Unified and AASHTO classifications made by SCS personnel]

| Mechanical analysis[1] | | | | | | | | | | | Liquid limit | Plasticity index | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage passing sieve— | | | | | | | | Percentage smaller than— | | | | | | |
| 1¼ inch | ⅞ inch | ⅝ inch | ⅜ inch | No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | 0.05 mm | 0.005 mm | 0.002 mm | | | AASHTO[2] | Unified[3] |
| | | | | | | | | | | | *Pct* | | | |
| ----- | ----- | ----- | ----- | 100 | 98 | 97 | 88 | 79 | 40 | 35 | 44 | 25 | A-7-6(15) | CL |
| ----- | ----- | ----- | ----- | 100 | 99 | 98 | 91 | 85 | 46 | 41 | 50 | 29 | A-7-6(18) | CL-CH |
| ----- | ----- | ----- | 100 | 99 | 97 | 94 | 89 | 84 | 49 | 44 | 55 | 34 | A-7-6(19) | CH |
| ----- | 100 | 98 | 95 | 93 | 90 | 88 | 86 | 82 | 47 | 39 | 63 | 42 | A-7-6(20) | CH |
| ----- | ----- | 100 | 99 | 98 | 98 | 97 | 96 | 91 | 52 | 45 | 68 | °45 | A-7-6(20) | CH |
| ----- | ----- | ----- | ----- | ----- | 100 | 93 | 5 | 4 | 1 | 0 | 23 | 2 | A-2-4(0) | SP-SM |
| ----- | ----- | ----- | ----- | ----- | 100 | 92 | 2 | 1 | 0 | ----- | 24 | 2 | A-2-4(0) | SP |
| 100 | 96 | 94 | 93 | 92 | 92 | 91 | 78 | 67 | 36 | 30 | 45 | 28 | A-7-6(16) | CL |
| 100 | 94 | 94 | 94 | 96 | 94 | 93 | 84 | 77 | 51 | 42 | 60 | 41 | A-7-6(20) | CH |
| ----- | ----- | ----- | ----- | 99 | 98 | 97 | 88 | 83 | 53 | 47 | 62 | 43 | A-7-6(20) | CH |
| ----- | ----- | ----- | ----- | 99 | 98 | 96 | 87 | 81 | 51 | 43 | 61 | 44 | A-7-6(20) | CH |
| ----- | ----- | ----- | ----- | 100 | 99 | 96 | 86 | 81 | 51 | 43 | 58 | 40 | A-7-6(20) | CH |
| 100 | 92 | 91 | 87 | 86 | 83 | 82 | 21 | 15 | 7 | 4 | 23 | 4 | A-2-4(0) | SM-SC |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 70 | 66 | 63 | 60 | 58 | 32 | A-7-6(18) | CH |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 66 | 62 | 57 | 55 | 52 | 28 | A-7-6(15) | CH |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 57 | 54 | 47 | 45 | 46 | 26 | A-7-6(11) | CL |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 44 | 41 | 33 | 31 | 40 | 22 | A-6(6) | SC |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 30 | 28 | 22 | 20 | 35 | 15 | A-2-6(1) | SC |
| ----- | ----- | ----- | ----- | ----- | ----- | 99 | 62 | 43 | 14 | 11 | 22 | 3 | A-4(5) | ML |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 80 | 71 | 51 | 46 | 54 | 34 | A-7-6(19) | CH |
| ----- | ----- | ----- | ----- | ----- | 99 | 99 | 80 | 70 | 51 | 45 | 53 | 36 | A-7-6(18) | CH |
| ----- | ----- | ----- | ----- | ----- | ----- | 99 | 80 | 67 | 46 | 42 | 52 | 36 | A-7-6(18) | CH |
| ----- | ----- | ----- | ----- | 99 | 99 | 98 | 80 | 69 | 46 | 39 | 53 | 36 | A-7-6(18) | CH |
| ----- | ----- | ----- | ----- | ----- | 99 | 98 | 85 | 74 | 42 | 34 | 54 | 35 | A-7-6(19) | CH |
| [4]79 | 58 | 44 | 31 | 17 | 11 | 9 | 4 | 4 | 2 | 1 | 18 | 5 | A-1-a(0) | GP |
| [4]69 | 59 | 48 | 40 | 34 | 31 | 38 | 23 | 22 | 20 | 19 | 75 | 46 | A-2-7(1) | GC |
| ----- | ----- | ----- | ----- | ----- | 100 | 98 | 96 | 94 | 67 | 58 | 84 | 61 | A-7-6(20) | CH |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 100 | 89 | 85 | 51 | 42 | 49 | 30 | A-7-6(18) | CL |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 100 | 89 | 84 | 49 | 40 | 47 | 27 | A-7-6(17) | CL |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | ----- | 80 | 72 | 46 | 31 | 38 | 22 | A-6(13) | CL |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 100 | 79 | 70 | 34 | 29 | 35 | 21 | A-6(12) | CL |
| ----- | ----- | 100 | 99 | 99 | 98 | 97 | 96 | 91 | 66 | 56 | 71 | 48 | A-7-6(20) | CH |
| ----- | ----- | ----- | 100 | 99 | 99 | 98 | 95 | 92 | 65 | 53 | 72 | 48 | A-7-6(20) | CH |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 99 | 97 | 66 | 57 | 79 | 53 | A-7-6(20) | CH |
| [4]93 | 84 | 74 | 62 | 47 | 37 | 26 | 6 | 5 | 4 | 3 | 16 | 2 | A-1-a(0) | GP-GM |
| ----- | ----- | ----- | ----- | ----- | 100 | 72 | 48 | 48 | 45 | 42 | 41 | 21 | A-7-6(7) | SC |

TABLE 7.—*Soil*

| Soil name and location | Parent material | Texas report number | Depth from surface | Shrinkage | | |
|---|---|---|---|---|---|---|
| | | | | Limit | Lineal | Ratio |
| | | | *In* | *Pct* | *Pct* | |
| Seawillow clay loam: 0.6 mile south on Farm Road 1322 from its intersection with Farm Road 20 in Lockhart, then 2.25 miles southeast on a county road, then 50 feet west of the road, in a pasture. (Modal) | Old alluvium of the Blanco River. | 69–320R | 0–7 | 16 | 11.6 | 1.82 |
| | | 69–321R | 7–18 | 16 | 12.2 | 1.85 |
| | | 69–322R | 18–54 | 19 | 4.5 | 1.75 |
| Seguin loam: 1.25 miles southeast of Martindale on a county road, then 500 feet south of the road, in a cultivated field. (Modal) | Calcareous alluvium | 70–425R | 0–12 | 16 | 11.2 | 1.88 |
| | | 70–426R | 12–60 | 15 | 11.5 | 1.89 |
| Silstid fine sand: 4.1 miles south of McMahan on Farm Road 3158, then 1 mile south on a county road, then 2.9 miles southeast on another county road, then 600 feet east of the road, in a wooded pasture. (Modal) | Acid sandy loams | 70–310R | 0–25 | 18 | 1.0 | 1.75 |
| | | 70–311R | 25–37 | 15 | 0.4 | 1.83 |
| | | 70–312R | 37–42 | 15 | 3.8 | 1.88 |
| | | 70–313R | 42–52 | 16 | 5.5 | 1.85 |
| | | 70–314R | 52–84 | 17 | 5.3 | 1.79 |
| Uhland fine sandy loam: 4.4 miles south of Delhi on Texas Highway 304, then 1.7 miles northwest on a county road, then 1,000 feet west of the road, in a wooded pasture. (Modal) | Local loamy alluvium | 70–321R | 0–5 | 25 | 3.6 | 1.56 |
| | | 70–322R | 5–21 | 20 | 5.1 | 1.73 |
| | | 70–323R | 21–43 | 15 | 2.7 | 1.85 |
| | | 70–324R | 43–72 | 13 | 13.3 | 1.98 |
| Wilson gravelly loam: 4.4 miles north on U.S. Highway 183 from its intersection with Farm Road 672 on the north side of Lockhart, then 200 feet west of the highway, in a field. (Modal) | Marl of Cretaceous age | 69–729R | 0–12 | 15 | 14.2 | 1.86 |
| | | 69–730R | 12–36 | 13 | 18.5 | 1.95 |

[1] Mechanical analysis according to the AASHTO Designation T–88 (See footnote 4, p. 47). Results by this procedure may differ somewhat from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

or adjoining, and on the experience of engineers and soil scientists with the soils of Caldwell County. In table 6, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for drainage for crops and pastures, irrigation, and terraces and diversions. For these particular uses, table 6 lists those soil features not to be overlooked in planning, installation, and maintenance of these structures.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means soil properties generally favorable for the rated use, or in other words, limitations that are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means soil properties so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

In the following paragraphs the columns in table 6 are explained.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material between the depths of 18 inches and 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and suscep-

*test data*—Continued

| Mechanical analysis[1] | | | | | | | | | | | Liquid limit | Plasticity index | Classification | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Percentage passing sieve— | | | | | | | | Percentage smaller than— | | | | | | |
| 1¼ inch | ⅞ inch | ⅝ inch | ⅜ inch | No. 4 (4.7 mm) | No. 10 (2.0 mm) | No. 40 (0.42 mm) | No. 200 (0.074 mm) | 0.05 mm | 0.005 mm | 0.002 mm | | | AASHTO[2] | Unified[3] |
| | | | | | | | | | | | *Pct* | | | |
| ----- | ----- | ----- | ----- | 100 | 99 | 97 | 61 | 54 | 31 | 20 | 29 | 15 | A-6(7) | CL |
| ----- | ----- | ----- | 100 | 99 | 98 | 95 | 68 | 63 | 38 | 26 | 32 | 16 | A-6(9) | CL |
| ----- | ----- | ----- | ----- | 100 | 99 | 97 | 74 | 68 | 37 | 22 | 27 | 10 | A-4(8) | CL |
| ----- | ----- | ----- | ----- | ----- | ----- | 100 | 91 | 84 | 44 | 32 | 38 | 20 | A-6(12) | CL |
| ----- | ----- | ----- | ----- | ----- | 100 | 99 | 91 | 85 | 47 | 34 | 38 | 21 | A-6(12) | CL |
| ----- | ----- | ----- | ----- | ----- | 100 | 92 | 22 | 15 | 5 | 1 | 20 | 3 | A-2-4(0) | SM |
| ----- | ----- | 100 | 99 | 98 | 98 | 86 | 19 | 14 | 5 | 3 | 19 | 2 | A-2-4(0) | SM |
| ----- | ----- | ----- | ----- | 100 | 99 | 86 | 32 | 29 | 23 | 20 | 22 | 9 | A-2-4(9) | SC |
| 100 | 97 | 97 | 97 | 97 | 97 | 81 | 32 | 29 | 25 | 22 | 26 | 14 | A-2-6(1) | SC |
| ----- | ----- | 100 | 97 | 96 | 95 | 73 | 24 | 23 | 20 | 18 | 27 | 15 | A-2-6(1) | SC |
| ----- | ----- | ----- | ----- | ----- | ----- | 100 | 82 | 64 | 16 | 15 | 32 | 6 | A-4(8) | ML |
| ----- | ----- | ----- | ----- | ----- | ----- | ----- | 82 | 68 | 28 | 21 | 30 | 15 | A-6(10) | CL |
| ----- | ----- | ----- | ----- | ----- | ----- | 100 | 69 | 59 | 22 | 15 | 19 | 4 | A-4(7) | CL-ML |
| ----- | ----- | ----- | ----- | ----- | 100 | 99 | 70 | 62 | 39 | 33 | 39 | 25 | A-6(13) | CL |
| ----- | 85 | 84 | 83 | 82 | 82 | 81 | 70 | 57 | 30 | 26 | 46 | 29 | A-7-6(16) | CL |
| ----- | ----- | 100 | 99 | 99 | 98 | 98 | 90 | 81 | 44 | 41 | 56 | 37 | A-7-6(19) | CH |

[2] Based on AASHTO Designation M 145–49 (See footnote 4, p. 47).

[3] Based on Unified soil classification system (See footnote 3, p. 47).

[4] 100 percent of material passed the 2-inch sieve.

tibility to flooding. Slope affects the difficulty of layout and construction and also the risk of erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor and sides, or embankments, of compacted soil material. The assumptions are made that the embankment is compacted to medium density and that the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic matter, and slope, and if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification system and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, such as excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or from a high water table.

Dwellings without basements, as rated in table 6, are not more than three stories high and are supported by foundation footings placed in undisturbed soil. The fea-

tures that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 6 apply only to a depth of about 6 feet; therefore, limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. Even though reliable predictions can be made to a depth of 10 or 15 feet for some soils, every site should be investigated before it is selected.

Local roads and streets, as rated in table 6, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly of asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep. Soil properties that most affect design and construction of roads and streets are load-supporting capacity, stability of the subgrade, and workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material as well as the shrink-swell potential indicate load-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect the ease of excavation and the amount of cut and fill needed to reach and even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and their depth to fractured or permeable bedrock or other permeable material.

Dikes, levees, and other embankments require soil material that is resistant to seepage and piping and has favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are unfavorable factors.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand is used in many kinds of construction. The ratings in table 6 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the sand, and neither do they indicate quality of the deposit.

Sources of gravel do not occur above a depth of 6 feet in Caldwell County. However, local sources of gravel occur below a depth of 6 feet in Branyon, Lewisville, and Queeny soils.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and content of stone fragments affect suitability. Damage to the area from which topsoil is taken is also considered in the rating.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

### *Engineering test data*

Table 7 contains engineering test data for some of the soil series in Caldwell County. The table gives the specific location where each sample was taken and the depth to which the sampling was done. The tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plasticity index. The mechanical analyses were made by combined sieve and hydrometer methods.

Tests to determine liquid limit and plasticity index measure the effect of water on the consistence of soil material, as has been explained for table 5.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Lineal shrinkage is the decrease in one dimension of the soil mass when the moisture content is reduced from the liquid limit to the shrinkage limit. It is expressed as a percentage of the original dimension.

## *Formation and Classification of the Soils*

The major factors of soil formation and how they have affected the soils of Caldwell County are discussed in this section. The current system for classifying soils is defined, and the soils of the county are classified according to this system.

### Factors of Soil Formation

Soil is produced by the action of soil-forming factors on material deposited or accumulated by natural forces. The characteristics of the soil at any given point are determined by (1) the physical and mineralogical composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time the forces of soil development have acted on the soil material.

Climate and living organisms, particularly vegetation, are the active forces in soil formation. These forces act on the parent material that has accumulated through the weathering of rocks and unconsolidated deposits and slowly change that material into a natural body that has genetically related horizons. The effects of climate and vegetation are conditioned by relief. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed to change the parent material into a soil. The amount of time may be short or long, but some time is always required for soil horizons to form. Usually, a long time is required for distinct horizons to develop in a soil.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. Many of the processes of soil development are unknown.

#### *Parent material*

Caldwell County is underlain by the sedimentary formations that slope gently toward the Gulf of Mexico. The oldest is the Navarro Group of Cretaceous age, which crops out in the northwestern part of the county. It is overlain by successively younger Tertiary formations known as the Midway Group, Wilcox Group, Carrizo Sand Formation, Reklaw Formation, Queen City Sand Formation, and Weches Greensand Formation. Still younger is the Leona Formation, which is a Pleistocene terrace. Youngest of all is alluvium of Recent age.

Clayey soils such as Burleson, Ferris, Heiden, and Houston Black formed in the clay, marl, and shaly clay of the Navarro Group.

Soils such as Behring, Burleson, Crockett, Ferris, Heiden, Mabank, and Wilson formed in the shaly clay of the Midway Group in the northwestern one third of the county.

Behring, Crockett, Heiden, Mabank, and Wilson soils formed in the more clayey parts of the Wilcox Group, and Chaney soils formed in the sandier parts. The Wilcox Group crops out in the central third of the county.

Sandy soils such as Arenosa, Patilo, and Silstid formed in the Carrizo Sand Formation in the southeastern part of the county. Other soils that formed in this part of Caldwell County are soils that have a red subsoil, such as Jedd and Rosanky. These soils formed in the iron-bearing Weches Greensand and Reklaw Formations. Chaney, Demona, and Silstid soils formed in the Queen City Sand Formation in this part of the county.

The Leona Formation consists of gravel, clay, and marl. Soils such as Branyon, Burleson, Lewisville, and Seawillow formed in the clay and marl. Fett and Queeny soils formed in the gravel. The Leona Formation is on a strip about four miles wide and parallel to the San Marcos River.

Soils of Recent alluvium are Bosque, Gowen, Seguin, Trinity, and Uhland. These soils are on the flood plains along rivers and creeks.

#### *Climate*

The main climatic forces that act on the parent material of soils are the amount and distribution of precipitation and the temperature, humidity, and wind. Climate directly affects soil formation through its influence on weathering, leaching of carbonates, translocation of clay, reduction and transfer of iron, and rate of erosion. Climatic forces also cause some of the variations in the plant and animal life on and in the soil. They influence changes in the parent material that are the result of differences in the kinds of plants and animals.

Caldwell County has a humid, subtropical climate that is nearly uniform and has only slight variations in rainfall and temperature throughout the year. The most frequent variations in temperature occur during winter in spans of 36 to 72 hours. Summers are hot, and the rainfall occurs as thundershowers. Most of the annual precipitation falls during spring and fall as thundershowers and at a time when most cultivated areas are bare. More climatic data are given in the section "Additional Facts About the County."

#### *Living organisms*

Vegetation, micro-organisms, macroorganisms, and other forms of life that live on and in the soil contribute to soil development. They provide organic matter, help to decompose plant residue, affect the chemistry of the soil, and hasten soil development. Living organisms also help to convert plant nutrients into a form readily available to higher plants. Some forms of life, such as earthworms, retard horizon differentiation by churning and mixing the soil.

Plants, mainly hardwoods and tall grasses, have affected soil formation in this county more than other living organisms. This vegetation contributed large amounts of organic matter to soils in the area. Decaying grass leaves and stems were left on the soil surface. Pores left throughout the soil solum by decaying roots allowed passage of air and water to furnish nutrients for bacteria and other micro-organisms.

The influence man has had upon the soils in the county cannot be overlooked. By cultivating and over-

grazing, he has caused soils to erode at an accelerated rate, sometimes to the degree that the surface layer has been removed.

### *Relief*

Relief, or lay of the land, in Caldwell County has not influenced soil development to a great extent. Soils such as Chaney, Crockett, and Heiden have similar horizon development on nearly level areas as they have on sloping areas. The combination of parent material and vegetation has exerted more influence on soil development than has relief.

The primary effect of relief upon soil development in the county has been its influence on the degree of erosion which has occurred. This is evident by the comparable thicknesses of surfaces on nearly level areas to those on sloping areas.

### *Time*

The length of time that climate, living organisms, and relief have acted on parent material affects the kind of soil that develops, but the effects of time are modified by the other four factors of soil formation. Soils that do not have clearly expressed horizons are considered immature, and those that have well-expressed horizons are considered mature.

Soils formed in Recent alluvium, such as Bosque, are immature because the alluvium has not been in place long enough for a distinct horizon to form. Mature soils such as the Chaney, Crockett, and Demona series show marked differences in horizons. Most of the mature soils are well drained and gently sloping and have been in place a long time.

## Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study, readers interested in developments of the current system should search the latest literature available. [5] [6]

The current system of classification has six categories. Beginning with the broadest, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Caldwell County are placed in family, subgroup, and order according to the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol). The five orders of the soils of Caldwell County are Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols have a light-colored surface layer that is low in organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent.

Entisols have little or no evidence of development of pedogenic horizons.

Inceptisols have a light-colored surface layer that is low in organic matter, but they lack a clay-enriched B horizon.

Mollisols have a dark-colored surface layer that is high in organic matter, and they have a base saturation of more than 50 percent.

Vertisols are clayey soils that have deep, wide cracks during a part of each year in most years.

SUBORDER: Each order is divided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or the absence of waterlogging or soil differences that result from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is Ustoll (*Ust*, meaning of dry climate, and *oll* from Mollisol).

GREAT GROUP: Each suborder is separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those that have thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplustolls (*Hapl*, meaning simple horizons, *ust* for dry climate, and *oll* from Mollisol).

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) segment of the group and others called intergrades that have

[5] Simonson, Roy W. Soil classification in the United States. Science, v. 137, No. 3535, pp. 1027–1034. 1962.

[6] United States Department of Agriculture. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. 1960. [Supplements issued in March 1967 and in September 1968]

properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Udertic Haplustolls.

FAMILY: Soil families are separated within a subgroup primarily on the basis of properties that affect the growth of plants or the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae as shown in table 8. An example is the fine, montmorillonitic, thermic family of Udertic Haplustolls.

SERIES: The series consists of a group of soils that have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. Behring series is an example.

## *Additional Facts About the County*

Caldwell County was established in 1848. It was created out of the northern part of Gonzales County. The population grew steadily from 1,329 in 1850 to 31,397 in the 1930's. Then, it steadily declined to 17,222 in 1960. From 1960 to 1971 it has again steadily grown to 21,178. Lockhart, the largest town and the county seat, has a population of 6,489, and Luling the second largest town has a population of 4,719.

The economy of the county is based on petroleum, field crops, livestock, and light industry. More than 200 million barrels of oil have been produced in Caldwell County since oil was first discovered in 1922. Twenty-four oil fields have been discovered to date, but nine are no longer producing. There are approximately 819 farm units that average 425 acres in size and produce livestock, cotton, and feed grain. Plastic and textile manufacturing and commercial feed processing are some of the light industries in the county.

## Water Supply

The water-bearing formations underlying Caldwell County are considered to be stable and dependable. Most of the ground water in storage is in the Carrizo Sand Formation and the Wilcox Group in the southeastern part of the county. Other water-bearing formations in Caldwell County are the Reklaw Formation, Queen City Sand Formation, Leona Formation, and Recent alluvium. The Navarro Group in the northwestern part of the county does not yield a good quality of water in most places.

Surface water is adequate in most areas, but it may be heavily silted and be of short supply during droughty periods. The San Marcos River furnishes a supply of water that can be used for domestic or irrigational uses. Most of the water used for irrigation is taken from this river. It is on the southern boundary of Caldwell County and is a perennial stream fed by large springs located near the town of San Marcos. These springs help maintain the river flow during periods of drought.

TABLE 8.—*Classification of soil series*

| Series | Family | Subgroup | Order |
|---|---|---|---|
| Arenosa | Siliceous, thermic, coated | Typic Quartzipsamments | Entisols. |
| Behring | Fine, montmorillonitic, thermic | Udertic Haplustolls | Mollisols. |
| Bosque | Fine-loamy, mixed, thermic | Cumulic Haplustolls | Mollisols. |
| Branyon | Fine, montmorillonitic, thermic | Udic Pellusterts | Vertisols. |
| Brazos variant | Sandy, siliceous, thermic | Typic Ustifluvents | Entisols. |
| Burleson | Fine, montmorillonitic, thermic | Udic Pellusterts | Vertisols. |
| Chaney | Fine, mixed, thermic | Aquic Paleustalfs | Alfisols. |
| Crockett | Fine, montmorillonitic, thermic | Udertic Paleustalfs | Alfisols. |
| Demona | Clayey, mixed, thermic | Aquic Arenic Paleustalfs | Alfisols. |
| Ferris | Fine, montmorillonitic, thermic | Udorthentic Chromusterts | Vertisols. |
| Fett | Clayey-skeletal, montmorillonitic, thermic | Aquic Paleustalfs | Alfisols. |
| Gowen | Fine-loamy, mixed, thermic | Cumulic Hapludolls | Mollisols. |
| Heiden | Fine, montmorillonitic, thermic | Udic Chromusterts | Vertisols. |
| Houston Black | Fine, montmorillonitic, thermic | Udic Pellusterts | Vertisols. |
| Jedd | Fine, mixed, thermic | Ultic Paleustalfs | Alfisols. |
| Lewisville | Fine-silty, mixed, thermic | Typic Calciustolls | Mollisols. |
| Mabank | Fine, montmorillonitic, thermic | Vertic Albaqualfs | Alfisols. |
| Menard variant | Fine-loamy, mixed, thermic | Typic Haplustalfs | Alfisols. |
| Patilo | Loamy, siliceous, thermic | Grossarenic Paleustalfs | Alfisols. |
| Queeny | Loamy, mixed, thermic, shallow | Petrocalcic Calciustolls | Mollisols. |
| Rosanky | Fine, mixed, thermic | Ultic Paleustalfs | Alfisols. |
| Seawillow | Fine-loamy, carbonatic, thermic | Typic Ustochrepts | Inceptisols. |
| Seguin | Fine-silty, carbonatic, thermic | Fluventic Haplustolls | Mollisols. |
| Silstid | Loamy, siliceous, thermic | Arenic Palustalfs | Alfisols. |
| Trinity | Fine, montmorillonitic (calcareous), thermic | Vertic Haplaquolls | Mollisols. |
| Uhland | Coarse-loamy, mixed, nonacid, thermic | Aquic Ustifluvents | Entisols. |
| Wilson | Fine, montmorillonitic, thermic | Vertic Ochraqualfs | Alfisols. |

The Watershed protection and Flood Prevention Plan for Plum Creek Watershed in Caldwell County includes construction of 26 floodwater control structures, 14 of which had been constructed by 1971. These structures will store 4,145 acre feet of permanent water when they are completed.

## Climate[7]

The climate of Caldwell County is humid subtropical and is characterized by hot summers. Tropical Maritime airmasses predominate throughout spring, summer, and fall. Modified Polar airmasses exert a considerable influence during winter and provide a continental type of climate, characterized by large day-to-day variations in temperature. Facts about temperature and precipitation are given in table 9.

Average annual total precipitation is 32.65 inches. Peak rainfall occurs during thundershowers late in spring and early in summer. A secondary peak occurs early in fall. In 1919, the wettest year of record, a total of 59.92 inches fell at Luling, but only 6.04 inches fell in 1893, the driest year.

The prevailing wind at Luling is southerly throughout the year. The average length of the warm season (freeze-free period) is 275 days. The average date of the last occurrence of 32° F., or below in spring is February 27, and the first occurrence of 32° or below in fall is November 29. Average annual free water (lake) evaporation is estimated at 56 inches. During an average year, evaporation exceeds rainfall by 22 inches.

[7] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

Winter is not marked by any prolonged periods of cold weather, but rather by short periods that last 36 to 72 hours. The season is one of many changes, and variations in the weather are frequent. Normally, daytime temperatures are sufficiently mild so as to cause little or no interference with outdoor work or recreation. Temperatures of 32° or below occur only on about one third of the days, and these freezing temperatures usually are confined to an hour or two before sunrise. Most winter precipitation falls as light rain or drizzle. Considerable cloudiness often persists through the morning hours but dissipates by noon or shortly thereafter, leaving clear to partly cloudy skies during the afternoon. The amount of sunshine received in winter averages approximately 50 percent of the total amount possible. Relative humidity at noon averages 60 percent in January.

Spring is pleasant, and March is relatively dry. Warm and cool spells of short duration follow each other in rapid succession. Thundershower activity increases in April and reaches a peak in May. Considerable early morning cloudiness continues, but clouds dissipate earlier than in winter. The average percentage of total possible sunshine received is 55, and relative humidity at noon averages 60 percent in April.

Summer has high daytime temperatures. The temperature exceeds 90° on most days. Heavy thundershowers continue into June but decrease in July, and the day-to-day weather during midsummer seldom changes. Relative humidity at noon averages 50 percent in July.

In fall, warm weather continues through September, and precipitation increases. The weather is more varied than in summer. Daytime temperatures in October and November are pleasantly mild, and nights are crisp and

TABLE 9.— *Temperature*

[Data recorded at Luling, elevation 405 feet; period

| Month | Temperature[1] | | | | Precipitation | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Average daily maximum | Average monthly maximum | Average daily minimum | Average monthly minimum | Average total | Probability, in percent, of receiving— | | | |
| | | | | | | 0 or trace | 0.50 inch or more | 1 inch or more | 2 inches or more |
| | °F | °F | °F | °F | In | Pct | Pct | Pct | Pct |
| January | 61.2 | 79.6 | 38.1 | 20.4 | 1.99 | <1 | 85 | 70 | 43 |
| February | 65.2 | 81.4 | 41.8 | 25.4 | 2.62 | <1 | 93 | 80 | 50 |
| March | 72.0 | 84.7 | 47.1 | 29.4 | 1.77 | <1 | 90 | 72 | 43 |
| April | 80.1 | 90.4 | 57.9 | 40.9 | 3.73 | <1 | 93 | 83 | 62 |
| May | 86.3 | 94.4 | 64.9 | 50.9 | 3.56 | <1 | 98 | 91 | 74 |
| June | 92.5 | 98.4 | 70.8 | 62.0 | 3.91 | <1 | 93 | 80 | 60 |
| July | 96.2 | 101.6 | 72.5 | 67.2 | 2.03 | <1 | 90 | 75 | 50 |
| August | 97.4 | 102.9 | 72.2 | 66.1 | 2.08 | 5 | 83 | 70 | 44 |
| September | 90.8 | 99.5 | 67.5 | 54.7 | 3.89 | <1 | 90 | 80 | 60 |
| October | 82.9 | 89.7 | 57.4 | 41.1 | 2.88 | 3 | 78 | 78 | 48 |
| November | 72.0 | 86.4 | 46.8 | 29.4 | 2.28 | <1 | 84 | 65 | 40 |
| December | 64.6 | 80.7 | 40.2 | 24.5 | 1.91 | 1 | 95 | 82 | 55 |
| Year | 80.1 | ---------- | 56.4 | ---------- | 32.65 | ---------- | ---------- | ---------- | ---------- |

[1] Average length of record, 30 years.

[2] Average length of record, 15 years.

cool. The amount of sunshine received in an average day is about 66 percent of the total amount possible. Relative humidity at noon averages 50 percent in October. Fall is a delightful season and has long periods of uninterrupted fair weather and light winds.

## Glossary

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

**Alluvium.** Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

**Association, soil.** A group of soils geographically associated in a characteristic repeating pattern.

**Available water capacity** (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

**Bench terrace.** A shelflike embankment of earth that has a level or nearly level top and a steep or nearly vertical downhill face, constructed along the contour of sloping land or across the slope to control runoff and erosion. The downhill face of the bench may be made of rocks or masonry, or it may be planted to vegetation.

**Calcareous soil.** A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

**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 clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

**Claypan.** A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

**Climax vegetation.** The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

**Coarse fragments.** Mineral or rock particles more than 2 millimeters in diameter.

**Cobblestone.** A rounded or partly rounded fragment of rock 3 to 10 inches in diameter.

**Concretions.** Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found 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 and brittle; little affected by moistening.

**Contour farming.** Plowing, cultivating, planting, and harvesting in rows that are at right angles to the natural direction of the slope or that are parallel to terrace grade.

**Diversion, or diversion terrace.** A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

**Erosion.** The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

*and precipitation*

of record, 1941–70. The symbol < means less than]

| Precipitation—Continued | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Probability, in percent, of receiving—Continued | | | | Average number of days when rainfall is—[2] | | | Snow and sleet | | |
| 3 inches or more | 4 inches or more | 5 inches or more | 6 inches or more | 0.10 inch or more | 0.50 inch or more | 1 inch or more | Average total[1] | Maximum[1] | Greatest depth[2] |
| *Pct* | *Pct* | *Pct* | *Pct* | | | | *In* | *In* | *In* |
| 26 | 15 | 10 | 4 | 4 | 1 | [3] | 0.3 | 5 | 0 |
| 30 | 15 | 10 | 5 | 5 | 2 | 1 | .1 | 3 | 3 |
| 24 | 14 | 6 | 4 | 4 | 1 | [3] | [4] | [4] | 0 |
| 44 | 30 | 20 | 10 | 5 | 3 | 1 | 0 | 0 | 0 |
| 54 | 37 | 28 | 20 | 5 | 2 | 1 | 0 | 0 | 0 |
| 42 | 26 | 20 | 10 | 4 | 2 | 1 | 0 | 0 | 0 |
| 30 | 18 | 9 | 5 | 2 | 1 | [3] | 0 | 0 | 0 |
| 30 | 18 | 10 | 10 | 4 | 1 | [3] | 0 | 0 | 0 |
| 45 | 35 | 25 | 17 | 6 | 3 | 1 | 0 | 0 | 0 |
| 35 | 25 | 18 | 12 | 4 | 2 | 1 | 0 | 0 | 0 |
| 23 | 12 | 9 | 5 | 4 | 1 | 1 | [4] | [4] | 0 |
| 30 | 17 | 10 | 4 | 4 | 1 | [3] | [4] | [4] | 0 |
| | | | | 51 | 20 | 7 | .4 | 5 | 3 |

[3] Less than one-half day.

[4] Trace, an amount too small to measure.

**Fertility, soil.** The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

**Flood plain.** Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

**Gilgai.** Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

**Gravel.** As a soil separate, the rounded or angular fragments of rock that range in size from 2 millimeters to 3 inches in diameter. As a soil textural class, soil material that consists of 15 to 50 percent gravel, by volume. In engineering, gravel is a coarse-grained soil of which more than 50 percent is retained on a No. 4 screen.

**Horizon, soil.** A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

*O horizon.*—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

*A horizon.*—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

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

*C horizon.*—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

*R layer.*—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

**Mottling, soil.** Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

**Munsell notation.** A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

**Ped.** An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

**Permeability.** The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

**Phase, soil.** A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

**pH value.** A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

**Plowpan.** A compacted layer formed in the soil immediately below the plowed layer.

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

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

**Reaction, soil.** The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

| | *pH* | | *pH* |
|---|---|---|---|
| Extremely acid | Below 4.5 | Mildly alkaline | 7.4 to 7.8 |
| Very strongly acid | 4.5 to 5.0 | Moderately alkaline | 7.9 to 8.4 |
| Strongly acid | 5.1 to 5.5 | Strongly alkaline | 8.5 to 9.0 |
| Medium acid | 5.6 to 6.0 | Very strongly alkaline | 9.1 and higher |
| Slightly acid | 6.1 to 6.5 | | |
| Neutral | 6.6 to 7.3 | | |

**Relief.** The elevations or inequalities of a land surface, considered collectively.

**Rill.** A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

**Sand.** Individual rock or mineral fragments in a soil that range in diameter from 0.05 millimeter to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

**Silt.** Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

**Slickensides.** Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

**Soil.** A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

**Soil separates.** Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

**Solum.** The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

**Structure, soil.** The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than hori-

zontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Substratum.** Technically, the part of the soil below the solum.

**Surface soil.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

**Terrace.** An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

**Terrace** (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

**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."

**Tilth, soil.** The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

**Topsoil.** A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

**Variant, soil.** A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

## GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a capability unit, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 9.
Predicted yields, table 2, page 35.
Suitability of soils for wildlife, table 3, pages 43 and 44.
Limitations and soil features affecting recreational development, table 4, pages 45 and 46.
Engineering uses of soils, tables 5, 6, and 7, pages 48 through 65.

| Map symbol | Mapping unit | Page | Capability unit | | Pasture and hay group | | Range site | |
|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Page | Symbol | Page | Name | Page |
| APC | Arenosa and Patilo soils, undulating | 8 | VIs-1 | 35 | 9B | 38 | Deep Sand | 40 |
| BeB | Behring clay loam, 1 to 3 percent slopes | 9 | IIe-1 | 32 | 7A | 36 | Blackland | 39 |
| BeC2 | Behring clay loam, 3 to 5 percent slopes, eroded | 10 | IIIe-3 | 33 | 7A | 36 | Blackland | 39 |
| BeD2 | Behring clay loam, 5 to 8 percent slopes, eroded | 10 | IVe-2 | 34 | 7B | 36 | Blackland | 39 |
| Bo | Bosque clay loam | 11 | I-1 | 32 | 2A | 36 | Loamy Bottomland | 41 |
| Bp | Bosque soils, frequently flooded | 11 | Vw-1 | 34 | 2A | 36 | Loamy Bottomland | 41 |
| BrA | Branyon clay, 0 to 1 percent slopes | 12 | IIw-2 | 33 | 7A | 36 | Blackland | 39 |
| BrB | Branyon clay, 1 to 3 percent slopes | 12 | IIe-1 | 32 | 7A | 36 | Blackland | 39 |
| Bs | Brazos fine sand, siliceous variant | 13 | Vw-2 | 34 | 3A | 36 | Sandy Bottomland | 41 |
| BuA | Burleson clay, 0 to 1 percent slopes | 13 | IIw-2 | 33 | 7A | 36 | Blackland | 39 |
| BuB | Burleson clay, 1 to 3 percent slopes | 13 | IIe-1 | 32 | 7A | 36 | Blackland | 39 |
| CaC | Chaney loamy fine sand, 1 to 5 percent slopes | 14 | IIIe-6 | 33 | 9A | 38 | Sandy Loam | 41 |
| CbB | Chaney loamy fine sand, valleys | 14 | IIIe-6 | 33 | 9A | 38 | Sandy Loam | 41 |
| CcC2 | Chaney soils, 2 to 6 percent slopes, eroded | 14 | IVe-1 | 34 | 8A | 37 | Sandy Loam | 41 |
| CcD3 | Chaney soils, 5 to 8 percent slopes, severely eroded | 15 | VIe-1 | 34 | 8B | 37 | Sandy Loam | 41 |
| CfB | Crockett fine sandy loam, 1 to 3 percent slopes | 15 | IIIe-4 | 33 | 8A | 37 | Claypan Prairie | 40 |
| CgC | Crockett gravelly sandy loam, 1 to 5 percent slopes | 15 | IVe-1 | 34 | 8A | 37 | Claypan Prairie | 40 |
| CrC2 | Crockett soils, 2 to 5 percent slopes, eroded | 16 | IVe-1 | 34 | 8A | 37 | Claypan Prairie | 40 |
| CrD3 | Crockett soils, 3 to 8 percent slopes, severely eroded | 16 | VIe-1 | 34 | 8B | 37 | Claypan Prairie | 40 |
| DeC | Demona loamy fine sand, 1 to 5 percent slopes | 17 | IIIe-6 | 33 | 9A | 38 | Sandy | 41 |
| FeE | Fett gravelly soils, 1 to 12 percent slopes | 18 | VIs-1 | 35 | 8A | 37 | Gravelly | 40 |
| Go | Gowen clay loam | 19 | IIw-1 | 32 | 2A | 36 | Loamy Bottomland | 41 |
| Gs | Gowen soils, frequently flooded | 19 | Vw-3 | 34 | 2A | 36 | Loamy Bottomland | 41 |
| HeB | Heiden clay, 1 to 3 percent slopes | 19 | IIe-1 | 32 | 7A | 36 | Blackland | 39 |
| HeC2 | Heiden clay, 3 to 5 percent slopes, eroded | 20 | IIIe-3 | 33 | 7A | 36 | Blackland | 39 |
| HeD2 | Heiden clay, 5 to 8 percent slopes, eroded | 20 | IVe-2 | 34 | 7B | 36 | Blackland | 39 |
| HgD | Heiden gravelly clay, 3 to 8 percent slopes | 20 | IVe-2 | 34 | 7B | 36 | Blackland | 39 |
| HhF3 | Heiden-Ferris complex, 5 to 20 percent slopes, severely eroded | 20 | VIe-2 | 34 | 7B | 36 | Eroded Blackland | 40 |
| HmB | Heiden-Wilson complex, 1 to 3 percent slopes | 20 | IIe-2 | 32 | 7A | 36 | Blackland | 39 |
| HoB | Houston Black clay, 1 to 3 percent slopes | 22 | IIe-1 | 32 | 7A | 36 | Blackland | 39 |
| HoC2 | Houston Black clay, 3 to 5 percent slopes, eroded | 22 | IIIe-3 | 33 | 7A | 36 | Blackland | 39 |
| HpD | Houston Black gravelly clay, 3 to 8 percent slopes | 22 | IIIe-2 | 33 | 7B | 36 | Blackland | 39 |
| JsF | Jedd stony soils, 5 to 20 percent slopes | 23 | VIe-3 | 34 | 8D | 37 | Sandstone Hills | 41 |
| LeA | Lewisville silty clay, 0 to 1 percent slopes | 24 | I-1 | 32 | 7C | 36 | Clay Loam | 39 |
| LeB | Lewisville silty clay, 1 to 3 percent slopes | 24 | IIe-3 | 32 | 7C | 36 | Clay Loam | 39 |

GUIDE TO MAPPING UNITS--Continued

| Map symbol | Mapping unit | Page | Capability unit | | Pasture and hay group | | Range site | |
|---|---|---|---|---|---|---|---|---|
| | | | Symbol | Page | Symbol | Page | Name | Page |
| LeC2 | Lewisville silty clay, 3 to 5 percent slopes, eroded | 24 | IIIe-5 | 33 | 7C | 36 | Clay Loam | 39 |
| MaA | Mabank loam, 0 to 1 percent slopes | 25 | IIIw-1 | 33 | 8A | 37 | Claypan Prairie | 40 |
| MaB | Mabank loam, 1 to 3 percent slopes | 25 | IIIe-1 | 33 | 8A | 37 | Claypan Prairie | 40 |
| MeC | Menard loam, thin solum variant, 1 to 5 percent slopes | 25 | IVe-4 | 34 | 8C | 37 | Sandy Loam | 41 |
| PaD | Patilo fine sand, 1 to 8 percent slopes | 26 | IIIe-7 | 33 | 9B | 38 | Deep Sand | 40 |
| QuC | Queeny gravelly loam, 1 to 5 percent slopes | 26 | IVs-1 | 34 | 14A | 38 | Chalky Ridge | 39 |
| QuF | Queeny gravelly loam, 5 to 20 percent slopes | 27 | VIs-2 | 35 | 14A | 38 | Chalky Ridge | 39 |
| RoD | Rosanky loamy fine sand, 1 to 8 percent slopes | 27 | IVe-4 | 34 | 9A | 38 | Sandy Loam | 41 |
| SeB | Seawillow clay loam, 1 to 3 percent slopes | 28 | IIe-3 | 32 | 7C | 36 | Clay Loam | 39 |
| SeD2 | Seawillow clay loam, 3 to 8 percent slopes, eroded | 28 | IVe-3 | 34 | 7C | 36 | Clay Loam | 39 |
| Sg | Seguin loam | 28 | I-1 | 32 | 2A | 36 | Loamy Bottomland | 41 |
| ShC | Silstid fine sand, 1 to 5 percent slopes | 29 | IIIe-6 | 33 | 9A | 38 | Sandy | 41 |
| Tr | Trinity clay | 29 | IIw-3 | 33 | 1A | 36 | Clayey Bottomland | 39 |
| Ts | Trinity soils, frequently flooded | 30 | Vw-3 | 34 | 1A | 36 | Clayey Bottomland | 39 |
| Us | Uhland soils, frequently flooded | 30 | Vw-1 | 34 | 2A | 36 | Loamy Bottomland | 41 |
| WgC | Wilson gravelly loam, 1 to 5 percent slopes | 31 | IVe-1 | 34 | 7H | 37 | Claypan Prairie | 40 |

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