United States Department of Agriculture

Natural Resources Conservation Service

In cooperation with Texas Agricultural Experiment Station

Soil Survey of Grimes County, Texas

How To Use This Soil Survey

General Soil Map

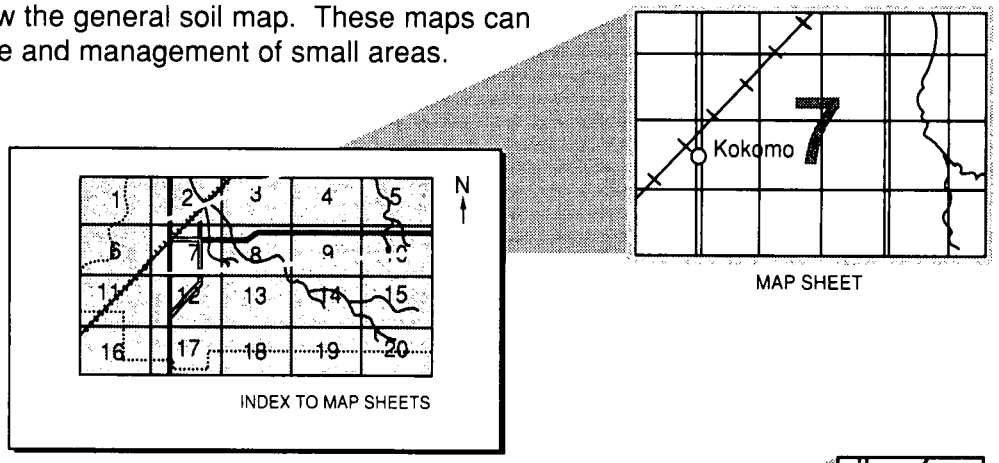
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the map unit in the area on the color-coded map legend, then refer to the section **General Soil Map Units** for a general description of the soils in your area.

Detailed Soil Maps

The detailed soil maps follow the general soil map. These maps can be useful in planning the use and management of small areas.

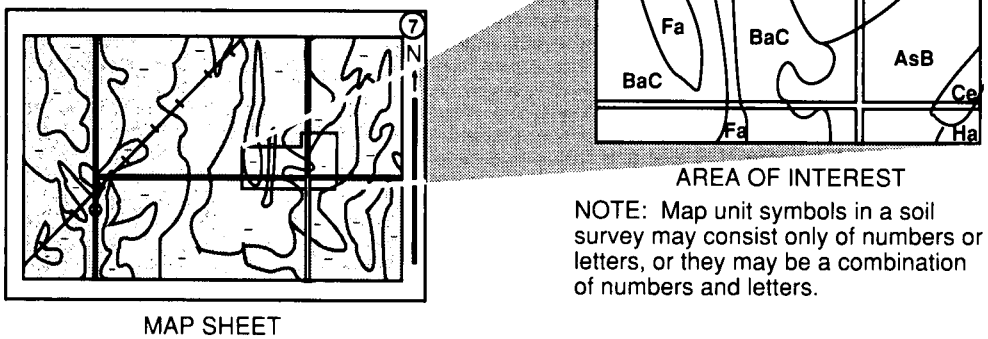
To find information about your area of interest, locate that area on the **Index to Map Sheets**, which precedes the soil maps. Note the number of the map sheet, and turn to that sheet.



INDEX TO MAP SHEETS

MAP SHEET

Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. Turn to the **Index to Map Units** (see Contents), which lists the map units by symbol and name and shows the page where each map unit is described.



MAP SHEET

AREA OF INTEREST

NOTE: Map unit symbols in a soil survey may consist only of numbers or letters, or they may be a combination of numbers and letters.

The **Summary of Tables** shows which table has data on a specific land use for each detailed soil map unit. See **Contents** for sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1988. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1986. This soil survey was made cooperatively by the Natural Resources Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Navasota Soil and Water Conservation District.

All programs of the Natural Resources Conservation Service are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

Cover: A field of Texas bluebonnets in Grimes County.

Contents

Issued January 1996

Index to Map Units

Summary of Tables

Foreword

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

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

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

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

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Soil Survey of Grimes County, Texas

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Soils surveyed by James Greenwade, Ron Schlappi, Brandon Smith, and Wilfred Crenwelge, Natural Resources Conservation Service

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

GRIMES COUNTY is located in the southeastern part of central Texas (fig. 1). The county has an area of 512,192 acres, or about 800 square miles. It is about 40 miles long and 20 miles wide. The Navasota and Brazos Rivers form the western boundary.

Anderson is the county seat. Navasota is the largest town. Other towns in the county are Courtney, Iola, Bedias, Shiro, Plantersville, Richards, Singleton, Roans Prairie, and Todd Mission.

Many well-defined drainageways dissect Grimes County. The western part of the county drains into the Navasota and Brazos Rivers. The northeast corner of the county drains into Bedias Creek and the Trinity River. The southeastern part of the county drains toward the San Jacinto River.

Most areas are gently sloping to sloping, but some areas are nearly level and other areas are moderately steep and steep. The elevation ranges from 180 feet along the Brazos River in the southwest corner of the county to 460 feet northeast of Singleton.

The soils in the county formed mostly under post oak trees or grasses. Those soils that formed under the trees are mostly light colored fine sandy loam and loamy fine sand. Those that formed under the grasses are mostly dark fine sandy loam, clay loam, and clay. These soils are subject to water erosion.

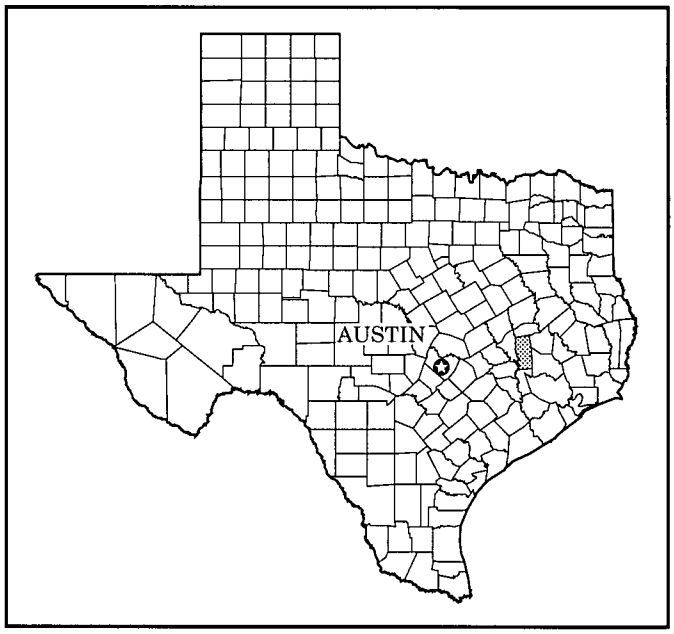

Figure 1.—Location of Grimes County in Texas.

General Nature of the County

This section gives general information about Grimes County. It describes settlement and population, agriculture, transportation and market facilities, climate, and natural resources.

Settlement and Population

In 1821, Stephen F. Austin obtained permission from the Spanish government to settle 300 families in Texas.

This settlement included most of the area that is now known as Grimes County. Grimes County was organized in 1846 from a portion of Montgomery County. It was named for Jesse Grimes, who signed the Texas Declaration of Independence. In 1854, part of the original county became part of Madison County. In 1873, part of the original county became part of Waller County.

The population of the county increased until about 1920 and then decreased until 1970. The population increased from 11,855 in 1970 to 18,828 in 1990.

Farming and ranching have always provided the main means of livelihood in the county. In recent years, more people are commuting to jobs in Houston, Bryan, Navasota, and other nearby cities. Many people from the Houston area have purchased farms and ranches in the county. Homesites have subdivided much of the area. Urban encroachment will likely increase.

Agriculture

The major land use in Grimes County is pasture. Other areas are used as range, woodland, and cropland. The areas of pasture and range are mainly used for producing beef and dairy cattle. Most livestock operations are cow-calf enterprises. Some ranchers adjust stocking rates with stocker calves. In recent years, many farmers have begun to raise horses.

Much of the county was cultivated in the past when cotton was in high demand. The main cultivated crops today in upland areas are small grain for winter grazing and forage sorghum for grazing and hay. Cotton and corn are the major crops grown in areas of the Brazos soils that are on bottom land. Improved pastures support mostly coastal bermudagrass and bahiagrass.

Timber is produced in parts of eastern Grimes County. An increase in urban areas and small farms, however, has resulted in a decrease in the total acreage used for timber.

Transportation and Market Facilities

State Highways 6, 90, and 105 and many farm-to-market roads provide a network for moving agricultural products in the county. Four major railroads serve the area. Railroads ship industrial goods, but trucks ship most agricultural products. Navasota has a city airport, and the county also has several private air fields.

Livestock markets in Navasota, and in nearby Brenham and Bryan Counties, provide for the sale of cattle, sheep, horses, and hogs throughout the year. Many large ranches market cattle and horses by holding onsite annual sales. Vegetable and truck crops are sold by growers at local roadside stands or are shipped to markets in Houston.

Hay is the most valuable crop produced in the county. It is stored and fed to cattle and horses in the winter. The demand for quality hay for horses has increased in recent years. Because it is difficult to move hay, most hay is sold or is locally stored at harvest time.

Natural Resources

The soil is the most important natural resource in the county. Most of the residents earn their living by producing forage for livestock or food and fiber for market and home.

Water is another important natural resource. Much of the county has good quality drinking water at a depth of about 100 feet. The Brazos River provides water for irrigation and recreation.

Lignite, a form of soft coal, underlies the area where the Jackson geological group crops out. Much of this area is leased to agencies interested in using this resource. The Texas Municipal Power Agency has a lignite power plant near Carlos in the northwestern part of the county.

Gravel suitable for construction is scarce in the county. A few sand and gravel deposits near the Brazos and Navasota Rivers and some ironstone gravel deposits are used for the construction of roads. Sandstone from the Oakville Formation and siltstone from the Catahoula Formation are used in the construction of local roads.

The northern part of the county produces oil and gas. Timber is an important resource in the eastern part of the county. A few farms grow Christmas trees for commercial sales or for on-the-farm sales (fig. 2).

Climate

Grimes County is hot in summer and cool in winter. An occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rainfall is uniformly distributed throughout the year, reaching a slight peak in spring. Snowfall is infrequent. Annual total precipitation is normally adequate for the production of cotton, feed grain, small grain, and pasture grasses.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Brenham, Texas, (in Washington County) in the period 1951 to 1981. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 52 degrees F

Figure 2.—Virginia pine grown for use as Christmas trees in an area of Elmina loamy fine sand, 1 to 5 percent slopes.

and the average daily minimum temperature is 40 degrees. The lowest temperature on record, which occurred at Brenham on February 2, 1951, is 9 degrees. In summer, the average temperature is 83 degrees and the average daily maximum temperature is 95 degrees. The highest recorded temperature, which occurred at Brenham on August 11, 1982, is 110 degrees.

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

The total annual precipitation is about 40 inches. Of this, nearly 22 inches, or about 55 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 16 inches. The heaviest 1-day rainfall during the period of record was 6.85 inches at Brenham on September 12, 1961. Thunderstorms occur on about 41 days each year. Tornadoes and severe thunderstorms occur occasionally. These storms are local in extent and of

short duration. The pattern of damage is variable and spotty.

The average seasonal snowfall is less than 1 inch. The greatest snow depth at any one time during the period of record was 3 inches.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The sun shines 70 percent of the time possible in summer and 55 percent in winter. The prevailing wind is from the south. Average windspeed is highest, 11 miles per hour, in spring.

How This Survey Was Made

This survey was made to provide information about the soils in the survey area. The information includes a description of the soils and their location and a discussion of the suitability, limitations, and management of the soils for specified uses. Soil scientists observed the steepness, length, and shape of slopes; the general pattern of drainage; the kinds of crops and native plants growing on the soils; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material from which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils in the survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil is associated with a particular kind of landscape or with a segment of the landscape. By observing the soils in the survey area and relating their position to specific segments of the landscape, a soil scientist develops a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. The system of taxonomic classification used in the United States is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area are generally collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot assure that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The soil descriptions, names, and delineations in this survey do not fully match those in the surveys of

adjoining counties that were published at an earlier date. Differences are the result of improved knowledge and changes in series concepts, mapping intensity, or extent of soils.

Map Unit Composition

A map unit delineation on a soil map represents an area dominated by one major kind of soil or an area dominated by two or three kinds of soil. A map unit is identified and named according to the taxonomic classification of the dominant soil or soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural objects. In common with other natural objects, they have a characteristic variability in their properties. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of soils of other taxonomic classes. Consequently, every map unit is made up of the soil or soils for which it is named and some soils that belong to other taxonomic classes. In the detailed soil map units, these latter soils are called inclusions or included soils. In the general soil map units, they are called soils of minor extent.

Most inclusions have properties and behavioral patterns similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting (similar) inclusions. They may or may not be mentioned in the map unit descriptions. Other inclusions, however, have properties and behavior divergent enough to affect use or require different management. These are contrasting (dissimilar) inclusions. They generally occupy small areas and cannot be shown separately on the soil maps because of the scale used in mapping. The inclusions of contrasting soils are mentioned in the map unit descriptions. A few inclusions may not have been observed and consequently are not mentioned in the descriptions, especially where the soil pattern was so complex that it was impractical to make enough observations to identify all of the kinds of soils on the landscape.

The presence of inclusions in a map unit in no way diminishes the usefulness or accuracy of the soil data. The objective of soil mapping is not to delineate pure taxonomic classes of soils but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but onsite investigation is needed to plan for intensive uses in small areas.

General Soil Map Units

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

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

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

Loamy and Sandy Soils on Uplands and Terraces; Formed Under Forest Vegetation

These soils make up about 48 percent of the county. The major soils are in the Axtell, Burlewash, Chazos, Conroe, Depcor, Elmina, Fetzer, Gomery, Gredge, Huntsburg, Lufkin, Robco, Shiro, and Singleton series. All of these soils are nearly level to strongly sloping. Native vegetation consists of a post oak savanna and pine forest.

Most areas are used as pasture or range or for timber production. The extent of urban development is increasing.

1. Axtell-Lufkin-Gredge

Nearly level to strongly sloping, moderately well drained and somewhat poorly drained, loamy soils; formed in loamy and clayey ancient alluvium

This map unit consists mainly of gently sloping or moderately sloping, moderately well drained Axtell soils on ridges and slopes; nearly level to gently sloping, somewhat poorly drained Lufkin soils on foot slopes and flats; and gently sloping to strongly sloping, moderately well drained Gredge soils on ridges and side slopes. All of these soils are underlain by neutral to moderately alkaline, loamy and clayey ancient alluvium. The landscape consists of broad flats and short side slopes above drainageways. Drainage mainly flows west to the Navasota River and northeast toward the Trinity River. Native vegetation consists of scattered hardwoods and tall and mid native grasses.

This map unit makes up about 13 percent of the county. It is about 24 percent Axtell and similar soils, 21 percent Lufkin and similar soils, 21 percent Gredge and similar soils, and 34 percent soils of minor extent.

Typically, the surface layer of the Axtell soils is fine sandy loam about 9 inches thick. It is dark grayish brown in the upper 3 inches and grayish brown in the lower 6 inches. The upper part of the subsoil, from a depth of 9 to 25 inches, is red clay that has light brownish gray mottles. The next part, from a depth of 25 to 50 inches, is light gray clay that has red and yellowish brown mottles. The lower part, from a depth of 50 to 65 inches, is light gray clay. The surface layer is moderately acid. The upper part of the subsoil is very strongly acid, and the lower part grades to slightly alkaline.

Typically, the surface layer of the Lufkin soils is grayish brown, moderately acid fine sandy loam about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 22 inches, is dark grayish brown, strongly acid clay. The next part, from a depth of 22 to 45 inches, is gray, moderately acid clay. The lower part, from a depth of 45 to 60 inches, is light brownish gray, neutral clay that has common, fine, faint, pale brown mottles. The underlying material, to a depth of 80 inches, is light brownish gray, neutral clay loam.

Typically, the surface layer of the Gredge soils is grayish brown, moderately acid fine sandy loam about 7 inches thick. The subsoil extends to a depth of 60 inches. From a depth of 7 to 15 inches, it is brown, strongly acid clay; from a depth of 15 to 31 inches, it is light yellowish brown, slightly acid clay that has light brownish gray mottles; from a depth of 25 to 45 inches, it is light brownish gray, moderately alkaline clay that grades to clay loam with increasing depth; and from a depth of 45 to 60 inches, it is very pale brown and light

gray, moderately alkaline sandy clay loam.

Of minor extent in this map unit are Boonville, Burlewash, Chazos, Elmina, Gladewater, Gowker, Nahatche, Navasan, Padina, Rader, Robco, Shiro, and Silstid soils. The nearly level to gently sloping, loamy Boonville and Rader soils are on foot slopes and broad flats. The gently sloping to strongly sloping, loamy Burlewash soils are on side slopes. The gently sloping or moderately sloping, sandy Chazos, Elmina, Padina, Robco, Shiro, and Silstid soils are on ridgetops and foot slopes. The nearly level, clayey Gladewater and loamy Gowker and Nahatche soils are along flood plains of local streams. The sandy Navasan soils are on low terraces along the flood plain of the Navasota River.

This map unit is used mainly as range or pasture. Some areas are cultivated. Forage sorghum and small grain are grown in these areas. The major limitations affecting urban development are the shrink-swell potential and very slow permeability. Deer hunting is the major recreational activity in areas of this unit.

2. Depcor-Fetzer-Huntsburg

Gently sloping or moderately sloping, moderately well drained and somewhat poorly drained sandy soils; formed in unconsolidated loamy and clayey material

This map unit consists mainly of gently sloping or moderately sloping, moderately well drained Depcor soils on ridgetops and slopes; gently sloping, somewhat poorly drained Fetzer soils on foot slopes; and gently sloping or moderately sloping, moderately well drained Huntsburg soils on ridges, slopes, and breaks (fig. 3). All of these soils are underlain by acid to alkaline, loamy and clayey material of the Willis Formation. The landscape consists of broad, sandy ridges. Drainage mainly flows southeast to the San Jacinto River. Native vegetation consists of pines and hardwoods and an understory of grasses and forbs.

This map unit makes up about 12 percent of the county. It is about 38 percent Depcor and similar soils, 22 percent Fetzer and similar soils, 21 percent Huntsburg soils, and 19 percent soils of minor extent.

Typically, the surface layer of the Depcor soils is grayish brown loamy fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 28 inches, is pale brown loamy fine sand. The upper part of the subsoil, from a depth of 28 to 40 inches, is brownish yellow sandy clay loam that has reddish and yellowish mottles. The lower part, from a depth of 40 to 72 inches, is red sandy clay loam that is mottled in shades of gray, yellow, and red. The surface layer and subsurface layer are slightly acid, and the subsoil is very strongly acid.

Typically, the surface layer of the Fetzer soils is brown loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 25 inches, is pale brown loamy fine sand that has yellowish brown mottles. The subsoil extends to a depth of 75 inches. From a depth of 25 to 34 inches, it is mottled yellowish brown and grayish brown clay loam; from a depth of 34 to 48 inches, it is light brownish gray sandy clay that has yellowish brown mottles; from a depth of 48 to 58 inches, it is yellowish brown sandy clay loam that has grayish brown and red mottles; from a depth of 58 to 65 inches, it is yellowish brown sandy clay that has gray mottles; and from a depth of 65 to 75 inches, it is light gray clay. The surface layer is moderately acid, and the lower part of the subsoil grades to slightly alkaline.

Typically, the surface layer of the Huntsburg soils is slightly acid, loamy fine sand about 11 inches thick. It is grayish brown in the upper part and light gray in the lower part. The upper part of the subsoil, from a depth of 11 to 16 inches, is yellowish brown, very strongly acid clay that has red mottles. The next part, from a depth of 16 to 40 inches, is light gray, very strongly acid clay that has red mottles. The lower part, from a depth of 40 to 65 inches, is light gray and white sandy clay that has brownish mottles.

Of minor extent in this map unit are Annona, Boy, Gowker, Hatliff, Landman, Nahatche, and Waller soils. The gently sloping or moderately sloping, loamy Annona soils are on ridges, side slopes, and breaks. The gently sloping or moderately sloping, sandy Boy soils are on ridges. The nearly level, loamy Gowker, Hatliff, and Nahatche soils are along flood plains of local streams. The gently sloping, sandy Landman soils are on foot slopes. The nearly level, loamy Waller soils are in slight depressions.

This map unit is used mainly as woodland or pasture. Many areas have been subdivided into small homesites. These soils are suited to most crops grown in the county. Deer hunting is the major recreational activity in areas of this unit. The major limitations affecting urban development are the wetness in some areas and the sandy surface texture.

3. Singleton-Burlewash-Shiro

Nearly level to strongly sloping, well drained or moderately well drained, sandy and loamy soils; formed in tuffaceous sandstone and shale

This map unit consists mainly of nearly level to gently sloping, moderately well drained Singleton soils on broad flats and divides; gently sloping to strongly sloping, well drained Burlewash soils on slopes and hillsides; and gently sloping or moderately sloping, moderately well drained Shiro soils on hilltops and hillsides. All of these soils are underlain by acid

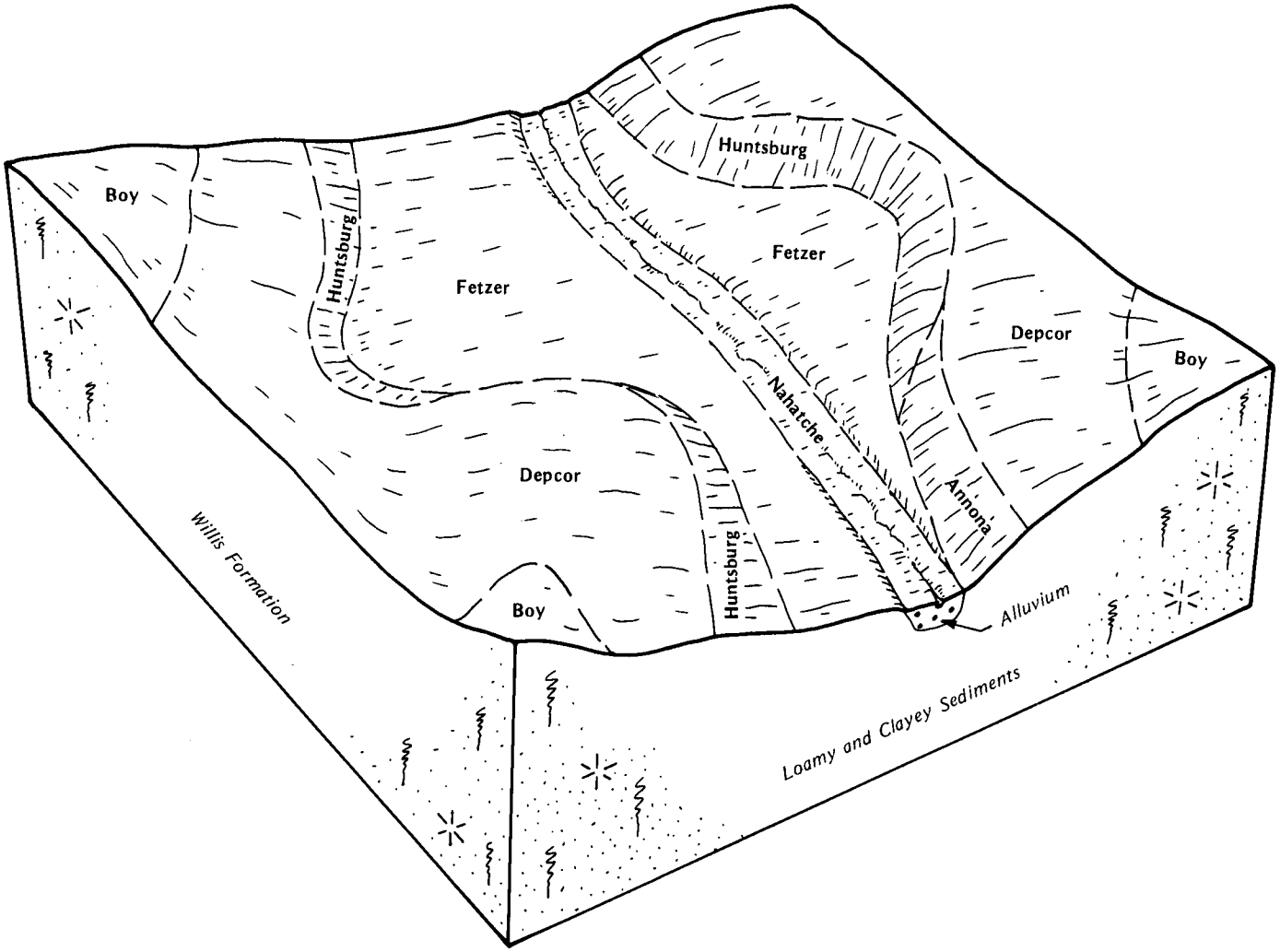

Figure 3.—Typical pattern of soils and parent material in the Depcor-Fetzer-Huntsburg general soil map unit.

sandstone and shale of the Jackson Group. The landscape is rolling and dissected by many drainageways. Drainage mainly flows to the southwest in the western part of the county and to the northeast in the eastern part. Native vegetation consists of scattered hardwoods that have an understory of grasses.

This map unit makes up about 11 percent of the county. It is about 23 percent Singleton and similar soils, 21 percent Burlewash and similar soils, 21 percent Shiro and similar soils, and 35 percent soils of minor extent.

Typically, the surface layer of the Singleton soils is light brownish gray, strongly acid fine sandy loam about 5 inches thick. The subsurface layer, from a depth of 5 to 9 inches, is pale brown, strongly acid fine sandy loam. The upper part of the subsoil, from a depth of 9 to 20 inches, is dark grayish brown, very strongly acid clay that is dark brown in the interior of the peds. The next part, from a depth of 20 to 32 inches, is grayish brown, very strongly acid clay that is brown in the interior of the peds. The lower part, from a depth of 32 to 38 inches, is brown, moderately acid clay loam. The underlying material, from a depth of 38 to 60 inches, is light gray, moderately acid, weakly cemented sandstone bedrock.

Typically, the surface layer of the Burlewash soils is dark grayish brown, slightly acid fine sandy loam about 6 inches thick. The subsoil, from a depth of 6 to 25 inches, is brown, very strongly acid clay. The underlying material, from a depth of 25 to 60 inches, is very strongly acid, very pale brown tuffaceous sandstone bedrock interbedded with light gray shale bedrock.

Typically, the surface layer of the Shiro soils is pinkish gray, moderately acid loamy fine sand about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 18 inches, is yellowish red, very strongly acid clay. The lower part, from a depth of 18 to 31 inches, is light gray, very strongly acid clay that has red mottles. The underlying material, from a depth of 31 to 40 inches, is white, very strongly acid sandstone bedrock.

Of minor extent in this map unit are Annona, Axtell, Gibbonscreek, Gladewater, Gomery, Hatliff, Huntsburg, Koether, Nahatche, Padina, Rader, and Tonkavar soils and areas of Arents. The gently sloping or moderately sloping, loamy Annona and Axtell soils are on foot slopes and hillsides. Arents consist of soil material that was mixed during surface mining and left in spoil piles. The gently sloping or moderately steep, loamy Gibbonscreek soils are in areas that have been mined for lignite and reclaimed. The nearly level, clayey Gladewater and loamy Hatliff and Nahatche soils are on flood plains. The gently sloping or moderately sloping, sandy Gomery, Huntsburg, Padina, and Tonkavar soils are on ridges and hillsides. The gently sloping or moderately sloping, sandy Koether soils are on slope breaks and hillsides. The loamy Rader soils are on flats.

This map unit is used mainly as range or pasture. Much of the unit is mined for lignite. The Gibbons Creek Reservoir is in this unit. It provides a source of cooling for the lignite power plant as well as recreational facilities. In a few areas small grain or forage sorghum are grown for grazing or hay. Deer hunting is the major recreational activity in areas of this unit. The major limitations affecting urban development are very slow permeability and the shrink-swell potential.

4. Gomery-Shiro-Elmina

Gently sloping or moderately sloping, moderately well drained and somewhat poorly drained, sandy soils; formed in sandstone and loamy tuffaceous material

This map unit consists mainly of gently sloping, somewhat poorly drained Gomery soils on broad ridgetops; gently sloping or moderately sloping, moderately well drained Shiro soils on breaks and slopes; and gently sloping or moderately sloping, somewhat poorly drained Elmina soils on hillsides and foot slopes (fig. 4). All of these soils are underlain by acid, sandy and loamy material, mainly sandstone, of the Jackson Group. The landscape is rolling. Small drainageways flow to the northeast in the eastern part of the county and to the northwest in the western part. Native vegetation consists of hardwoods and pine trees that have an understory of grasses.

This map unit makes up about 8 percent of the county. It is about 35 percent Gomery and similar soils, 19 percent Shiro soils, 17 percent Elmina soils, and 29 percent soils of minor extent.

Typically, the surface layer of the Gomery soils is grayish brown loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 30 inches, is light brownish gray loamy fine sand. The upper part of the subsoil, from a depth of 30 to 45 inches, is grayish brown sandy clay loam that has yellowish brown and red mottles. The lower part, from a depth of 45 to 59 inches, is gray sandy clay loam that has red mottles. The underlying material, from a depth of 59 to 65 inches, is brown, weakly cemented sandstone bedrock. The surface layer and subsurface layer are slightly acid, and the subsoil and underlying material are very strongly acid.

Typically, the surface layer of the Shiro soils is pinkish gray, moderately acid loamy fine sand about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 18 inches, is yellowish red, very strongly acid clay. The lower part, from a depth of 18 to 31 inches, is light gray, very strongly acid clay that has red mottles. The underlying material, from a depth of 31 to 40 inches, is white, very strongly acid sandstone bedrock.

Typically, the surface layer of the Elmina soils is loamy fine sand about 22 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The subsoil, from a depth of 22 to 55 inches, is sandy clay that has dark red to red mottles. It is light brownish gray in the upper part and grayish brown in the lower part. The underlying material, from a depth of 55 to 72 inches, is light yellowish brown sandy clay loam that has tuffaceous clay fragments. The surface layer is slightly acid, and the underlying material grades to very strongly acid.

Of minor extent in this map unit are Arol, Burlewash, Falba, Gladewater, Hatliff, Huntsburg, Koether, Nahatche, Shalba, Singleton, and Tonkavar soils. The nearly level to gently sloping, loamy Arol, Falba, and Singleton soils are on broad flats and foot slopes. The gently sloping to strongly sloping, loamy Burlewash and Shalba soils are on slopes and hillsides. The nearly level, clayey Gladewater and loamy Hatliff and Nahatche soils are on flood plains. The gently sloping or moderately sloping, sandy Huntsburg, Koether, and Tonkavar soils are on ridges and hillsides.

This map unit is used mainly as range or pasture. Some areas support marketable stands of pine timber and are managed for timber production. Much of this map unit is underlain by deposits of lignite. Some areas are now leased for surface mining. In a few areas forage sorghum is grown for grazing or hay. Deer hunting is the major recreational activity in areas of this unit. The major limitations affecting urban development

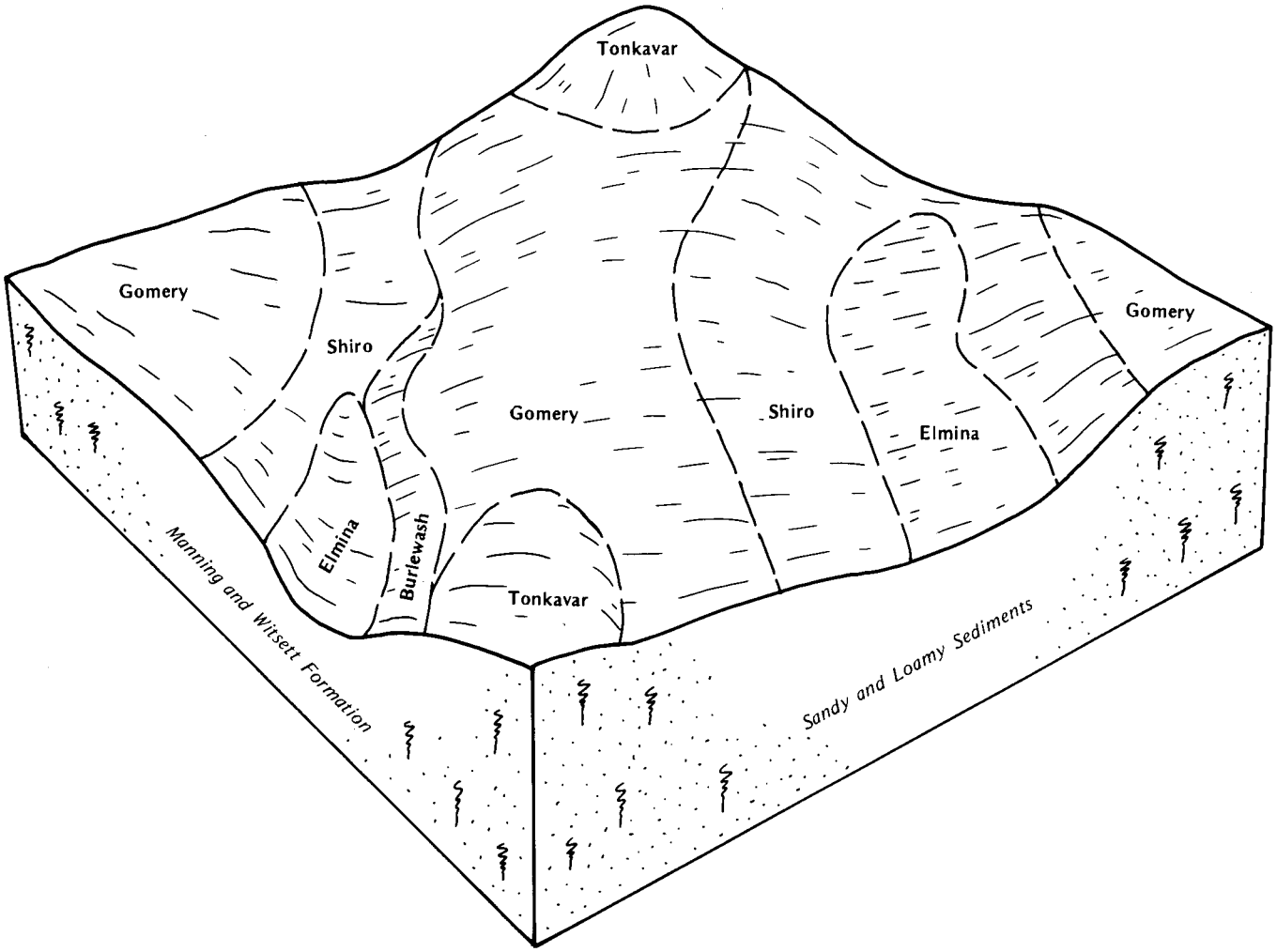

Figure 4.—Typical pattern of soils and parent material in the Gomery-Shiro-Elmina general soil map unit.

are the sandy texture and slow permeability.

5. Robco-Chazos-Axtell

Gently sloping or moderately sloping, moderately well drained, sandy and loamy soils; formed in loamy and clayey ancient alluvium

This map unit consists mainly of gently sloping or moderately sloping, sandy Robco and Chazos soils on ridges and hillsides and gently sloping or moderately sloping, loamy Axtell soils on hilltops, ridges, and breaks (fig. 5). All of these soils are underlain by acid to alkaline, loamy and clayey ancient alluvium on terraces along the Brazos and Navasota Rivers. Drainage flows west toward these rivers. Native vegetation consists of scattered hardwoods and tall and mid native grasses.

This map unit makes up about 5 percent of the county. It is about 32 percent Robco and similar soils, 29 percent Chazos soils, 16 percent Axtell and similar soils, and 23 percent soils of minor extent.

Typically, the surface layer of the Robco soils is slightly acid, dark brown loamy fine sand about 5 inches thick. The subsurface layer, from a depth of 5 to 25 inches, is moderately acid, yellowish brown loamy fine sand. The subsoil extends to a depth of 75 inches. From a depth of 25 to 30 inches, it is yellowish brown sandy clay loam; from a depth of 30 to 50 inches, it is mottled yellowish brown, red, and grayish brown clay loam; from a depth of 50 to 65 inches, it is grayish brown clay loam; and from a depth of 65 to 75 inches, it is light brownish gray clay loam. It is strongly acid.

Typically, the surface layer of the Chazos soils is pinkish gray, slightly acid loamy fine sand about 15 inches thick. The upper part of the subsoil, from a depth

of 15 to 27 inches, is moderately acid, strong brown clay that has red and grayish brown mottles. The next part, from a depth of 27 to 52 inches, is dark grayish brown, moderately acid, dark grayish brown clay that has red and strong brown mottles. The lower part, from a depth of 52 to 65 inches, is red, moderately alkaline clay that has yellowish brown mottles. The underlying material, from a depth of 65 to 90 inches, is yellowish red, moderately alkaline sandy clay loam.

Typically, the surface layer of the Axtell soils is fine sandy loam about 9 inches thick. It is dark grayish brown in the upper part and grayish brown in the lower part. The upper part of the subsoil, from a depth of 9 to 25 inches, is red clay that has light brownish gray mottles. The next part, from a depth of 25 to 50 inches, is light gray clay that has red and yellowish brown mottles. The lower part, from a depth of 50 to 65 inches, is light gray clay. The surface layer is moderately acid. The upper part of the subsoil is very strongly acid, and the lower part grades to slightly alkaline.

Of minor extent in this map unit are Boy, Brenham, Fetzer, Frelsburg, Gowker, Hatliff, Huntsburg, Nahatchee, Padina, Rader, Silawa, and Tabor soils. The gently sloping or moderately sloping, sandy Boy, Huntsburg, Padina, and Silawa soils are on ridges. The gently sloping or moderately sloping, loamy Brenham and Tabor soils are on hillsides and ridges. The gently sloping, sandy Fetzer soils are on foot slopes. The gently sloping, clayey Frelsburg soils are on hillslopes

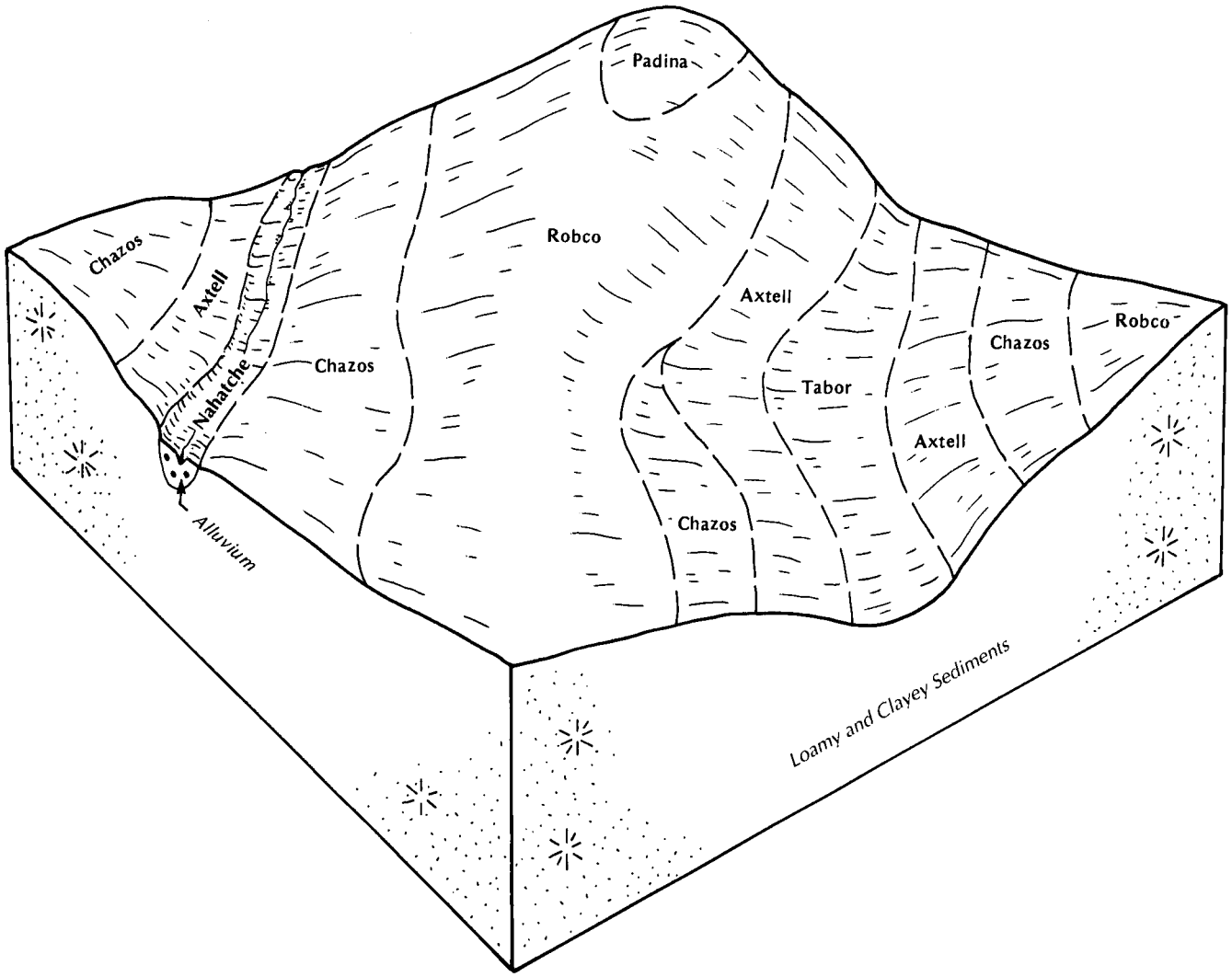

Figure 5.—Typical pattern of soils and parent material in the Robco-Chazos-Axtell general soil map unit.

and foot slopes. The nearly level, loamy Hatliff, Gowker, and Nahatche soils are along flood plains of small streams.

This map unit is used mainly as pasture or range. Some areas are cultivated. Small grain and forage sorghum are grown in these areas. Watermelons and other truck crops are grown in other areas. The major limitations affecting urban development are the shrink-swell potential and very slow permeability. Deer hunting is the major recreational activity in areas of this unit.

6. Conroe-Depcor

Gently sloping or moderately sloping, moderately well drained, sandy soils; formed in unconsolidated loamy material

This map unit consists mainly of gently sloping Conroe soils on hilltops and ridges and gently sloping or moderately sloping Depcor soils on foot slopes and breaks. All of these soils are underlain by acid, loamy material of the Willis Formation. The landscape is gently rolling. Drainage flows southeast to the San Jacinto River. The native vegetation consists of pine trees that have an understory of grasses and forbs.

This map unit makes up about 1 percent of the county. It is about 45 percent Conroe soils, 39 percent Depcor soils, and 16 percent soils of minor extent.

Typically, the surface layer of the Conroe soils is grayish brown loamy fine sand about 5 inches thick. The subsurface layer, from a depth of 5 to 24 inches, is light yellowish brown, gravelly loamy fine sand. The subsoil, from a depth of 24 to 74 inches, is clay. It is yellowish brown and moderately acid in the upper part and mottled light gray, yellowish brown, and red in the lower part. It grades to strongly acid in the lower part.

Typically, the surface layer of the Depcor soils is grayish brown loamy fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 28 inches, is pale brown loamy fine sand. The upper part of the subsoil, from a depth of 28 to 40 inches, is brownish yellow sandy clay loam that has reddish and yellowish mottles. The lower part, from a depth of 40 to 72 inches, is red sandy clay loam that is mottled in shades of gray, yellow, and red. The surface layer and subsurface layer are slightly acid, and the subsoil is very strongly acid.

Of minor extent in this map unit are Annona, Boy, Fetzer, Hatliff, Landman, and Nahatche soils. The gently sloping to sloping, loamy Annona soils are on ridges and breaks. The gently sloping or moderately sloping, sandy Boy soils are on ridgetops and divides. The gently sloping, sandy Fetzer and Landman soils are on foot slopes. The nearly level, loamy and sandy Hatliff and Nahatche soils are along flood plains of local streams.

This map unit is used mainly as woodland or pasture. Many areas have been subdivided into small homesites. The Conroe soils are a source of gravel used in the construction of most county and private roads. This unit is suited to most crops grown in the county. Deer hunting is the major recreational activity in areas of this unit. The major limitations affecting urban development are the wetness and the sandy surface layer.

Dominantly Clayey and Loamy Soils on Uplands and Terraces; Formed Under Prairie Vegetation

These soils make up about 41 percent of the county. The major soils are in the Boonville, Brenham, Burleson, Crockett, Falba, Frelsburg, Greenvine, Mabank, Shiro, Wilson, Zack, and Zulch series. All of these soils are nearly level to moderately sloping. Native vegetation consists of a tall grass prairie that has scattered motts of hardwoods. Limitations affecting urban development include very slow permeability and the shrink-swell potential.

7. Frelsburg-Crockett-Brenham

Gently sloping or moderately sloping, well drained and moderately well drained, loamy and clayey soils; formed in loamy and clayey material

This map unit consists mainly of gently sloping, moderately well drained Frelsburg soils on ridges and side slopes; gently sloping or moderately sloping, well drained Brenham soils on hillsides and foot slopes; and gently sloping or moderately sloping, moderately well drained Crockett soils on ridges and slopes (fig. 6). All of these soils are underlain by alkaline, clayey and loamy material of the Fleming Formation. The landscape is typically rolling and well dissected by drainageways. Drainage flows west to the Brazos River in the western part of the county and southeast to the San Jacinto River in the eastern part. The native vegetation consists of a tall grass prairie or savanna that has has motts of elm, oak, and mixed hardwoods along creeks.

This map unit makes up about 20 percent of the county. It is about 42 percent Frelsburg and similar soils, 15 percent Crockett and similar soils, 12 percent Brenham and similar soils, and 31 percent soils of minor extent.

Typically, the surface layer of the Frelsburg soils is very dark gray clay about 10 inches thick. The upper part of the subsoil, from a depth of 10 to 32 inches, is

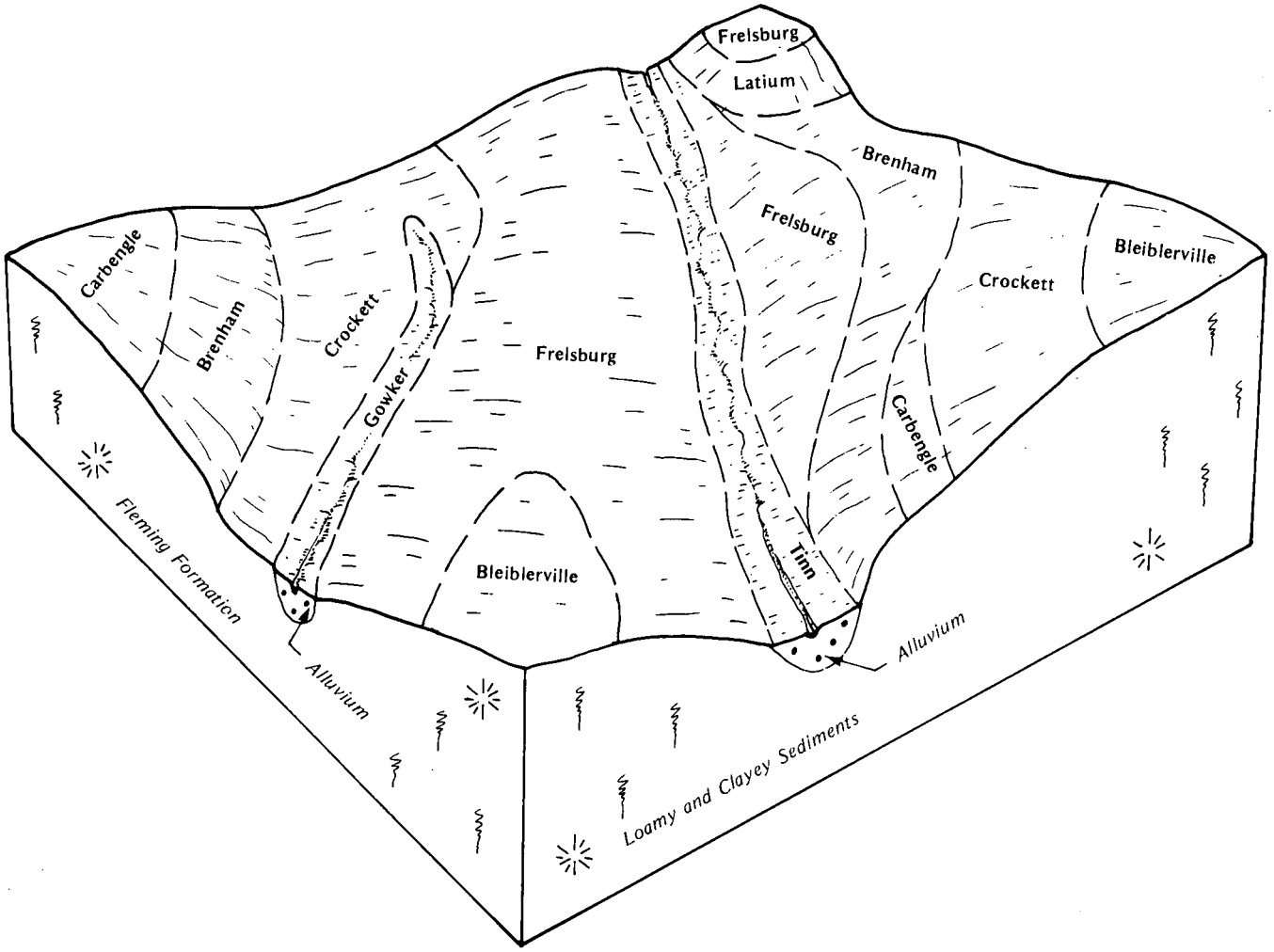

Figure 6.—Typical pattern of soils and parent material in the Frelsburg-Crockett-Brenham general soil map unit.

dark grayish brown clay. The next part, from a depth of 32 to 52 inches, is grayish brown clay. The lower part, from a depth of 52 to 70 inches, is olive yellow clay. These soils are moderately alkaline and calcareous throughout.

Typically, the surface layer of the Crockett soils is dark brown fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 27 inches, is dark brown clay that has yellowish brown and red mottles. The next part, from a depth of 27 to 42 inches, is olive brown clay that has gray and yellowish brown mottles. The lower part, from a depth of 42 to 55 inches, is grayish brown clay. The underlying material, from a depth of 55 to 65 inches, is light brownish gray clay. The surface layer is moderately acid, and the underlying material is moderately alkaline.

Typically, the surface layer of the Brenham soils is very dark grayish brown clay loam about 12 inches thick. The subsoil, from a depth of 12 to 55 inches, is silty clay loam. It is yellowish brown in the upper part and light yellowish brown in the lower part. The underlying material, from a depth of 55 to 80 inches, is yellowish brown silty clay loam. These soils are moderately alkaline and calcareous throughout.

Of minor extent in this map unit are Chazos, Depcor, Gowker, Huntsburg, and Tinn soils. The nearly level, loamy Gowker soils and clayey Tinn soils are along flood plains of local streams. The gently sloping or moderately sloping, loamy Carbengle and sandy Chazos, Depcor, and Huntsburg soils are on ridges and side slopes. The nearly level to gently sloping, clayey Bleiblerville soils and moderately sloping or strongly sloping, clayey Latium soils are on ridges.

This map unit is used mainly as range and pasture.

Some areas are cultivated. Forage sorghum and small grain are grown in these areas. The major limitations affecting urban development are the shrink-swell potential and very slow permeability. Fishing in private ponds and hunting are recreational activities in areas of this unit.

8. Falba-Shiro-Greenvine

Gently sloping or moderately sloping, moderately well drained, sandy, loamy, and clayey soils; formed in tuffaceous clay and sandstone

This map unit consists mainly of gently sloping, Falba soils on side slopes and foot slopes; gently sloping or moderately sloping, Shiro soils on ridgetops and side slopes; and gently sloping or moderately sloping, Greenvine soils on ridgetops and slopes (fig. 7). All of these soils are underlain by acid to alkaline, tuffaceous clay and sandstone of the Catahoula Formation. The landscape is gently rolling and well dissected by many small drainageways. Drainage mainly flows to the southwest in the western part of the county and to the north and south in the eastern part. The native vegetation consists of a tall grass prairie or savanna that has motts of oak along sandy ridges and breaks.

This map unit makes up about 12 percent of the county. It is about 42 percent Falba and similar Arol soils, 13 percent Shiro and similar Huntsburg soils, 12 percent Greenvine soils, and 33 percent soils of minor extent.

Typically, the surface layer of the Falba soils is slightly acid, grayish brown fine sandy loam about 6

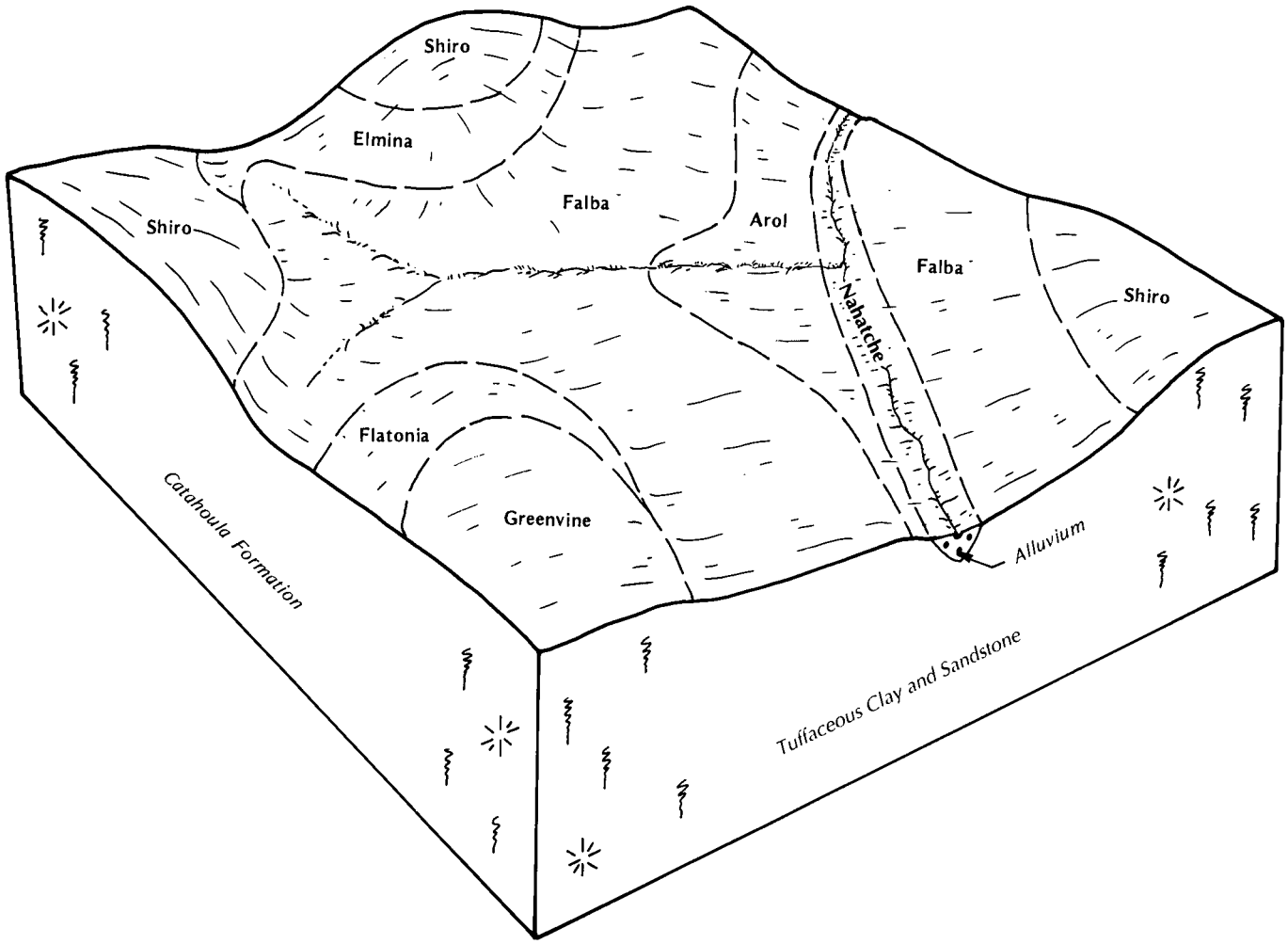

Figure 7.—Typical pattern of soils and parent material in the Falba-Shiro-Greenvine general soil map unit.

inches thick. The upper part of the subsoil, from a depth of 6 to 21 inches, is slightly acid, grayish brown clay. The lower part, from a depth of 21 to 35 inches, is very strongly acid, light gray clay. The underlying material, from a depth of 35 to 40 inches, is slightly alkaline, white, tuffaceous sandstone bedrock.

Typically, the surface layer of the Shiro soils is pinkish gray, moderately acid loamy fine sand about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 18 inches, is yellowish red, very strongly acid clay. The lower part, from a depth of 18 to 31 inches, is gray, very strongly acid clay that has red mottles. The underlying material, from a depth of 31 to 40 inches, is white, very strongly acid sandstone bedrock.

Typically, the surface layer of the Greenvine soils is clay that is about 15 inches thick. The upper part is black, and the lower part is very dark gray. The subsoil, from a depth of 15 to 30 inches, is very dark gray clay that has streaks of light brownish gray. The underlying material, from a depth of 30 to 60 inches, is light brownish gray, interbedded tuffaceous clay. These soils are moderately alkaline and calcareous throughout.

Of minor extent in this map unit are Annona, Arol, Chazos, Elmina, Flatonia, Gomery, Gowker, Hatliff, Nahatche, and Padina soils. The gently sloping to sloping, loamy Annona soils and nearly level to gently sloping, loamy Arol soils are on ridges and breaks. The gently sloping to sloping, sandy Chazos, Elmina, and Padina soils are on ridges and side slopes. The gently sloping, sandy Gomery soils are on ridges in the uplands. The nearly level to gently sloping, loamy Flatonia soils are on broad flats. The nearly level, loamy Gowker, Hatliff, and Nahatche soils are on bottom land that is frequently flooded.

This map unit is used mainly as range and pasture. Some areas are cultivated. Forage sorghum and small grain are grown in these areas. Coastal bermudagrass and bahiagrass are the main species of improved grasses. The major limitations affecting urban development are the shrink-swell potential and very slow permeability. Hunting and fishing are recreational activities in areas of this unit.

9. Zulch-Zack-Boonville

Nearly level to gently sloping, moderately well drained and somewhat poorly drained, loamy soils; formed in siltstone and unconsolidated loamy material

This map unit consists mainly of nearly level to gently sloping, moderately well drained Zulch soils on flat ridges and foot slopes; gently sloping, moderately well drained Zack soils on side slopes; and gently sloping, somewhat poorly drained Boonville soils on foot slopes (fig. 8). All of these soils are underlain by acid to alkaline, clayey and loamy material of the Yegua Formation. The landscape consists mainly of broad, gently rolling ridges that are well dissected by creeks and small drainageways. Drainage mainly flows northeast to Bedias Creek and the Trinity River. The native vegetation consists of tall and medium grasses interspersed with scattered hardwoods.

This map unit makes up about 9 percent of the county. It is about 36 percent Zulch and similar soils, 27 percent Zack and similar soils, 10 percent Boonville and similar soils, and 27 percent soils of minor extent.

Typically, the surface layer of the Zulch soils is dark grayish brown, slightly acid fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 25 inches, is very dark grayish brown, slightly acid clay. The lower part, from a depth of 25 to 39 inches, is dark grayish brown, slightly acid clay. The underlying material, from a depth of 39 to 60 inches, is light brownish gray, moderately alkaline, weakly consolidated siltstone bedrock.

Typically, the surface layer of the Zack soils is dark brown, moderately acid fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 22 inches, is dark brown, moderately acid clay that has grayish brown mottles. The lower part, from a depth of 22 to 32 inches, is brown slightly acid clay that has grayish brown mottles. The underlying material, from a depth of 32 to 48 inches, is pale brown, neutral siltstone bedrock.

Typically, the surface layer of the Boonville soils is neutral fine sandy loam about 13 inches thick. It is very dark grayish brown in the upper part and grayish brown in the lower part. The upper part of the subsoil, from a depth of 13 to 20 inches, is dark grayish brown, strongly acid clay that has brownish yellow and reddish yellow mottles. The lower part, from a depth of 20 to 46 inches, is grayish brown, strongly acid clay. The underlying material, from a depth of 46 to 60 inches, is gray and brown, moderately acid clay loam.

Of minor extent in this map unit are Axtell, Chazos, Gowker, Kaman, Nahatche, Padina, Rader, and Shiro soils. The gently sloping to sloping, loamy Axtell soils are on ridges and side slopes. The gently sloping to sloping, sandy Chazos, Padina, and Shiro soils are on ridges and side slopes. The nearly level, loamy Gowker and Nahatche soils and clayey Kaman soils are on flood plains. The nearly level to gently sloping, loamy Rader soils are on broad flats and foot slopes.

This map unit is used mainly as range or pasture. A few areas are cultivated. Small grain and forage sorghum are grown in these areas. The major limitations affecting urban development are the shrink-swell potential and very slow permeability. Deer hunting is the major recreational activity in areas of this unit.

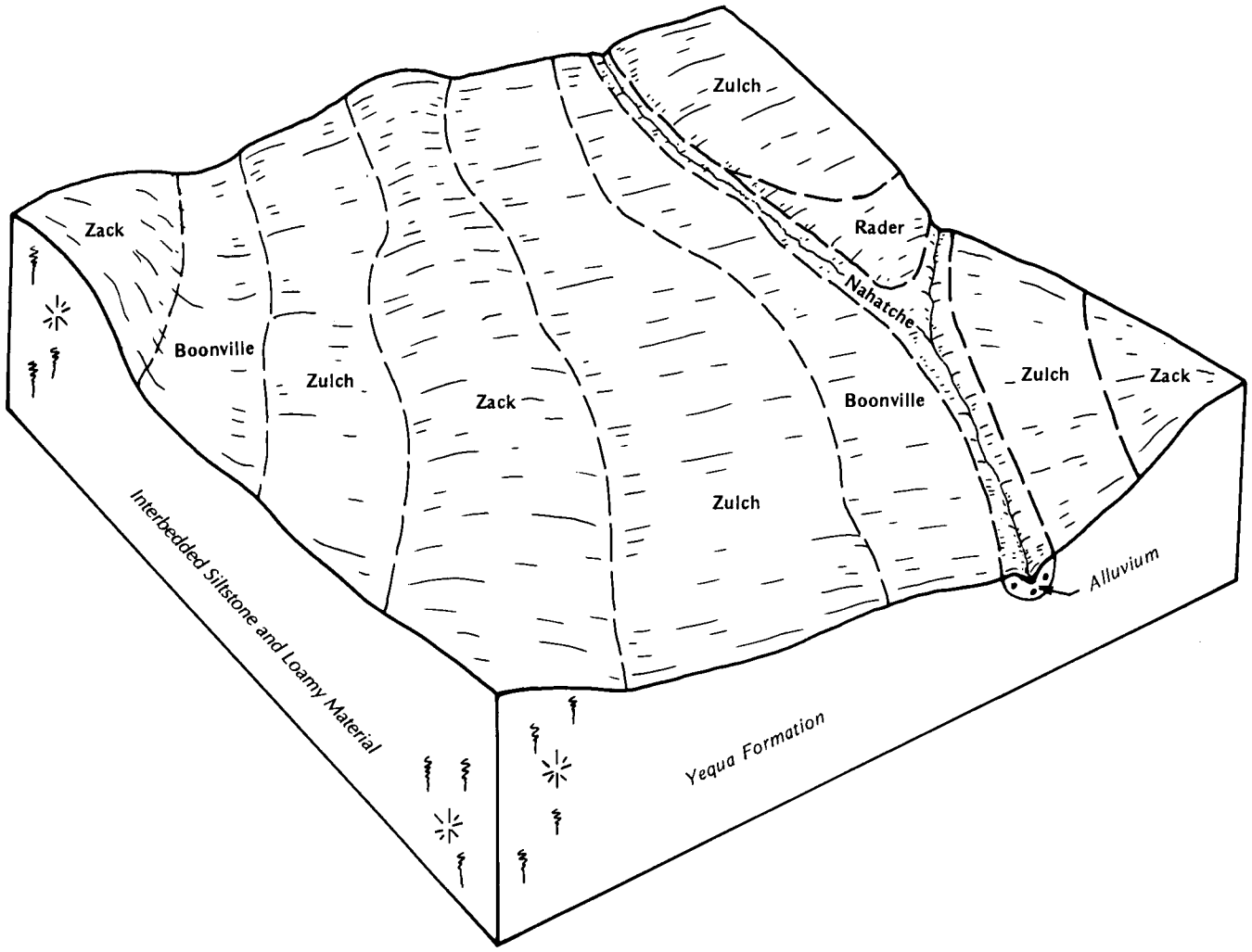

Figure 8.—Typical pattern of soils and parent material in the Zulch-Zack-Boonville general soil map unit.

10. Mabank-Wilson-Burleson

Nearly level to gently sloping, moderately well drained and somewhat poorly drained, loamy and clayey soils; formed in clayey ancient alluvium

This map unit consists mainly of nearly level to gently sloping, somewhat poorly drained Mabank soils on flats and low, smooth ridges; nearly level to gently sloping, somewhat poorly drained Wilson soils on flats and hillsides; and nearly level, moderately well drained Burleson soils on flats and in slightly depressional areas. All of these soils are underlain by alkaline, loamy and clayey ancient alluvium. The landscape is mostly flat and smooth with a few breaks to drainageways. Drainage flows west to the Brazos River. The native vegetation consists of tall and medium grasses interspersed with scattered hardwoods.

This map unit makes up about 2 percent of the county. It is about 28 percent Mabank and similar soils, 18 percent Wilson soils, 14 percent Burleson soils, and 40 percent soils of minor extent.

Typically, the surface layer of the Mabank soils is grayish brown, slightly acid fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 40 inches, is very dark gray, moderately acid clay. The next part, from a depth of 40 to 46 inches, is very dark gray, neutral clay. The lower part, from a depth of 46 to 65 inches, is grayish brown, moderately alkaline clay. The underlying material, from a depth of 65 to 70 inches, is light gray, moderately alkaline clay.

Typically, the surface layer of the Wilson soils is very dark gray clay loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 25 inches, is black clay. The lower part, from a depth of 25 to 60

inches, is dark gray clay that has dark grayish brown streaks. The underlying material, from a depth of 60 to 72 inches, is gray and pale brown clay. The upper part of the profile is slightly acid, and the lower part grades to moderately alkaline.

Typically, the surface layer of the Burleson soils is clay about 42 inches thick. It is black in the upper part and very dark gray in the lower part. The subsoil, from a depth of 42 to 81 inches, is clay. It is dark gray in the upper part and gray in the lower part. The underlying material, from a depth of 81 to 95 inches, is light gray clay. The upper part of the profile is slightly alkaline, and the lower part is moderately alkaline. These soils are calcareous below a depth of 42 inches.

Of minor extent in this map unit are Axtell, Chazos, Crockett, Frelsburg, Gowker, Padina, Rader, Robco, Silawa, Silstid, and Tabor soils. The gently sloping to sloping, loamy Axtell, Crockett, and Tabor soils and sandy Chazos, Padina, Robco, Silawa, and Silstid soils are on undulating ridges and slopes. The gently sloping, clayey Frelsburg soils are on upland ridges and slopes. The nearly level, loamy Gowker soils are along flood plains of local streams. The nearly level to gently sloping Rader soils are on broad flats and hillsides.

This map unit is used mainly as pasture or range. Some areas are cultivated. Small grain or forage sorghum are grown in these areas. Most of the Navasota River is located in this unit. Many areas have been subdivided into small tracts. The major limitations affecting urban development are very slow permeability and the shrink-swell potential.

Clayey and Loamy Soils on Flood Plains

These soils make up about 7 percent of the county. The major soils are Brazoria, Gladewater, Gowker, Nahatche, and Norwood soils. All of these soils are on nearly level flood plains. Most areas are used as pasture or range. Native vegetation consists of hardwoods on bottom land and an understory of grasses. These soils generally are not suited to urban development because of the hazard of flooding.

11. Gladewater-Nahatche-Gowker

Nearly level, moderately well drained to somewhat poorly drained, loamy and clayey soils; formed in recent alluvium

This map unit consists mainly of somewhat poorly drained Gladewater soils in broad, flat backswamps; somewhat poorly drained Nahatche soils near streams; and moderately well drained Gowker soils on broad flats. All of these soils are on flood plains along the Navasota River and smaller streams. They are underlain by slightly acid to slightly alkaline, loamy and clayey sediments. The landscape is flat and has a few sloughs and stream channels. The native vegetation consists of tall grasses and hardwoods.

This map unit makes up about 4 percent of the county. It is about 38 percent Gladewater soils, 29 percent Nahatche soils, 20 percent Gowker soils, and 13 percent soils of minor extent.

Typically, the surface layer of the Gladewater soils is dark gray, slightly acid clay about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 25 inches, is light brownish gray, moderately acid clay that has yellowish brown mottles. The next part, from a depth of 25 to 35 inches, is light gray, moderately acid clay that has yellowish brown mottles. The lower part, from a depth of 35 to 60 inches, is gray, slightly acid clay that has yellowish brown mottles.

Typically, the surface layer of the Nahatche soils is dark grayish brown, slightly acid clay loam about 6 inches thick. The upper part of the underlying material, from a depth of 6 to 15 inches, is grayish brown, slightly acid fine sandy loam. The next part, from a depth of 15 to 32 inches, is very dark gray, slightly acid loam that has yellowish brown mottles. The lower part, from a depth of 32 to 60 inches, is grayish brown, slightly alkaline fine sandy loam.

Typically, the surface layer of the Gowker soils is very dark grayish brown, slightly acid clay loam about 24 inches thick. Below this, from a depth of 24 to 28 inches, is very dark gray, slightly acid clay. The underlying material, from a depth of 28 to 60 inches, is gray, neutral clay loam that has thin strata of fine sandy loam.

Of minor extent in this map unit are Hatliff, Kaman, Navasan, and Tinn soils. The nearly level, loamy Hatliff soils are on pointbars near stream channels. The nearly level, clayey Kaman and Tinn soils are in slight depressions along the flood plains of local streams that drain areas of blackland soils. The gently sloping, sandy Navasan soils are on slight knolls along the flood plain of the Navasota River.

This map unit is used mainly as range or pasture. These soils are subject to frequent flooding. Very few areas are cultivated. The major limitation affecting urban development is the flooding. Fishing and deer hunting are the major recreational activities.

12. Brazoria-Norwood

Nearly level to gently sloping, well drained to somewhat poorly drained, loamy and clayey soils; formed in recent alluvium

This map unit consists mainly of nearly level to gently sloping Brazoria soils in backswamps and on gentle

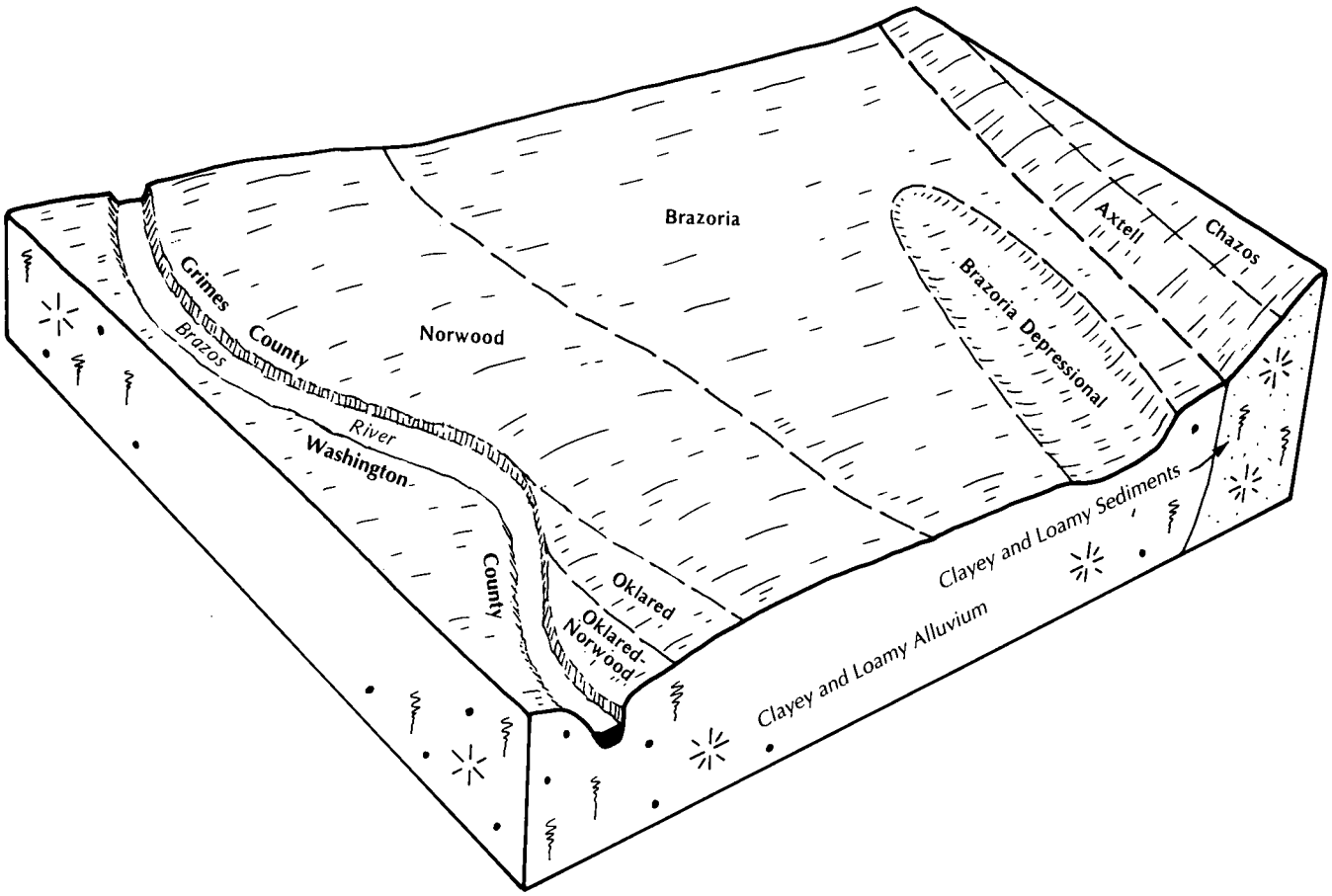

Figure 9.—Typical pattern of soils and parent material in the Brazoria-Norwood general soil map unit.

breaks and nearly level to gently sloping Norwood soils on pointbars, natural levees, and breaks (fig. 9). These moderately alkaline soils developed in loamy and clayey sediments along the flood plain of the Brazos River. The landscape is generally smooth and has a few sloughs and small, local drainageways. The native vegetation consists of a tall grass prairie and scattered trees.

This map unit makes up about 3 percent of the county. It is about 42 percent Brazoria soils, 27 percent Norwood soils, and 31 percent soils of minor extent.

Typically, the surface layer of the Brazoria soils is dark reddish brown clay about 15 inches thick. The upper part of the subsoil, from a depth of 15 to 60 inches, is dark reddish gray clay. The lower part, from a depth of 60 to 85 inches, is dark reddish brown clay. The underlying material, from a depth of 85 to 98 inches, is reddish brown silty clay. These soils are moderately alkaline and calcareous throughout.

Typically, the surface layer of the Norwood soils is reddish brown silt loam about 18 inches thick. The underlying material extends to a depth of 85 inches. From a depth of 18 to 28 inches, it is reddish brown silt loam; from a depth of 28 to 45 inches, it is dark reddish gray silt loam; from a depth of 45 to 63 inches, it is dark reddish brown silty clay loam; and from a depth of 63 to 85 inches, it is dark reddish gray silty clay loam. These soils are moderately alkaline and calcareous throughout.

Of minor extent in this map unit are Axtell, Chazos, Oklared, and Tinn soils. The nearly level to gently sloping, loamy Oklared soils are on pointbars and in frequently flooded areas adjacent to the Brazos River. The nearly level, clayey Tinn soils are along local streams and along the flood plain of the Brazos River in areas where sediments from local streams were deposited. The gently sloping or moderately sloping, loamy Axtell soils and sandy Chazos soils are on ancient stream terraces.

This map unit is used mainly as cropland or pasture.

Many areas are cultivated. Corn, small grain, forage sorghum, alfalfa, and other crops are grown in these areas. Most areas are subject to rare flooding. The hazard of flooding is a limitation affecting urban development. Fishing and hunting are the main recreational activities in areas of this unit.

Detailed Soil Map Units

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

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

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

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Axtell fine sandy loam, 1 to 5 percent slopes, is a phase of the Axtell series.

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Oklared-Norwood complex, frequently flooded, is an example.

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

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

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

AnC—Annona fine sandy loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands and old terraces. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 3 percent.

Typically, the surface layer is dark grayish brown fine sandy loam about 7 inches thick. The upper part of the subsoil, from a depth of 7 to 45 inches, is red clay. The next part, from a depth of 45 to 65 inches, is light brownish gray clay that is mottled in shades of red, brown, and gray. The lower part, from a depth of 65 to 75 inches, is light gray clay loam. Reaction is slightly acid in the surface layer and very strongly acid or strongly acid in the subsoil.

This soil is somewhat poorly drained. Surface runoff is slow. The soil is saturated with water at a depth of 2 to 4 feet during the winter. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when it is wet or dry. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Boy, Conroe, Depcor, Fetzer, and Huntsburg soils and the nearly level Annona soils. Also included are small areas where the original surface layer has been removed by erosion. Included soils make up less than 15 percent of the map unit.

This Annona soil is used mainly as woodland or pasture. Native vegetation includes hardwoods, pines, and native grasses. The soil is moderately suited to pines and hardwoods. The clayey subsoil is a moderate limitation affecting the use of equipment. The dominant trees are loblolly pine and shortleaf pine. Trees are harvested for pulpwood and sawlogs.

This soil is moderately well suited to pasture. Some areas support improved bermudagrass and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, and vetch, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to small grain or forage sorghum. It is difficult to work and is crusty and hard when dry. Leaving crop residue on the surface helps to conserve moisture, control erosion, and improve tilth. Contour farming and terraces help to control erosion.

This soil produces only a moderate amount of native forage because of the dense canopy of pines and hardwoods. Good management practices include controlled grazing, proper stocking rates, and thinning of trees.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, the seasonal wetness, and the very slow permeability are the main limitations.

This soil is in capability subclass IVe, and the woodland ordination symbol is 8C.

AnC2—Annona fine sandy loam, 1 to 5 percent slopes, eroded. This very deep, gently sloping soil is on uplands and old terraces. Areas of this map unit were formerly cultivated but are now used as pasture or woodland. They range from 8 to 50 acres in size. Slopes average about 3 percent.

Typically, the surface layer is dark brown, slightly acid, fine sandy loam about 4 inches thick. The subsoil extends to a depth of 60 inches. From a depth of 4 to 12 inches, it is red, strongly acid clay that has grayish brown and yellowish brown mottles; from a depth of 12 to 30 inches, it is red, very strongly acid clay that has brown mottles; from a depth of 30 to 50 inches, it is grayish brown, slightly acid clay that has brownish yellow mottles; and from a depth of 50 to 65 inches, it is light brownish gray, moderately alkaline sandy clay.

This soil is somewhat poorly drained. Surface runoff is medium. The soil is saturated with water at a depth of 2 to 4 feet during the winter. Permeability is very slow, and the available water capacity is high. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by water, air, and roots. The hazard of erosion is severe. Sheet erosion has removed more than half of the original surface layer in most areas. Rills are common, and the plow layer consists of a mixture of the original surface layer and the upper part of the subsoil.

Included with this soil in mapping are small areas of Boy, Depcor, Fetzer, and Huntsburg soils. Also included are a few areas that have slopes of more than 5 percent. Included in some areas is a soil that is similar to the Annona soil but has a clayey subsoil less than 60 inches deep.

This soil is used mainly as woodland or pasture. Many of these areas were once used as cropland. Native vegetation includes hardwoods, pines, and native grasses. The soil is moderately suited to pines and hardwoods. The clayey subsoil is a moderate limitation affecting the use of equipment. The dominant trees are loblolly pine and shortleaf pine. Trees are mainly harvested for pulpwood and sawlogs.

This soil is moderately well suited to pasture. Some areas support coastal bermudagrass and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, and vetch, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of erosion that occurred in the past and because of an insufficient amount of moisture. Closely spaced crops, such as forage sorghum and small grain, can be grown on this soil. Leaving crop residue on the surface helps to conserve moisture, control erosion, and improve tilth.

This soil produces a moderate amount of native forage. Good management practices include proper stocking rates and controlled grazing.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, the seasonal wetness, the very slow permeability, and the thin surface layer are the main limitations.

This soil is in capability subclass IVe, and the woodland ordination symbol is 8C.

AnD—Annona fine sandy loam, 5 to 8 percent slopes. This very deep, moderately sloping soil is on uplands and old terraces. Areas are irregular in shape. They range from 8 to 200 acres in size. Slopes average about 6 percent.

Typically, the surface layer is moderately acid fine sandy loam about 5 inches thick. It is dark grayish brown in the upper 2 inches and light brownish gray in the lower 3 inches. The subsoil extends to a depth of 70 inches. From a depth of 5 to 28 inches, it is yellowish red, strongly acid clay that has grayish brown and yellowish brown mottles; from a depth of 28 to 40 inches, it is mottled light brownish gray and dark red,

moderately acid clay; from a depth of 40 to 60 inches, it is dark yellowish brown, moderately acid sandy clay that has light brownish gray mottles; and from a depth of 60 to 70 inches, it is yellowish brown, slightly acid clay loam.

This soil is somewhat poorly drained. Surface runoff is rapid. The soil is saturated with water at a depth of 2 to 4 feet during wet periods in the winter. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when it is wet or dry. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Boy, Depcor, Fetzer, and Huntsburg soils and a few small areas of Annona soils that have slopes of less than 5 percent. Included in some areas is a soil that is similar to the Annona soil but has a clayey subsoil that is less than 60 inches deep. Also included in small areas are Annona soils that have an eroded surface layer. Included soils make up less than 20 percent of the map unit.

This Annona soil is used mainly as woodland or pasture. Native grasses, hardwoods, and pines are the most common vegetation. The soil is moderately suited to pines and hardwoods. The clayey subsoil is a moderate limitation affecting the use of equipment. The dominant trees are post oak, water oak, loblolly pine, and shortleaf pine. Trees are mainly harvested for pulpwood and sawlogs.

This soil is moderately well suited to pasture. Some areas support coastal bermudagrass and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, and vetch, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the hazard of erosion and the slope.

This soil produces a moderate amount of native forage. Good management practices include proper stocking rates and controlled grazing.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, the very slow permeability, and the slope are the main limitations.

This soil is in capability subclass VIe, and the woodland ordination symbol is 8C.

Ap—Arents. This very deep, gently sloping or moderately steep soil is on uplands. Construction or mining has altered, moved, and mixed the soil. Areas are irregular in shape. They range from 8 to 100 acres in size. Slopes are mainly 1 to 5 percent, but are as much as 20 percent along the edges of spoil piles.

Typically, the surface layer is very pale brown, slightly acid silt loam about 6 inches thick. The underlying material, from a depth of 6 to 60 inches, is very pale brown, slightly acid silty clay loam that has common masses of clay, clay loam, loam, and sandstone and siltstone bedrock.

The native soils that were in this unit consisted mainly of the Burlewash, Elmina, Falba, Gomery, and Shiro soils. These soils were formed over tuffaceous siltstone and sandstone bedrock.

These areas are mainly used by the Texas Municipal Power Agency Power Plant for the power plant, storage buildings, and other facilities and for ponds and drainageways. Some areas support bermudagrass.

This soil is poorly suited to pasture. Some areas support coastal bermudagrass and bahiagrass. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the hazard of erosion and the low available water capacity.

This soil produces a moderate amount of native forage. Good management practices include proper stocking rates and controlled grazing.

This soil is poorly suited to urban and recreational uses. The slow permeability and an insufficient amount of moisture are the main limitations.

This soil is in capability subclass VIe. No range site or woodland ordination symbol is assigned.

ArA—Arol fine sandy loam, 0 to 1 percent slopes. This moderately deep, nearly level soil is on uplands. Areas are irregular in shape. They range from 10 to 70 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is dark grayish brown fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 20 inches, is very dark gray clay. The next part, from a depth of 20 to 25 inches, is very dark grayish brown clay. The lower part, from a depth of 25 to 30 inches, is very dark grayish brown clay that has light gray mottles. The underlying material, from a depth of 30 to 60 inches, is tuffaceous clay that has layers of siltstone bedrock. Reaction is moderately acid in the upper 25 inches and grades to neutral in the underlying material.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 18 to 30 inches during the winter. Permeability is very slow, and the available water capacity is low. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard

of erosion is moderate. The soil is hard, crusty, and droughty in the summer.

Included with this soil in mapping are small areas of Elmina, Falba, Koether, Shalba, and Shiro soils. Also included are a few small, eroded areas. Included soils make up less than 10 percent of the map unit.

This Arol soil is used mainly as range or pasture. A few areas are used as cropland. The main crops in these areas are forage sorghum, oats, and ryegrass.

This soil is moderately well suited to pasture. The major limitations are the wetness during the winter and the droughtiness during the summer. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Some areas support common bermudagrass and improved bermudagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Some areas support forage sorghum used for hay and small grain used for winter grazing. The soil is difficult to work during the winter because of the wetness. It is hard and droughty during the summer. Leaving crop residue on the surface helps to maintain the content of organic matter, control soil erosion, and conserve moisture during the summer.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, low strength, and wetness are the main limitations on sites for buildings, roads, and streets.

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

ArC—Arol fine sandy loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. The soils are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 3 percent.

Typically, the surface layer is dark grayish brown fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 26 inches, is very dark gray clay. The lower part, from a depth of 26 to 34 inches, is gray clay that has very dark gray mottles. The underlying material, from a depth of 34 to 45 inches, is very pale brown, weathered tuffaceous clay. Reaction is slightly acid in the surface layer and grades to moderately alkaline in the underlying material.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 18 to 30 inches during the winter. Permeability is very slow, and the available water capacity is low. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe. The soil is hard, crusty, and droughty in the summer and wet in the winter.

Included with this soil in mapping are small areas of Elmina, Falba, Koether, Renish, and Shalba soils. Also included are a few small eroded areas. Included soils make up less than 10 percent of the map unit.

This Arol soil is used mainly as range or pasture. A few areas are used as cropland. The main crop is forage sorghum.

This soil is moderately well suited to pasture. The wetness during the winter and the droughtiness during the summer are limitations. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Some areas support common bermudagrass and improved bermudagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Some areas support forage sorghum used for hay and small grain used for winter grazing. The soil is difficult to work because it is wet during the winter and droughty during the summer. Leaving crop residue on the surface helps to maintain the content of organic matter, control soil erosion, and conserve moisture during the summer.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, low strength, and wetness are the main limitations on sites for buildings, roads, and streets.

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

AxC—Axtell fine sandy loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on ancient stream terraces. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 3 percent.

Typically, the surface layer is dark grayish brown fine sandy loam about 3 inches thick. The subsurface layer is grayish brown fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 9 to 25 inches, is red clay that has light brownish gray mottles. The next part, from a depth of 25 to 50 inches, is light gray clay that has red and yellowish brown mottles. The lower part, from a depth of 50 to 65 inches, is light gray clay. Reaction is moderately acid in the surface layer. It

is very strongly acid in the upper part of the subsoil and grades to slightly alkaline in the lower part.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is moderate. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe. The soil tends to be droughty.

Included with this soil in mapping are small areas of Chazos, Lufkin, Rader, Robco, and Tabor soils. Also included are small areas of the nearly level Axtell soils and a few small eroded areas. Included soils make up less than 15 percent of the map unit.

This Axtell soil is used mainly as range or pasture. A few areas are used as cropland. The main crops grown in these areas are small grain or forage sorghum.

This soil is moderately well suited to pasture. Some areas support common bermudagrass, improved bermudagrass, and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. In some areas small grain, forage sorghum, corn, and peanuts are grown. The soil is droughty and difficult to work. Leaving crop residue on the surface helps to maintain the content of organic matter and control soil erosion. Cover crops are beneficial. Terraces and contour farming help to control erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The high shrink-swell potential, the very slow permeability, and low strength are the main limitations.

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

AxC2—Axtell fine sandy loam, 1 to 5 percent slopes, eroded. This very deep, gently sloping, eroded soil is on ancient stream terraces. Areas of this map unit were formerly cultivated but are now used as range. They range from 5 to 40 acres in size. Slopes average about 4 percent.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsoil extends to a depth of 52 inches. The upper part is red clay that has gray mottles, the next part is yellowish brown clay that has gray mottles, and the lower part is dark yellowish brown clay. The underlying material, from a depth of 52 to 65 inches, is yellowish brown clay loam. Reaction is moderately acid in the surface layer and strongly acid in the upper part of the subsoil. It grades to moderately alkaline in the underlying material.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is moderate. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe. The soil tends to be droughty. Sheet erosion has removed more than half of the original surface layer in most areas. In a few places erosion has exposed the subsoil. Rills and shallow gullies that can be crossed with regular farm equipment are in some areas.

Included with this soil in mapping are small areas of Chazos, Lufkin, Rader, Silawa, and Tabor soils. Also included are a few areas of the Axtell soils that are not eroded. Included soils make up less than 15 percent of the map unit.

Most areas of this Axtell soil were once used as cropland but are now used as range. A few areas are now used as pasture.

This soil is moderately well suited to pasture. Some areas support improved grasses, such as bermudagrass and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. A few areas are farmed. Small grain or forage sorghum are grown in these areas. The soil is droughty. Much of the original surface layer has been removed by erosion, and fertility is low. Leaving crop residue on the surface helps to maintain the content of organic matter and control soil erosion. Cover crops are beneficial. Terraces and contour farming help to control erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, low strength, and the very slow permeability are the main limitations.

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

AxD—Axtell fine sandy loam, 5 to 8 percent slopes. This very deep, moderately sloping soil is on slope breaks of ancient stream terraces. Areas are irregular in shape and are parallel to the contour of the landscape. They range from 5 to 50 acres in size. Slopes average about 7 percent.

Typically, the surface layer is slightly acid, dark brown fine sandy loam about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 30 inches, is

very strongly acid, strong brown clay that has red mottles. The next part, from a depth of 30 to 42 inches, is moderately acid, light brownish gray clay that has strong brown mottles. The lower part, from a depth of 42 to 72 inches, is moderately alkaline, light brownish gray clay that has brown and yellow mottles.

This soil is moderately well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is severe. The soil tends to be droughty.

Included with this soil in mapping are small areas of Chazos, Crockett, Silawa, and Tabor soils and a few areas of the gently sloping Axtell soils and the Axtell soils where the original surface layer has been removed by erosion. Also included are a few small areas that have slopes of more than 8 percent. Included soils make up less than 15 percent of the map unit.

This Axtell soil is used mainly as range. A few areas are used as cropland or pasture. Some woody areas are used only as wildlife habitat.

This soil is moderately well suited to pasture. A few areas support coastal bermudagrass or bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the slope, the hazard of erosion, and the droughtiness.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The slope, the shrink-swell potential, and the very slow permeability are the main limitations.

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

BcA—Bleiblerville clay, 0 to 1 percent slopes. This very deep, nearly level soil is on ridges in the uplands. Areas are round to irregular in shape. They range from 20 to 200 acres in size. Slopes average less than 1 percent.

Typically, the surface layer is black clay about 15 inches thick. The subsoil, from a depth of 15 to 65 inches, is very dark gray clay that has streaks of grayish brown in the lower part. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when wet. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Brenham, Carbengle, Frelsburg, and Latium soils. Included soils make up less than 15 percent of the map unit.

This Bleiberville soil is used mainly as cropland or pasture. Some areas are used as range. A few areas support native grasses used for hay.

This soil is well suited to pasture. Native grasses and improved grasses, such as coastal bermudagrass, are grown. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to corn, grain sorghum, small grain, and forage sorghum. Leaving crop residue on the surface helps to control erosion and increase the content of organic matter.

This soil produces a high amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, the very slow permeability, and low strength are the major limitations.

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

BcB—Bleiblerville clay, 1 to 3 percent slopes. This very deep, gently sloping soil is on ridges in the uplands. Areas are round to irregular in shape. They range from 10 to 200 acres in size. Slopes average about 2 percent.

Typically, the surface layer is black clay about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 40 inches, is very dark gray clay. The next part, from a depth of 40 to 55 inches, is dark gray clay that has black streaks. The lower part, from a depth of 55 to 65 inches, is yellowish brown clay that has black streaks. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when wet. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Brenham, Carbengle, Frelsburg, and Latium soils. Included soils make up less than 15 percent of the map unit.

This Bleiblerville soil is used mainly as cropland or

pasture. Some areas are used as range. A few areas support native grasses used for hay.

This soil is well suited to pasture. Native grasses and improved grasses, such as coastal bermudagrass and kleingrass, are grown. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to corn, grain sorghum, small grain, and forage sorghum. Leaving crop residue on the surface helps to control erosion and increase the content of organic matter. Terraces and contour farming help to control erosion.

This soil produces a high amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, the very slow permeability, and low strength are the main limitations.

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

BfB—Boonville fine sandy loam, 1 to 3 percent slopes. This very deep, gently sloping soil is on uplands. Areas are elongated and are parallel to the contour of the landscape along foot slopes. They range from 5 to 200 acres in size. Slopes average about 2 percent.

Typically, the surface layer is neutral fine sandy loam about 13 inches thick. It is very dark grayish brown in the upper 11 inches and grayish brown in the lower 2 inches. The upper part of the subsoil, from a depth of 13 to 20 inches, is dark grayish brown, strongly acid clay that has brownish yellow and reddish yellow mottles. The next part, from a depth of 20 to 46 inches, is grayish brown, strongly acid clay. The lower part, from a depth of 46 to 60 inches, is light gray and brown, moderately alkaline clay loam.

This soil is somewhat poorly drained. Surface runoff is medium. A perched water table is within a depth of 12 inches during wet periods in the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is also moderate. The soil is saturated during the winter.

Included with this soil in mapping are small areas of Lufkin, Mabank, Rader, Robco, Tabor, Zack, and Zulch soils. Included soils make up less than 15 percent of the map unit.

The Boonville soil is used mainly as pasture or cropland.

This soil is moderately well suited to pasture. Many areas support common bermudagrass, improved bermudagrass, and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to crops. Some areas are cultivated. Forage sorghum, small grain, and ryegrass for winter pasture are grown in these areas. The soil is difficult to work. Leaving crop residue on the surface helps to maintain the content of organic matter and control soil erosion. Terraces, minimum tillage, and contour farming help to control erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to urban and recreational uses. The high shrink-swell potential, wetness, low strength, and the very slow permeability are the main limitations.

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

BgD—Boy fine sand, 1 to 8 percent slopes. This very deep, gently sloping or moderately sloping soil is on ridges in the uplands. Areas are irregular in shape. They range from 20 to 300 acres in size. Slopes average about 4 percent.

Typically, the surface layer is dark grayish brown fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 49 inches, is light yellowish brown fine sand. The upper part of the subsoil, from a depth of 49 to 58 inches, is light yellowish brown sandy clay loam that has brownish yellow mottles and 5 percent plinthite nodules. The lower part, from a depth of 58 to 70 inches, is brown sandy clay loam that has red and brownish yellow mottles. Reaction is moderately acid in the surface layer and subsurface layer and very strongly acid or strongly acid in the subsoil.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 3.5 to 5.5 feet during the winter and spring. Permeability is rapid in the surface layer and subsurface layer and moderately slow in the subsoil, and the available water capacity is low. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Conroe, Depcor, Fetzer, Splendora, and Waller soils. Included soils make up less than 15 percent of the map unit.

The Boy soil is used mainly as woodland or native pasture. The amount of forage produced is low because of the woodland canopy. The soil is moderately suited to pines and hardwoods. The sandy texture of the soil is a moderate limitation affecting the seedling mortality rate. The main management concern is the control of pine seedlings. The dominant trees are loblolly pine,

shortleaf pine, post oak, and water oak. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Some areas have been cleared and planted to improved bermudagrass and bahiagrass. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to crops. A few areas have been cleared and planted to small grain or forage sorghum. Watermelons and truck crops grow well in areas of this soil. Crops are difficult to establish because of an insufficient amount of moisture in the sandy surface layer. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

If used for grazing, this soil produces a moderate amount of native forage. Thinning the trees encourages the growth of grasses and forbs. Good management practices include thinning of trees, proper stocking rates, and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The main limitation is the sandy surface layer.

This soil is in capability subclass IIIs, and the woodland ordination symbol is 9S.

BoA—Brazoria clay, 0 to 1 percent slopes. This very deep, nearly level soil is along the flood plains of the Brazos River. Brief flooding occurs about once every 20 to 25 years. Areas are elongated and curved. They range from 10 to 1,000 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is dark reddish brown clay about 15 inches thick. The upper part of the subsoil, from a depth of 15 to 60 inches, is dark reddish gray clay. The lower part, from a depth of 60 to 85 inches, is dark reddish brown clay. The underlying material, from a depth of 85 to 98 inches, is reddish brown silty clay. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when it is wet or dry. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Norwood and Oklared soils. Also included are a few areas of the depressional Brazoria soils. Included soils make up less than 15 percent of the map unit.

This Brazoria soil is used mainly as pasture or cropland. Some areas are used as woodland. The dominant trees are pecan, ash, elm, and cottonwood.

This soil is well suited to pasture. Some areas support improved bermudagrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to corn, cotton, soybeans, and forage sorghum. Seasonal wetness can delay planting. Listing or bedding in the fall can help overcome wetness in the spring. Surface drainage is needed in some areas.

This soil produces a high amount of forage. Good management practices include proper stocking rates, controlled grazing, and brush control.

This soil is poorly suited to urban and recreational uses. The main limitations are wetness, the high shrink-swell potential, the very slow permeability, and the flooding.

This soil is in capability subclass IIw and the Clayey Bottomland range site.

BoB—Brazoria clay, 1 to 3 percent slopes. This very deep, gently sloping soil is along the undulating flood plain of the Brazos River. Brief flooding occurs about once every 20 to 25 years. Areas range from 10 to 100 acres in size. Slopes average about 2 percent.

Typically, the surface layer is very dark gray clay about 18 inches thick. The subsoil is dark reddish brown clay to a depth of 60 inches. The underlying material, from a depth of 60 to 90 inches, is dark reddish brown clay that has common medium distinct black mottles. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Norwood and Oklared soils. Also included are a few small areas of the depressional Brazoria soils. Included soils make up less than 15 percent of the map unit.

This Brazoria soil is used as pasture or cropland. Some areas are used as woodland. The dominant trees are pecan, ash, elm, and cottonwood.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass produce a high amount of forage. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover,

and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to crops. Corn and soybeans are the main crops, but cotton also is grown. Crop residue helps to maintain the content of organic matter and improves tilth. Plowing in the fall helps to overcome wetness in the early spring.

This soil produces a high amount of forage. Good management practices include proper stocking rates, controlled grazing, and brush and weed control.

This soil is poorly suited to urban and recreational uses. Limitations include wetness, the high shrink-swell potential, the very slow permeability, and the flooding.

This soil is in capability subclass IIe and the Clayey Bottomland range site.

Bp—Brazoria clay, depressional. This very deep, nearly level soil is along the flood plain of the Brazos River. Brief flooding occurs about once every 20 to 25 years. Areas are elongated and irregularly curved. They range from 5 to 300 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is dark brown clay about 20 inches thick. The subsoil, from a depth of 20 to 40 inches, is dark reddish brown clay. The underlying material, from a depth of 40 to 65 inches, is reddish brown clay. The soil is moderately alkaline and calcareous throughout.

This soil is somewhat poorly drained. It is ponded for prolonged periods during rainy seasons. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when it is wet or dry. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Norwood and Oklared soils. Included soils make up less than 15 percent of the map unit.

This Brazoria soil is used primarily as pasture or cropland. Some areas are used as woodland. The dominant trees are pecan, elm, ash, and cottonwood.

This soil is well suited to pasture. Some areas support improved bermudagrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to corn, soybeans, and forage sorghum because of the excessive wetness. Seasonal wetness can delay tilling and planting. Surface drainage is needed in some areas.

This soil produces a moderate to high amount of forage. Good management practices include proper stocking rates, controlled grazing, and brush control.

This soil is poorly suited to urban and recreational uses. The main limitations include wetness, the very slow permeability, and the flooding.

This soil is in capability subclass IIIw and the Clayey Bottomland range site.

BrD—Brenham clay loam, 3 to 8 percent slopes. This very deep, gently sloping or moderately sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 50 acres in size. Slopes average about 6 percent.

Typically, the surface layer is very dark grayish brown clay loam about 12 inches thick. The subsoil, from a depth of 12 to 55 inches, is silty clay loam that is yellowish brown in the upper part and light yellowish brown in the lower part. It has concretions of calcium carbonate. The amount of calcium carbonate is high. The underlying material, from a depth of 55 to 80 inches, is yellowish brown silty clay loam. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Surface runoff is rapid. Permeability is moderate, and the available water capacity is high. The hazard of erosion is severe.

Included in some areas of this soil are small areas of Bleiblerville, Carbengle, Cuero, Frelsburg, Klump, and Latium soils. Also included is a soil that is similar to the Brenham soil but has a lighter colored surface layer, a few areas of the strongly sloping Brenham soils, and a soil that is similar to the Brenham soil but is noncalcareous in the surface layer. Included soils make up less than 15 percent of the map unit.

This soil is used mainly as range or pasture. Small grain or forage sorghum are the main crops.

This soil is well suited to pasture (fig. 10). Some areas support improved grasses, such as bermudagrass and bahiagrass, but most areas support native grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Forage sorghum and small grain are well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Terraces help to control erosion.

This soil produces a high amount of forage. The climax vegetation is mainly tall and mid grasses. Good management practices include proper stocking rates, controlled grazing, and brush control.

This soil is moderately well suited to urban and recreational uses. The slope and the shrink-swell potential are the main limitations.

Figure 10.—Coastal bermudagrass hay in an area of Brenham clay loam, 3 to 8 percent slopes. It is one of the major crops grown in Grimes County.

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

BsA—Burleson clay, 0 to 1 percent slopes. This very deep, nearly level soil is on uplands and ancient stream terraces. Areas are round. They range from 10 to 300 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is clay that is about 42 inches thick. It is black in the upper 6 inches and very dark gray in the lower 36 inches. The subsoil, from a depth of 42 to 81 inches, is clay. It is dark gray in the upper part and gray in the lower part. The underlying material, from a depth of 81 to 95 inches, is light gray clay. The soil is slightly alkaline in the upper 6 inches and moderately alkaline below that depth. The soil is calcareous below a depth of 42 inches.

This soil is moderately well drained. Surface runoff is slow. Permeability is very slow. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. The hazard of erosion is slight. The soil is wet for long periods in the winter and early spring.

Included with this soil in mapping are some small areas of Crockett, Mabank, and Wilson soils. Also included are a few small areas of the gently sloping Burleson soils. Included soils make up less than 15 percent of the map unit.

This Burleson soil is used mainly as range or cropland.

This soil is well suited to pasture. Good management practices include weed control and proper stocking rates. Some areas support improved bermudagrass and bahiagrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to crops. The main crops are corn, grain sorghum, forage sorghum, and small grain. Leaving crop residue on the surface improves tilth, maintains the content of organic matter, and helps to control erosion. Plowing in the fall helps to overcome the seasonal wetness in the spring. Surface drainage is needed in some areas.

This soil produces a high amount of forage. Good management practices include proper stocking rates, controlled grazing, and weed and brush control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, and low strength.

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

BuC—Burlewash fine sandy loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 5 to 200 acres in size. Slopes average about 3 percent.

Typically, the surface layer is dark grayish brown, moderately acid fine sandy loam about 7 inches thick. The upper part of the subsoil, from a depth of 7 to 20 inches, is brown, strongly acid clay. The lower part, from a depth of 20 to 35 inches, is brown, strongly acid clay. The underlying material, from a depth of 35 to 55 inches, is brown, very strongly acid stratified shale, clay, and loam.

This soil is well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is low. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Arol, Axtell, Elmina, Falba, and Shiro soils. Also included are a few small eroded areas. Included soils make up less than 20 percent of the map unit.

This Burlewash soil is used as range or pasture. It is moderately well suited to pasture. Adapted grasses include improved bermudagrass and bahiagrass. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the hazard of erosion and the low available water capacity. Some areas are farmed. Small grain or forage sorghum are grown in these areas.

This soil produces a moderate amount of forage. Good management practices include controlled grazing, proper stocking rates, and weed and brush control.

This soil is poorly suited to urban and recreational uses. Limitations include the slope, the shrink-swell potential, and the very slow permeability.

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

BuE—Burlewash fine sandy loam, 5 to 12 percent slopes. This moderately deep, strongly sloping soil is on upland ridges and side slopes. Areas are parallel to breaks. They range from 5 to 200 acres in size. Slopes average about 8 percent.

Typically, the surface layer is dark grayish brown, slightly acid fine sandy loam about 6 inches thick. The subsoil, from a depth of 6 to 25 inches, is brown, very strongly acid clay. The underlying material, from a depth of 25 to 60 inches, is very strongly acid, very pale brown interbedded tuffaceous sandstone and light gray shale.

This soil is well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is low. Because of the clayey and shaly lower layers, the soil cannot be easily penetrated by roots. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Arol, Axtell, Elmina, Falba, Gomery, and Shiro soils. Also included are a few small areas of eroded soils, a few areas of stony soils, and areas that have slopes of as much as 15 percent. Included soils make up less than 20 percent of the map unit.

This Burlewash soil is used as range.

This soil is moderately well suited to pasture. Adapted grasses include improved bermudagrass and bahiagrass. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the slope, the hazard of erosion, and the low available water capacity.

This soil produces a moderate amount of native grass forage. Many areas now have thick stands of hardwoods. Good management practices include brush control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. Limitations include the slope, the very slow permeability, and hazard of erosion.

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

BxE—Burlewash-Gullied land complex, 5 to 15 percent slopes. This map unit consists of a strongly sloping Burlewash soil intermingled with areas of gullies. The unit is on uplands along ridges and breaks. Areas are parallel to the contour of the landscape and are often along drainageways. They range from 5 to 20 acres in size. Slopes average about 12 percent.

This unit is 40 percent Burlewash soil, 40 percent Gullied land, and 20 percent other soils. This soil and the Gullied land occur as areas so intricately mixed that separating in mapping is not practical.

Typically, the Burlewash soil has a surface layer of dark grayish brown, slightly acid fine sandy loam about 5 inches thick. The subsoil, from a depth of 5 to 22

inches, is brown, very strongly acid clay. The underlying material, from a depth of 22 to 60 inches, is very strongly acid, light gray tuffaceous shale that has a texture of clay.

The Burlewash soil is well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is low. The hazard of erosion is severe.

Typically, the gullies are about 10 to 15 feet deep but range to 20 feet deep. They are V-shaped and are 10 to 50 feet across.

The gullies are excessively drained. Surface runoff is very rapid. Permeability is very slow, and the available water capacity is very low. The hazard of erosion is severe.

Included with this unit in mapping are small areas of Arol, Elmina, Falba, and Shiro soils. Also included is a soil that is similar to the Burlewash soil but has had part of the original surface layer and part of the subsoil removed by erosion. Included soils make up less than 20 percent of the map unit.

This unit is used as range or wildlife habitat.

This unit is not suited to pasture or cropland because of the hazard of erosion, the gullies, and the slope (fig. 11).

This unit produces a small amount of native grass forage. Good management practices include proper stocking rates and controlled grazing. Gully erosion can be controlled in some areas by shaping, but erosion-control structures are needed in most areas.

This unit is poorly suited to urban or recreational uses because of the slope, the hazard of erosion, and the very slow permeability.

This unit is in capability subclass VIIe and the Claypan Savannah range site.

CaC—Carbengle clay loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on ridges in the uplands. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 3 percent.

Typically, the surface layer is very dark grayish brown clay loam about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 17 inches, is dark grayish brown clay loam. The lower part, from a depth of 17 to 30 inches, is yellowish brown sandy clay loam. The underlying material, from a depth of 30 to 60 inches, is weakly cemented sandstone bedrock. The soil is moderately alkaline and calcareous throughout. It has a high content of calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is low. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Bleiblerville, Brenham, Cuero, Frelsburg, Klump, and Renish soils. Included soils make up less than 15 percent of the map unit.

This Carbengle soil is used mainly as range and cropland.

This soil is well suited to pasture. Some areas support improved bermudagrass, and other areas support kleingrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

The main crops grown on this soil are forage sorghum and small grain. Leaving crop residue on the surface helps to control erosion and improve tilth. Terraces and contour farming help to control runoff and erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The main limitation is depth to bedrock.

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

CaD—Carbengle clay loam, 5 to 8 percent slopes. This moderately deep, moderately sloping soil is on uplands. Areas are parallel to hills and ridges. They range from 10 to 75 acres in size. Slopes average about 7 percent.

Typically, the surface layer is dark grayish brown clay loam about 12 inches thick. The subsoil, from a depth of 12 to 22 inches, is grayish brown clay loam. The underlying material, from a depth of 22 to 60 inches, is weakly cemented sandstone bedrock. The soil is moderately alkaline and calcareous throughout. It has a high content of calcium carbonate.

This soil is well drained. Surface runoff is medium. Permeability is moderate, and the available water capacity is low. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Bleiblerville, Brenham, Cuero, Klump, and Renish soils. Included soils make up less than 15 percent of the map unit.

This Carbengle soil is used mainly as range. A few areas are used as pasture or cropland.

This soil is suited to pasture. Some areas support improved bermudagrass. Most areas, however, support native grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Figure 11.—An area of Burlewash-Gullied land complex, 5 to 15 percent slopes, where erosion has exposed the underlying light gray clay parent material that is of volcanic origin.

This soil is moderately well suited to forage sorghum and small grain. Terraces and contour farming help to control runoff and erosion. Leaving crop residue on the surface helps to maintain the content of organic matter, improves tilth, and controls erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and brush control.

This soil is moderately well suited to urban and recreational uses. The main limitations are the slope and depth to bedrock.

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

ChC—Chazos loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on ancient stream terraces. Areas are irregular in shape. They range from 25 to 1,000 acres in size. Slopes average about 3 percent.

Typically, the surface layer is pinkish gray, slightly acid loamy fine sand about 15 inches thick. The subsoil is clay. The upper part of the subsoil, from a depth of 15 to 27 inches, is strong brown and moderately acid and has red and grayish brown mottles. The next part,

from a depth of 27 to 52 inches, is dark grayish brown and moderately acid and has red and strong brown mottles. The lower part, from a depth of 52 to 65 inches, is red and moderately alkaline and has yellowish brown mottles. The underlying material, from a depth of 65 to 90 inches, is yellowish red, moderately alkaline sandy clay loam.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is moderate. The hazard of erosion is moderate. The upper part of the subsoil is saturated for short periods during the winter and early spring.

Included with this soil in mapping are small areas of Axtell, Lufkin, Robco, Silawa, and Tabor soils. Also included are small areas of the nearly level Chazos soils. Included soils make up less than 15 percent of the map unit.

This Chazos soil is used mainly as pasture or range. Some areas are used as cropland.

This soil is well suited to pasture. Many areas support improved bermudagrass or bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to corn, peanuts, and truck crops. Crop residue helps to maintain the content of organic matter and control erosion. Cover crops also help to control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential and low strength.

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

ChD—Chazos loamy fine sand, 5 to 8 percent slopes. This very deep, moderately sloping soil is on ancient stream terraces. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 6 percent.

Typically, the surface layer is brown, slightly acid loamy fine sand about 12 inches thick. The subsoil is clay that extends to a depth of 65 inches. From a depth of 12 to 22 inches, it is yellowish red and moderately acid and has grayish brown mottles; from a depth of 22 to 35 inches, it is strong brown and moderately acid and has light brownish gray mottles; from a depth of 35 to 42 inches, it is slightly acid and has strong brown and light brownish gray mottles; and from a depth of 42 to 65 inches, it is light brownish gray and moderately alkaline and has strong brown mottles.

This soil is moderately well drained. Surface runoff is medium. Permeability is slow, and the available water capacity is moderate. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Axtell, Robco, Silawa, and Tabor soils. Also included are small areas where most of the original sandy surface layer has been removed by erosion. Included soils make up less than 15 percent of the map unit.

This Chazos soil is used mainly as range or pasture. Some areas have been cultivated in the past and are now idle.

This soil is well suited to pasture. Many areas have been cleared and planted to improved bermudagrass or bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. A few areas are farmed. Small grain or forage sorghum are grown in these areas. Crop residue helps to maintain the content of organic matter and control erosion. Cover crops help to control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is poorly suited to urban and recreational uses because of the slope, the shrink-swell potential, and low strength.

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

CoC—Conroe loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on hilltops. Areas are rounded to irregular in shape. They range from 10 to 400 acres in size. Slopes average about 2 percent.

Typically, the surface layer is grayish brown loamy fine sand about 5 inches thick. The subsurface layer, from a depth of 5 to 24 inches, is light yellowish brown, gravelly loamy fine sand that has about 20 percent nodules of ironstone. The subsoil, from a depth of 24 to 74 inches, is clay. It is yellowish brown in the upper part and mottled light gray, yellowish brown, and red in the lower part. The content of plinthite in the subsoil ranges from 10 to 25 percent. Reaction is moderately acid in the upper part of the subsoil and grades to strongly acid in the lower part.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 2.0 to 3.5 feet during the winter and spring. Permeability is

moderately rapid in the surface and subsurface layer and slow in the subsoil, and the available water capacity is moderate. The root zone is deep, but the soil cannot be easily penetrated by roots because of the layers of plinthite. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Boy, Depcor, Fetzer, and Splendora soils and some areas where the surface texture is gravelly loamy fine sand. Also included are a few small areas where the surface layer has been mined for ironstone gravel. Included soils make up less than 15 percent of the map unit.

This Conroe soil is used mainly as woodland or pasture. A few areas are used as cropland. The soil is moderately suited to pines and hardwoods. The use of equipment for planting and harvesting is moderately limited because of the sandy texture and seasonal wetness. Seedling mortality also is a moderate limitation. The dominant trees are loblolly pine and shortleaf pine. Trees are mainly harvested for pulpwood and sawlogs.

This soil is well suited to pasture. Some areas have been cleared of timber and planted to coastal bermudagrass or bahiagrass. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to corn, forage sorghum, and peanuts. Crop residue helps to maintain the content of organic matter and control erosion.

This soil produces a moderate amount of native grass forage. Most areas are wooded and have a dense canopy of pines and hardwoods. Forage production is generally low in these areas. Good management practices include proper stocking rates, controlled grazing, and thinning of trees.

This soil is moderately well suited to urban and recreational uses. The ironstone gravel in the subsurface layer is a source of gravel for building roads. The main limitations are the sandy surface texture and the seasonal wetness.

This soil is in capability subclass IIIs, and the woodland ordination symbol is 8S.

CpC—Conroe gravelly loamy fine sand, graded, 1 to 5 percent slopes. This very deep, gently sloping soil is on ridges in the uplands. Areas are irregular in shape. They range from 5 to 40 acres in size. Slopes average about 3 percent. The gravelly surface layer has been removed for use in building roads.

Typically, the surface layer is grayish brown gravelly loamy fine sand about 2 inches thick. The upper part of the subsoil, from a depth of 2 to 17 inches, is yellowish brown clay that is mottled in shades of red and gray. The lower part, from a depth of 17 to 60 inches, is mottled reddish yellow, red, and gray clay that has 15 percent plinthite. The surface layer is moderately acid, and the subsoil is strongly acid.

This soil is moderately well drained. Surface runoff is rapid. A perched water table is at a depth of 2.0 to 3.5 feet during the winter and spring. Permeability is slow, and the available water capacity is moderate. The root zone is deep, but the layers that have plinthite and ironstone gravel cannot be easily penetrated by roots. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Depcor, Fetzer, Landman, and Waller soils and areas of soils that have a surface texture of gravelly sandy loam or gravelly sandy clay loam. Also included are a few areas of the strongly sloping Conroe soils. Included soils make up less than 15 percent of the map unit.

This Conroe soil is used mainly as woodland or pasture. It is moderately suited to pines and hardwoods. The use of equipment is moderately limited because of the clayey texture and wetness. Seedling mortality and erosion are also moderate limitations. The dominant trees include loblolly pine and shortleaf pine. Trees are harvested for pulpwood and sawlogs.

This soil is poorly suited to pasture, but some areas support improved pasture grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suitable for cultivated crops. Most of the original surface layer has been removed. The present surface layer has very low fertility, is gravelly, and has poor tilth.

In most areas of this soil, woodland vegetation invades after mining. This vegetation mainly consists of a thin cover of small pines interspersed with a few hardwoods. Because of the plinthite in the clayey subsoil, the soil cannot be easily penetrated by roots and the growth of plants is slow. The soil produces a small amount of forage. Good management practices include controlled grazing, proper stocking rates, and thinning of trees.

This soil is poorly suited to urban and recreational development. The limitations include the thin surface layer, the slow permeability, and the seasonal wetness.

This soil is in capability subclass VIe, and the woodland ordination symbol is 6C.

CrC—Crockett fine sandy loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on upland

ridges and slope breaks. Areas are irregular in shape. They range from 5 to 200 acres in size. Slopes average about 3 percent.

Typically, the surface layer is dark brown fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 27 inches, is dark brown clay that has yellowish brown and red mottles. The next part, from a depth of 27 to 42 inches, is olive brown clay that has gray and yellowish brown mottles. The lower part, from a depth of 42 to 55 inches, is grayish brown clay. The underlying material, from a depth of 55 to 65 inches, is light brownish gray clay. Reaction is moderately acid in the surface layer and grades to moderately alkaline in the underlying material.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when it is wet or dry. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, water, and air. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Burleson, Frelsburg, Mabank, Robco, Tabor, and Wilson soils. Also included are small areas of Crockett soils that have been eroded. Included soils make up less than 20 percent of the map unit.

This Crockett soil is used mainly as pasture or range.

This soil is well suited to pasture. Many areas that were once cultivated are now planted to coastal bermudagrass and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility. Some areas support native grasses used for pastures. Good management practices include brush and weed control and applications of fertilizer.

This soil is moderately well suited to corn, small grain, forage sorghum, or grain sorghum. Crop residue helps to maintain the content of organic matter and control erosion. Terraces help to control runoff and erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is poorly suited to urban and recreational uses because of the shrink-swell potential, the very slow permeability, and the seasonal wetness.

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

CrC2—Crockett fine sandy loam, 1 to 5 percent, eroded. This very deep, gently sloping soil is on upland ridges and side slopes. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 4 percent.

Typically, the surface layer is dark brown, neutral fine sandy loam about 4 inches thick. The subsoil extends to a depth of 60 inches. From a depth of 4 to 9 inches, it is dark brown, neutral clay; from a depth of 9 to 16 inches, it is dark grayish brown, neutral clay that has brownish yellow and reddish brown mottles; from a depth of 16 to 30 inches, it is gray, neutral clay that has brownish yellow and reddish brown mottles; from a depth of 30 to 48 inches, it is gray, moderately alkaline clay that has reddish yellow and reddish brown mottles; and from a depth of 48 to 60 inches, it is light gray, moderately alkaline clay that has reddish yellow mottles.

This soil is moderately well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is high. Because of the clayey subsoil, the soil cannot be easily penetrated by roots. The hazard of erosion is severe. Sheet erosion has removed more than half of the original surface layer in most areas. Rills are common, and the plow layer consists of a mixture of the original surface layer and the subsoil.

Included with this soil in mapping are small areas of Axtell, Brenham, Chazos, Frelsburg, Latium, Robco, Straber, and Tabor soils. Also included are a few areas of Crockett soils that are not eroded. Included soils make up less than 15 percent of the map unit.

This Crockett soil is used mainly as range. A few areas are used for pasture.

This soil is suited to pasture. Improved bermudagrass and bahiagrass are the main grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the slope and the hazard of erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is poorly suited to urban and recreational development. The main limitations are the very slow permeability and the slope.

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

CrD—Crockett fine sandy loam, 5 to 8 percent slopes. This very deep, moderately sloping soil is on upland ridges and side slopes. Areas are elongated and are parallel to breaks between land forms that have different elevations. They range from 10 to 100 acres in

size. Slopes average about 6 percent.

Typically, the surface layer is brown, moderately acid fine sandy loam about 6 inches thick. The subsoil, from a depth of 6 to 23 inches, is grayish brown, neutral clay that has reddish brown and yellowish brown mottles. The next part, from a depth of 23 to 42 inches, is grayish brown, slightly alkaline clay that has yellowish brown, brownish yellow, and strong brown mottles. The lower part, from a depth of 42 to 50 inches, is grayish brown, moderately alkaline clay that has brownish yellow mottles. The underlying material, from a depth of 50 to 60 inches, is light yellowish brown, moderately alkaline clay.

This soil is moderately well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is high. Because of the clayey subsoil, the soil cannot be easily penetrated by roots. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Axtell, Chazos, Frelsburg, Latium, Robco, and Tabor soils. Also included are a few areas of eroded Crockett soils. Included soils make up less than 15 percent of the map unit.

This Crockett soil is used mainly as range. A few areas are used for pasture.

This soil is suited to pasture. Improved bermudagrass and bahiagrass are the main grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the slope and the hazard of erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is poorly suited to urban and recreational development. The main limitations are the very slow permeability and the slope.

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

CuC—Cuero clay loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on foot slopes. Areas range from 5 to 30 acres in size. Slopes average about 2 percent.

Typically, the surface layer is clay loam about 15 inches thick. It is very dark grayish brown in the upper part and very dark brown in the lower part. The subsoil extends to a depth of 65 inches. From a depth of 15 to 23 inches, it is very dark brown clay loam that has strong brown mottles; from a depth of 23 to 30 inches, it is dark brown clay loam that has strong brown mottles; from a depth of 30 to 40 inches, it is yellowish red clay loam that has strong brown mottles; from a depth of 40 to 48 inches, it is yellowish brown sandy clay loam that has yellowish red and gray mottles; and from a depth of 48 to 65 inches, it is strong brown sandy clay loam that has yellowish red mottles. The underlying material, from a depth of 65 to 72 inches, is brownish yellow fine sandy loam that has yellowish brown mottles. The soil is slightly acid throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is high. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Brenham, Carbengle, Crockett, Frelsburg, Klump, and Knolle soils and areas of Cuero soils that have a surface layer of sandy clay loam or loam. Also included is a soil that is similar to the Cuero soil but has a subsoil that is more clayey. Included soils make up less than 15 percent of the map unit.

The Cuero soil is used as pasture, range, and cropland. Some areas support native grasses used for hay.

This soil is well suited to pasture. Many areas support improved bermudagrass or bahiagrass. Other areas support kleingrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to corn, small grain, and forage sorghum. Crop residue helps to control erosion and maintain the content of organic matter. Terraces and contour farming help to control runoff and erosion.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The main limitations are the moderate shrink-swell potential and low strength. The slope is a limitation affecting some recreational uses.

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

DeC—Depcor loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 20 to 600 acres in size. Slopes average about 3 percent.

Typically, the surface layer is grayish brown loamy fine sand about 7 inches thick. The subsurface layer, from a depth of 7 to 28 inches, is pale brown loamy fine sand. The upper part of the subsoil, from a depth of 28 to 40 inches, is brownish yellow sandy clay loam that

has reddish and yellowish mottles. The lower part, from a depth of 40 to 60 inches, is red sandy clay loam that is mottled in shades of gray, yellow, and red. The soil is slightly acid in the surface layer and subsurface layer and very strongly acid in the subsoil.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 2.0 to 3.5 feet during the winter and spring. Permeability is rapid in the surface layer and subsurface layer and slow in the subsoil, and the available water capacity is moderate. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Boy, Conroe, Fetzer, and Splendora soils and a soil that is similar to the Depcor soil but has a sandy surface layer that is less than 20 inches thick. Also included are a few small areas of the moderately sloping Depcor soils. Included soils make up less than 20 percent of the map unit.

This Depcor soil is used mainly as woodland or pasture. It is well suited to pines and hardwoods. The sandy texture is a moderate limitation affecting the use of equipment. It is also a limitation affecting the seedling mortality rate. The dominant trees are loblolly pine and shortleaf pine. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Improved grasses, such as coastal bermudagrass and bahiagrass, are suitable species. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to crops. Corn, peanuts, and small grain are the main crops. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

This soil produces a high amount of native forage. Most areas have a dense canopy of pines and hardwoods. Forage production is low in these areas. Good management practices include thinning of trees, proper stocking rates, and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The main limitations are the sandy texture, the seasonal wetness, and the slope.

This soil is in capability subclass IIIe, and the woodland ordination symbol is 8S.

DeD—Depcor loamy fine sand, 5 to 8 percent slopes. This very deep, moderately sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 6 percent.

Typically, the surface layer is dark grayish brown loamy fine sand about 4 inches thick. The subsurface layer, from a depth of 4 to 36 inches, is light yellowish brown loamy fine sand. The upper part of the subsoil, from a depth of 36 to 42 inches, is brownish yellow sandy clay loam that is mottled in shades of gray and red. The lower part, from a depth of 42 to 65 inches, is sandy clay loam that is mottled in shades of red, gray, and yellow. The soil is slightly acid in the surface layer and subsurface layer and very strongly acid in the subsoil.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 2.0 to 3.5 feet during the winter. Permeability is slow, and the available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Boy, Conroe, Fetzer, Huntsburg, Landman, and Splendora soils and a soil that is similar to the Depcor soil but has a sandy surface layer less than 20 inches thick. Also included are a few areas of the less sloping Depcor soils. Included soils make up less than 20 percent of the map unit.

This Depcor soil is used mainly as woodland or pasture. It is well suited to pines and hardwoods. The sandy surface texture is a moderate limitation affecting the use of equipment. It is also a limitation affecting the seedling mortality rate. The dominant trees are loblolly pine and shortleaf pine. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Improved grasses, such as improved bermudagrass and bahiagrass, are suitable species. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the slope and the hazard of erosion. Planting small grain or other closely spaced crops can help to control excessive erosion. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

This soil produces a high amount of native forage. Most areas have a dense canopy of pines and hardwoods. Forage production is low in these areas. Good management practices include thinning of trees, proper stocking rates, and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The main limitations are the sandy texture, the seasonal wetness, and the slope.

This soil is in capability subclass IVe, and the woodland ordination symbol is 9S.

Du—Dumps, ash. This map unit consists of piles of fly ash from the Gibbons Creek lignite mine that have

been covered by clayey material. Areas are rectangular. They are as much as 150 acres in size. They are increasing in size daily as more ash is stored and covered.

This map unit is well drained. Surface runoff is medium. Permeability in the clay cap is very slow. The available water capacity is low. The hazard of erosion is moderate.

No areas are included with this unit in mapping. The unit consists of piles of ash covered with a cap of impervious clay. The ash is being stored because it may have considerable commercial value in the future as use for roadbase, fertilizers, or other industrial products.

Improved bermudagrass and some native grasses have been established in areas of this map unit to control erosion.

This unit is not suitable for pasture, woodland, range, or urban and recreational uses.

No capabilty subclass, range site, or woodland ordination symbol is assigned.

EmC—Elmina loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping soil is on uplands. Soils are irregular in shape. They range from 10 to 300 acres in size. Slopes average about 3 percent.

Typically, the surface layer is loamy fine sand about 22 inches thick. It is dark grayish brown in the upper part and brown in the lower part. The subsoil, from a depth of 22 to 55 inches, is sandy clay. It is light brownish gray in the upper part and grayish brown in the lower part. It has dark red to red mottles. The underlying material, from a depth of 55 to 72 inches, is light yellowish brown sandy clay loam that has tuffaceous clay fragments. The soil is slightly acid in the surface layer and grades to very strongly acid in the underlying material.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 1.5 to 3.5 feet during wet periods in the fall, winter, and spring. Permeability is rapid in the surface layer and subsurface layer and very slow in the subsoil, and the available water capacity is low. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Falba, Gomery, Shiro, and Singleton soils. Included soils make up less than 10 percent of the map unit.

This Elmina soil is mainly used as pasture or woodland. It is moderately suited to pines and hardwoods. The sandy texture and the seasonal wetness are moderate limitations affecting the use of equipment for planting and harvesting. The low available water capacity is a limitation affecting the seedling mortality rate. The dominant trees are post oak, loblolly pine, and shortleaf pine. Trees are harvested mainly for sawlogs and pulpwood.

This soil is well suited to pasture. Some areas support common bermudagrass, improved bermudagrass, and bahiagrass. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to crops. The soil is difficult to work during wet periods.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Many areas have a dense overstory of pines and hardwoods. Thinning the trees increases forage production.

This soil is poorly suited to urban and recreational uses. The very slow permeability and the seasonal wetness are the main limitations.

This soil is in capability subclass IIIe, and the woodland ordination symbol is 8S.

EmD—Elmina loamy fine sand, 5 to 8 percent slopes. This deep, sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 50 acres in size. Slopes average about 6 percent.

Typically, the surface layer is loamy fine sand about 24 inches thick. It is grayish brown in the upper part and pale brown in the lower part. The subsoil, from a depth of 24 to 55 inches, is grayish brown clay that is mottled in shades of brown and red. The underlying material, from a depth of 55 to 70 inches, is dark grayish brown tuffaceous clay that has red mottles. The surface layer is slightly acid, and the subsoil and underlying material are very strongly acid.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 1.5 to 3.5 feet during wet periods in the fall, winter, and spring. Permeability is rapid in the surface layer and subsurface layer and very slow in the subsoil, and the available water capacity is low. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Falba, Gomery, Shiro, and Singleton soils. Included soils make up less than 20 percent of the map unit.

This Elmina soil is used mainly as pasture and woodland. It is moderately suited to pines and hardwoods. The sandy texture and the seasonal wetness are moderate limitations affecting the use of equipment for planting and harvesting. The low available water capacity is a limitation affecting the seedling mortality rate. The dominant trees are loblolly

pine and shortleaf pine. Trees are harvested for pulpwood and sawlogs.

This soil is well suited to pasture. Some areas support coastal bermudagrass and bahiagrass. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the slope and the hazard of erosion. Some areas are farmed. Small grain or forage sorghum are grown in these areas. Leaving crop residue on the surface and minimizing tillage help to maintain the content of organic matter and control erosion.

This soil produces a high amount of forage. Many areas have a dense stand of hardwoods and pines. Thinning the trees helps to increase forage production. Controlled grazing and proper stocking rates increase plant vigor and production.

This soil is poorly suited to urban and recreational uses. The slope, wetness, the very slow permeability, and the sandy surface texture are the major limitations.

This soil is in capability subclass IVe, and the woodland ordination symbol is 8S.

FaC—Falba fine sandy loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 300 acres in size. Slopes average about 3 percent.

Typically, the surface layer is slightly acid, grayish brown fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 21 inches, is slightly acid, grayish brown clay. The lower part, from a depth of 21 to 35 inches, is very strongly acid, light gray clay. The underlying material, from a depth of 35 to 40 inches, is slightly alkaline, white tuffaceous sandstone bedrock.

This soil is moderately well drained. Surface runoff is medium or slow. A perched water table is at a depth of 0.5 foot to 1.5 feet during the winter and spring. Permeability is very slow. Natural fertility, the content of organic matter, and the available water capacity are low. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, water, and air. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Arol, Elmina, Koether, Shiro, and Singleton soils. Also included are small areas that have slopes of more than 5 percent. Included soils make up less than 15 percent of the map unit.

This Falba soil is used mostly as range or pasture. A few areas are used as cropland. The main crops grown in these areas are small grain or forage sorghum.

This soil is moderately well suited to pasture. Some areas support improved bermudagrass and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Some small areas are farmed. Small grain, ryegrass, and forage sorghum are grown in these areas. The soil is droughty and difficult to work in the summer. Leaving crop residue on the surface helps to maintain the content of organic matter and control soil erosion. Terraces and contour farming help to control erosion.

This soil produces a moderate amount of forage. Good management practices include controlled grazing and proper stocking rates. Many areas have a dense stand of trees. Thinning the trees and brush increases forage production.

This soil is poorly suited to urban and recreational uses. The very slow permeability, the shrink-swell potential, and wetness are the major limitations.

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

FaC2—Falba fine sandy loam, 1 to 5 percent slopes, eroded. This moderately deep, gently sloping soil is on uplands. Areas are irregular in shape. They are as much as 50 acres in size. Slopes average about 3 percent.

Sheet erosion has removed more than half of the original surface layer. It has removed all the surface layer and part of the subsoil in some areas. Rills are common. A few areas have gullies that are 1 to 3 feet deep.

Typically, the surface layer is dark grayish brown fine sandy loam about 3 inches thick. The subsoil, from a depth of 3 to 25 inches, is dark gray clay. The underlying material, from a depth of 25 to 40 inches, is very pale brown tuffaceous siltstone bedrock. The soil is slightly acid throughout.

This soil is moderately well drained. Surface runoff is medium or slow. A perched water table is at a depth of 0.5 foot to 1.5 feet during the winter and spring. Permeability is very slow, and the available water capacity is low. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, water, and air. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Arol, Elmina, Koether, Shiro, and Singleton soils. Also included are small areas that have slopes of more than 5 percent. Included soils make up less than 15 percent of the map unit.

This soil is used mainly as range or pasture. Most

areas were formerly used as cropland.

This soil is moderately well suited to pasture. Most areas support poor quality grasses. A few areas have been planted to improved bermudagrass and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. The soil is eroded, droughty in the summer, difficult to work, and low in fertility.

This soil is moderately well suited to range. Good management practices include controlled grazing, proper stocking rates, and brush and weed control.

This soil is poorly suited to urban and recreational uses. The very slow permeability, the shrink-swell potential, and depth are the main limitations.

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

FeC—Fetzer loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on upland foot slopes. Areas are elongated and are parallel to drainageways. They range from 20 to 400 acres in size. Slopes average about 2 percent.

Typically, the surface layer is brown loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 25 inches, is pale brown loamy fine sand that has yellowish brown mottles. The subsoil extends to a depth of 75 inches. From a depth of 25 to 34 inches, it is yellowish brown and grayish brown clay loam; from a depth of 34 to 48 inches, it is light brownish gray sandy clay that has yellowish brown mottles; from a depth of 48 to 58 inches, it is yellowish brown sandy clay loam that has grayish brown and red mottles; from a depth of 58 to 65 inches, it is yellowish brown sandy clay that has gray mottles; and from a depth of 65 to 75 inches, it is light gray clay. Reaction is moderately acid in the surface layer and grades to slightly alkaline in the lower part of the subsoil.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 1.5 to 3.5 feet during the winter and spring. Permeability is rapid in the surface layer and subsurface layer and slow in the subsoil, and the available water capacity is moderate. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Boy, Conroe, Depcor, Splendora, and Waller soils. Also included are a few areas of the depressional Fetzer soils. Included soils make up less than 15 percent of the map unit.

The Fetzer soil is used as woodland or pasture. It is well suited to pines and hardwoods. The wetness during certain times of the year is a limitation affecting the seedling mortality rate and the use of equipment. The dominant trees are loblolly pine and shortleaf pine. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are the main grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, peanuts, truck crops, and small grain are well suited to this soil. Minimum tillage systems that leave crop residue on the surface help to control erosion.

This soil produces a high amount of native grass forage. Most areas, however, have a dense canopy of pines and hardwoods. Forage production is low in these areas. Good management practices include thinning of trees, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are wetness and the slow permeability. In some places the slope is a limitation affecting recreational uses.

This soil is in capability subclass IIIe, and the woodland ordination symbol is 8W.

FlA—Flatonia clay loam, 0 to 1 percent slopes. This deep, nearly level soil is on upland ridges and foot slopes. Areas are irregular in shape and are parallel to the contour of the landscape. They range from 10 to 50 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is very dark gray, slightly acid clay loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 18 inches, is very dark gray, slightly acid clay. The next part, from a depth of 18 to 30 inches, is very dark gray, neutral clay. The lower part, from a depth of 30 to 45 inches, is light brownish gray, neutral silty clay. The underlying material, from a depth of 45 to 60 inches, is white, neutral, weakly cemented siltstone bedrock.

This soil is moderately well drained. Surface runoff is slow. Permeability also is slow, and the available water capacity is moderate. The soil is difficult to work when it is wet or dry. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Arol, Falba, Greenvine, and Shiro soils. Also included are small areas of a soil that is similar to the Flatonia soil but is less than 40 inches deep to siltstone bedrock. A few areas have a surface layer that is lighter colored. Also included are some areas where the surface layer is hard and massive when dry. Included soils make up less than 25 percent of the map unit.

This Flatonia soil is used mainly as pasture or range. Some areas support small grain or forage sorghum.

This soil is well suited to pasture. Adapted grasses include improved bermudagrass and bahiagrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, cotton, forge sorghum, and small grain are moderately well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

This soil is well suited to range. Good management practices include proper stocking rates, controlled grazing, and brush and weed control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, low strength, and wetness.

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

FlB—Flatonia clay loam, 1 to 4 percent slopes. This deep, gently sloping soil is on uplands. Areas are irregular in shape and are parallel to the contour of the landscape. They range from 10 to 300 acres in size. Slopes average about 2 percent.

Typically, the surface is slightly acid, very dark gray clay loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 22 inches, is slightly acid, very dark gray clay. The next part, from a depth of 22 to 32 inches, is slightly acid, dark gray clay that has very dark gray mottles. The lower part, from a depth of 32 to 45 inches, is neutral, gray clay. The underlying material, from a depth of 45 to 55 inches, is neutral, light gray siltstone bedrock.

This soil is moderately well drained. Surface runoff is medium. Permeability is slow, and the available water capacity is moderate. The soil is difficult to work when it is wet or dry. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Arol, Falba, Greenvine, and Shiro soils. Also included is a soil that is similar to the Flatonia soil but is less than 40 inches deep to siltstone bedrock. A few areas have a surface layer that is lighter colored. Included soils make up less than 25 percent of the map unit.

This Flatonia soil is used mainly as pasture or range. A few areas are used as cropland. The main crops grown in these areas are forage sorghum and small grain.

This soil is moderately well suited to pasture. Adapted grasses include improved bermudagrass and bahiagrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Some areas support corn, forage sorghum, and small grain. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

This soil produces a high amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Good management practices include brush control and proper stocking rates.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, low strength, and wetness.

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

FrC—Frelsburg clay, 1 to 5 percent slopes. This very deep, gently sloping soil is on upland hillsides. Areas are elongated and are parallel to the contour of the landscape. They range from 5 to 100 acres in size. Slopes average about 4 percent.

Typically, the surface layer is very dark gray clay about 10 inches thick. The upper part of the subsoil, from a depth of 10 to 32 inches, is dark gray and grayish brown clay. The lower part, from a depth of 52 to 70 inches, is olive yellow clay. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Bleiblerville, Brenham, Carbengle, Klump, Knolle, and Latium soils. Included soils make up less than 20 percent of the map unit.

This Frelsburg soil is used as pasture, range, or cropland.

This soil is well suited to pasture. Adapted grasses include improved bermudagrass and kleingrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to corn, grain sorghum, cotton, small grain, and forage sorghum. Leaving crop residue on the surface helps to control erosion, maintain the content of organic matter, and maintain tilth. Terraces and contour farming help to control erosion.

This soil produces a high amount of native grass forage. Good management practices include proper

stocking rates, brush and weed control, and controlled grazing.

This soil is poorly suited to recreational and urban uses. The main limitations are the shrink-swell potential, the very slow permeability, and low strength.

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

FrC2—Frelsburg clay, 1 to 5 percent slopes, eroded. This very deep, gently sloping soil is along slope breaks on uplands. Areas are elongated and are parallel to the contour of the landscape. They range from 5 to 50 acres in size. Slopes average about 4 percent.

Erosion has removed much of the original surface layer of this soil. Rills and a few gullies that are 1 to 3 feet deep are common. In some places the plow layer is a mixture of the original surface layer and the subsoil.

Typically, the surface layer is clay about 12 inches thick. It is black in the upper part and dark gray in the lower part. The upper part of the subsoil, from a depth of 12 to 38 inches, is light brownish gray clay that has black streaks. The lower part, from a depth of 38 to 60 inches, is light olive gray clay that has black streaks. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. Erosion has removed some of the surface layer in places. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Bleiblerville, Brenham, Carbengle, Frelsburg, and Klump soils. Also included are a few gullies about 6 feet deep along field boundaries and drainageways. Included areas make up less than 20 percent of the map unit.

This Frelsburg soil is used as pasture, range, or cropland. Forage sorghum, grain sorghum, and small grain are the main crops.

This soil is moderately well suited to pasture. Improved bermudagrass and kleingrass are suitable species. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, forage sorghum, grain sorghum, and small grain are moderately well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Terraces, grassed waterways, and contour farming help to control runoff and erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and brush and weed control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, and low strength.

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

GbC—Gibbonscreek clay loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands. It formed from spoil materials in an area that was reclaimed after mining for lignite. Areas range from 500 to more than 1,000 acres in size. Slopes average about 4 percent.

Typically, the surface layer is light brownish gray, slightly acid clay loam about 8 inches thick. The underlying material, from a depth of 8 to 80 inches, is light brownish gray clay loam. It is moderately acid in the upper part and neutral in the lower part.

This soil is well drained. Surface runoff is medium. Permeability is moderate for a few years after reclamation. It becomes moderately slow with time and settling. The available water capacity is high. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Burlewash and Falba soils and a soil that is similar to the Gibbonscreek soil but has a surface layer of clay. Also included along the northwestern part of the mined area is a soil that is similar to the Gibbonscreek soil but averages less than 10 percent clay in the control section. Included soils make up less than 15 percent of the map unit.

This Gibbonscreek soil is used mainly as pasture, hayland, or wildlife habitat.

This soil is suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Crops, such as corn, grain sorghum, and small grain, can be grown in the less sloping areas of this soil where erosion is less severe. Minimum tillage that leaves crop residue on the surface is needed to control erosion.

This soil is well suited to range, but it is not used as range. Disturbance of the soil has eliminated the source of native grass seeds. Reseeding would be needed to reestablish native grasses. The soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and brush and weed control.

This soil is poorly suited to urban and recreational

uses. The restricted permeability and the hazard of erosion are limitations on sites for campgrounds. The slope is a limitation on sites for playgrounds.

This soil is in capability subclass IVe. No range site or woodland ordination symbol is assigned.

GbE—Gibbonscreek clay loam, 5 to 20 percent slopes. This very deep, moderately sloping to moderately steep soil is on uplands. It formed from spoil materials in an area that was reclaimed after mining for lignite. This area is in the boxcut spoil of the mine. Areas range from 30 to 100 acres in size. Slopes average about 15 percent.

Typically, the surface layer is light brownish gray, slightly acid clay loam about 7 inches thick. The underlying material, from a depth of 7 to 80 inches, is stratified, light brownish gray clay loam and clay that is moderately acid to neutral.

This soil is well drained. Surface runoff is rapid. Permeability is moderately slow, and the available water capacity is high. The hazard of erosion is severe.

Included with this soil in mapping are small areas of a soil that is similar to the Gibbonscreek soil but has a surface layer of clay. Also included along the northwest part of the mined area is a soil that is similar to the Gibbonscreek soil but averages less than 18 percent clay in the control section and a few areas of a soil that is similar to the Gibbonscreek soil but has more than 35 percent clay in the control section.

This Gibbonscreek soil is used mainly as pasture, hayland, or wildlife habitat.

This soil is suited to pasture. Improved bermudagrass is adapted to this soil. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the hazard of erosion and the slope.

This soil is well suited to range, but it is not used as range. Disturbance of the soil has eliminated the source of native grass seeds. Reseeding would be needed to reestablish native grasses. The soil produces a moderate amount of native forage.

This soil is poorly suited to urban and recreational uses. The moderately slow permeability and the slope are limitations on sites for campgrounds, trails, and playgrounds.

This soil is in capability subclass VIe. No range site or woodland ordination symbol is assigned.

Gd—Gladewater clay, frequently flooded. This very deep, nearly level, somewhat poorly drained soil is along the broad flood plain of the Navasota River and along flood plains of local creeks. Flooding occurs about once every year for 7 to 14 days. Areas range from 10 to 5,000 acres in size. Slopes are 0 to 1 percent but average about 0.5 percent.

Typically, the surface layer is dark gray, slightly acid clay about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 25 inches, is light brownish gray, moderately acid clay that has yellowish brown mottles. The next part, from a depth of 25 to 35 inches, is light gray, moderately acid clay that has yellowish brown mottles. The lower part, from a depth of 35 to 60 inches, is gray, slightly acid clay that has yellowish brown mottles.

This soil is somewhat poorly drained. Surface runoff is very slow. The water table is within a depth of 3.5 feet during the winter and spring. Permeability is very slow, and the available water capacity is high. Flooding occurs frequently, and the soil remains wet for most of the year.

Included with this soil in mapping are small areas of Gowker and Nahatche soils. Included soils make up less than 15 percent of the map unit. Some areas are wooded. Water oak, willow oak, cottonwood, and elm trees and an understory of grasses and forbs are in these areas.

The Gladewater soil is mainly used as range. A few areas support native pastures or pastures of improved bermudagrass or bahiagrass.

This soil is well suited to pasture. The major limitations are wetness and flooding. Grazing only during the dry seasons can decrease soil compaction. A few areas support improved bermudagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Wetness and the flooding can result in the failure of crops.

This soil produces a high amount of forage. Many areas have an overstory of hardwoods. Thinning the trees in these areas can maintain maximum production of grasses. Flooding and wetness are the major limitations. Soil compaction is a problem if pastures are grazed during the wet season. Grazing only during the dry seasons can decrease soil compaction. Good management practices include proper stocking rates and controlled grazing.

This soil is unsuited to urban and recreational uses. The main limitations are flooding, wetness, and the high shrink-swell potential.

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

GmC—Gomery loamy fine sand, 1 to 5 percent slopes. This deep, gently sloping soil in on upland ridges and slopes. Areas are irregular in shape. They range from 5 to 100 acres in size. Slopes average about 3 percent.

Typically, the surface layer is grayish brown loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 30 inches, is light brownish gray loamy fine sand. The upper part of the subsoil, from a depth of 30 to 45 inches, is grayish brown sandy clay loam that has yellowish brown and red mottles. The lower part, from a depth of 45 to 59 inches, is gray sandy clay loam that has red mottles. The underlying material, from a depth of 59 to 65 inches, is brown, weakly cemented sandstone bedrock. The soil is slightly acid in the surface layer and subsurface layer and very strongly acid in the subsoil and underlying material.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is rapid in the surface layer and subsurface layer and moderately slow in the subsoil, and the available water capacity is moderate. A perched water table is above the layers of rock during wet seasons. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Boy, Burlewash, Elmina, Shiro, and Tonkavar soils. Also included are soils that are very similar to the Gomery soil but are slightly deeper to sandstone bedrock. Included soils make up less than 30 percent of the map unit.

The Gomery soil is used mainly as woodland or pasture. It is moderately suited to pines and hardwoods. The sandy texture is a moderate limitation affecting the seedling mortality rate. The dominant trees include loblolly pine and shortleaf pine. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to small grain or forage sorghum. Leaving crop residue on the surface helps to control erosion and maintain the content of organic matter. Minimum tillage helps to control erosion.

This soil produces a moderate amount of forage. Many areas currently have dense stands of pines and hardwoods. Good management practices include thinning of trees, proper stocking rates, and controlled grazing.

This soil is moderately well suited to urban and recreational uses. Limitations include the sandy texture and the moderately slow permeability. Wetness is a limitation on sites for buildings with basements and sanitary facilities.

This soil is in capability subclass IIIe, and the woodland ordination symbol is 8S.

Go—Gowker loam, frequently flooded. This very deep, nearly level soil is along the flood plains of small streams. Flooding of brief duration occurs at least once every 2 years (fig. 12). Areas are elongated. They range from 10 to 200 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is very dark grayish brown loam about 22 inches thick. The underlying material, from a depth of 22 to 60 inches, is clay loam that is dark grayish brown in the upper part and pale brown in the lower part. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface rufoff is slow. The water table is within a depth of 30 inches during the winter and spring. Permeability is slow, and the available water capacity is high. The root zone is deep. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Brenham, Cuero, Frelsburg, and Tinn soils. Included near stream channels is a soil similiar to the Gowker soil but is calcareous throughout and has less than 18 percent clay and a soil that is moderately permeable and well drained. Also included are areas of a similar soil that is not calcareous. Included soils make up less than 15 percent of the map unit.

This Gowker soil is used mainly as pasture because of the flooding. Some areas are wooded. The soil is not suited to pines but is well suited to commercial hardwoods, such as water oak, green ash, sycamore, and pecan. Some trees are harvested for sawlogs. Wetness and flooding are limitations affecting the management and harvest of timber.

This soil is well suited to native pasture or improved pasture. It is especially suited to improved grasses, such as coastal bermudagrass and kleingrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil soil is not suited to crops because of the flooding. It is subject to washing, scouring, and deposition of fresh allivial sediment. A few areas, however, are farmed intermittently. Small grain or forage sorghum are grown in these areas.

This soil produces a high amount of forage. Good management practices include proper stocking rates, brush management, and weed control.

This soil is poorly suited to urban and recreational

Figure 12.—Flooding in an area of Gowker loam, frequently flooded. Flooding is a major hazard in many areas near creeks and rivers.

uses mainly because of the flooding.

This soil is in capability subclass Vw, and the woodland ordination symbol is 6W.

Gp—Gowker clay loam, frequently flooded. This very deep, nearly level soil in on flood plains. Flooding occurs at least once every 1 or 2 years for a few hours to several days. Most of the flooding is in May and September. Areas are elongated. They range from 50 to 1,000 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is very dark grayish brown, slightly acid clay loam about 24 inches thick. The next layer, from a depth of 24 to 28 inches, is very dark gray, slightly acid clay. The underlying material, from a depth of 28 to 60 inches, is gray, neutral clay loam that has a thin strata of fine sandy loam.

This soil is moderately well drained. Surface runoff is slow. The water table is within a depth of 30 inches during the winter and spring. Permeability is slow, and the available water capacity is high. The hazard of erosion is slight.

Included with this soil in mapping are small areas of

Gladewater, Hatliff, and Nahatche soils. Also included are a few areas of a soil similar to the Gowker soil but is calcareous. Included soils make up less than 40 percent of the map unit.

This Gowker soil is used mainly as native pasture for grazing. Some areas are used as woodland. The soil is not suited to pines but is well suited to commercial hardwoods, such as water oak, green ash, sycamore, and red oak. Some trees are harvested for sawlogs. Wetness and flooding are limitations affecting the management and harvest of timber.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to cultivated crops because of the frequent flooding.

This soil produces a high amount of tall native grass forage. Good management practices include weed and brush control, proper stocking rates, and controlled grazing. Many areas currently have a dense stand of trees and shrubs. Thinning the trees and shrubs increases forage production.

This soil is not suited to urban and recreational uses because of the frequent flooding.

This soil is in capability subclass Vw, and the woodland ordination symbol is 6W.

GrC—Gredge fine sandy loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 200 acres in size. Slopes average about 3 percent.

Typically, the surface layer is grayish brown, moderately acid fine sandy loam about 7 inches thick. The subsoil extends to a depth of 80 inches. From a depth of 7 to 15 inches, it is brown, strongly acid clay; from a depth of 15 to 25 inches, it is light yellowish brown, slightly acid clay that has light brownish gray mottles; from a depth of 25 to 45 inches, it is light brownish gray, moderately alkaline clay that grades to clay loam with increasing depth; and from a depth of 60 to 80 inches, it is very pale brown and light gray, moderately alkaline sandy clay loam.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is moderate. The soil is difficult to work when it is wet or dry. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Axtell, Boonville, Lufkin, Mabank, Rader, Tabor, Zack, and Zulch soils. Included soils make up less than 15 percent of the map unit.

This Gredge soil is used mainly as range or pasture. A few areas support small grain or forage sorghum.

This soil is moderately well suited to pasture. Some areas support common bermudagrass, improved bermudagrass, and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Some areas are farmed. Small grain or forage sorghum are grown in these areas. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Minimum tillage, terraces, and contour farming help to control erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation increases plant vigor and production. Good management practices include proper stocking rates and brush and weed control.

This soil is poorly suited to urban and recreational uses. The high shrink-swell potential, the very slow permeability and low strength are the main limitations.

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

GrE—Gredge fine sandy loam, 5 to 12 percent slopes. This very deep, strongly sloping soil is on upland breaks. Areas are elongated and are parallel to the contour of the landscape. They range from 10 to 300 acres in size. Slopes average about 7 percent.

Typically, the surface layer is grayish brown, strongly acid fine sandy loam about 5 inches thick. The upper part of the subsoil, from a depth of 5 to 15 inches, is brown, strongly acid clay that has gray mottles. The next part, from a depth of 15 to 32 inches, is light yellowish brown, slightly acid clay. The lower part, from a depth of 32 to 60 inches, is light gray and pale brown, moderately alkaline clay loam and fractured siltstone bedrock.

This soil is moderately well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is moderate. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, water, and air. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Axtell, Boonville, Lufkin, Rader, Tabor, Zack, and Zulch soils. Also included are a few areas of the Gredge soils where the original surface layer has been removed by

erosion. Included soils make up less than 15 percent of the map unit.

This Gredge soil is used mainly as range or wildlife habitat.

This soil is moderately well suited to pasture. Some areas support common bermudagrass, improved bermudagrass, and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the hazard of erosion. A few areas support small grain and ryegrass.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Good management practices include proper stocking rates and weed and brush control.

This soil is poorly suited to urban and recreational uses. The shrink-swell potential, the very slow permeability, low strength, and the slope are the main limitations.

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

GvC—Greenvine clay, 1 to 5 percent slopes. This moderately deep, gently sloping soil is in convex areas on uplands. Areas are irregular in shape. They range from 8 to 50 acres in size. Slopes average about 2 percent.

Typically, the surface layer is clay about 15 inches thick. It is black in the upper part and very dark gray in the lower part. The subsoil, from a depth of 15 to 30 inches, is very dark gray clay that has streaks of light brownish gray. The underlying material, from a depth of 30 to 60 inches, is light brownish gray interbedded tuffaceous clays. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is slow or medium. Permeability is very slow, and the available water capacity is low. Water infiltrates the soil rapidly when the soil is dry and has cracks. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Arol, Falba, Flatonia, and Shalba soils. Also included are small areas of the nearly level Greenvine soils and a few small eroded areas. Included soils make up less than 15 percent of the map unit.

This Greenvine soil is used mainly as range or pasture. A few areas are used as cropland. The main crops grown in these areas are small grain or forage sorghum.

This soil is moderately well suited to pasture. Some areas support common bermudagrass and improved bermudagrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the low available water capacity. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

This soil produces a high amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Good management practices include proper stocking rates and weed and brush control.

This soil is poorly suited to urban and recreational uses. The high shrink-swell potential, the very slow permeability, and low strength are the main limitations.

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

GvD—Greenvine clay, 5 to 8 percent slopes. This moderately deep, moderately sloping soil is in convex areas on uplands. Areas range from 8 to more than 25 acres in size. Slopes average about 6 percent.

Typically, the surface layer is clay about 12 inches thick. It is black in the upper part and very dark gray in the lower part. The subsoil, from a depth of 12 to 25 inches, is very dark gray clay. The underlying material, from a depth of 25 to 60 inches, is light brownish gray tuffaceous clayey marl. The soil is moderately alkaline and calcareous throughout.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is low. Water infiltrates the soil rapidly when the soil is dry and has cracks. The hazard of erosion is severe. The soil cannot be easily tilled because it is very hard when dry and very sticky when wet.

Included with this soil in mapping are small areas of Arol, Falba, Frelsburg, and Shalba soils. Also included are soils that are very shallow to claystone or marl. Included soils make up less than 15 percent of the map unit.

This Greenvine soil is used mainly as range or pasture.

This soil is moderately well suited to pasture. Some areas support common bermudagrass and improved bermudagrass. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the low available water capacity and the hazard of erosion. Some areas are farmed. Small grain or forage sorghum are grown in these areas. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Terraces and minimum tillage help to control erosion.

This soil produces a high amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Good management practices include proper stocking rates and weed and brush control.

This soil is poorly suited to urban and recreational uses. The high shrink-swell potential, the very slow permeability, low strength, and the slope are the main limitations.

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

Ha—Hatliff fine sandy loam, frequently flooded. This very deep, nearly level soil is on flood plains. Flooding occurs at least once every 1 or 2 years for a few hours to several days. Most of the flooding is in the spring or fall. Areas are elongated. They range from 50 to 2,000 acres in size. Slopes range from 0 to 1 percent but average about 0.5 percent.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam about 6 inches thick. From a depth of 6 to 72 inches, the soil is stratified brown, light gray, grayish brown, light brownish gray, dark grayish brown, or pale brown, slightly acid fine sandy loam, loam, and loamy sand.

This soil is moderately well drained. Surface runoff is slow. The water table is within a depth of 2 feet during the spring and winter. Permeability is moderately rapid, and the available water capacity is high. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Gowker, Nahatche, and Tinn soils. Also included are small areas of Hatliff soils that have a surface texture that is sandier. Included soils make up less than 30 percent of the map unit.

The Hatliff soil is used mainly as pasture. Some areas are used as woodland. Livestock graze in some areas of the woodland. The soil is well suited to pines and hardwoods. The dominant trees include pine, water oak, sweetgum, willow oak, cottonwood, and pecan. Some trees are harvested for sawlogs. The wetness is a moderate limitation affecting the use of equipment, the seedling mortality rate, and plant competition.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to cultivated crops because of the frequent flooding.

This soil produces a high amount of native grass forage. Some areas have an overstory of pines and hardwoods. Thinning the trees increases forage production. Good management practices include weed and brush control, proper stocking rates, and controlled grazing.

This soil is not suited to urban and recreational development because of the frequent flooding.

This soil is in capability subclass Vw, and the woodland ordination symbol is 10W.

HuC—Huntsburg loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 300 acres in size. Slopes average about 3 percent.

Typically, the surface layer is slightly acid loamy fine sand about 11 inches thick. It is grayish brown in the upper part and light gray in the lower part. The upper part of the subsoil, from a depth of 11 to 16 inches, is yellowish brown, very strongly acid clay that has red mottles. The next part, from a depth of 16 to 40 inches, is light gray, very strongly acid clay that has red mottles. The lower part, from a depth of 40 to 65 inches, is light gray and white sandy clay that has brownish mottles.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 0.5 to 2 feet during the winter and spring. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Annona, Boy, Depcor, and Fetzer soils. Also included is a soil that is similar to the Huntsburg soil but has less clay in the lower part of the subsoil. Included soils make up less than 15 percent of the map unit.

This Huntsburg soil is used mainly as woodland or pasture. Some areas are used for recreation, and a few areas are used as cropland. The soil is well suited to pines and hardwoods. The use of equipment for planting and harvesting is moderately limited because of the sandy texture and seasonal wetness. Seedling mortality and plant competition are also moderate limitations. The dominant trees are loblolly pine and shortleaf pine. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer and lime are

needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Crop residue helps to maintain the content of organic matter and control erosion. Cover crops help to control erosion.

This soil produces a high amount of native grass forage. Many areas have a dense canopy of pines and hardwoods. Forage production is generally low in these areas. Good management practices include proper stocking rates, controlled grazing, and thinning of trees.

This soil is poorly suited to urban and recreational uses. The main limitations are wetness and the sandy texture.

This soil is in capability subclass IIIe, and the woodland ordination symbol is 10S.

HuD—Huntsburg loamy fine sand, 5 to 8 percent slopes. This very deep, moderately sloping soil is on upland hillsides and slope breaks. Areas are elongated and are parallel to the contour of the landscape. They range from 10 to 300 acres in size. Slopes average about 7 percent.

Typically, the surface layer is brown, slightly acid loamy fine sand about 10 inches thick. The upper part of the subsoil, from a depth of 10 to 25 inches, is yellowish brown, strongly acid clay. The lower part, from a depth of 25 to 65 inches, is light brownish gray, strongly acid clay that has brownish mottles.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 0.5 to 2 feet during wet periods in the winter and spring. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Annona, Boy, Depcor, and Fetzer soils. Also included is a soil that is similar to the Huntsburg soil but has less clay in the lower part of the subsoil and some small eroded areas. Included soils make up less than 15 percent of the map unit.

This Huntsburg soil is used mainly as woodland or pasture. Some areas are used for recreational and urban development. The soil is well suited to pines and hardwoods. The use of equipment for planting and harvesting is moderately limited because of the sandy texture and seasonal wetness. Seedling mortality and plant competition are also moderate limitations. The dominant trees are loblolly pine and shortleaf pine. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the slope and the hazard of erosion.

This soil produces a high amount of native grass forage. Many areas have a dense canopy of pines and hardwoods. Forage production is generally low in these areas. Good management practices include proper stocking rates, controlled grazing, and thinning of trees.

This soil is poorly suited to urban and recreational uses. The main limitations are the slope and the sandy surface layer.

This soil is in capability subclass IVe, and the woodland ordination symbol is 10S.

Ka—Kaman clay, frequently flooded. This very deep, nearly level soil is on flood plains. Flooding occurs at least once every 1 or 2 years for 7 to 14 days. Most of the flooding occurs in the spring or fall. Areas are elongated. They range from 30 to 1,000 acres in size. Slopes are 0 to 1 percent but average 0.5 percent.

Typically, the surface layer is very dark gray clay about 15 inches thick. The lower layer, from a depth of 15 to 60 inches, is black clay. The soil is slightly alkaline throughout.

This soil is poorly drained. Surface runoff is very slow. The water table is at a depth of 1.5 to 3 feet during the winter and spring. Permeability is very slow, and the available water capacity is high. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Gowker, Hatliff, and Tinn soils. Also included near stream banks is a soil that is similar to the Kaman soil but has an overwash of loamy material less than 10 inches thick. Included soils make up less than 15 percent of the map unit.

The Kaman soil is used mainly as native pasture. Some areas are wooded. The soil is not suited to pine but is moderately suited to water oak, elm, cottonwood, and pecan. Some trees are harvested for sawlogs. Wetness and flooding are limitations affecting the management and harvest of timber.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to cultivated crops because of the frequent flooding.

If used for grazing, this soil produces a high amount of native grass forage. Good management practices

include weed and brush control, proper stocking rates, and controlled grazing. Flooding and wetness are the major limitations. Soil compaction is a problem if pastures are grazed during the wet season. Grazing only during the dry seasons can decrease soil compaction.

This soil is not suited to urban and recreational development because of the frequent flooding.

This soil is in capability subclass Vw, and the woodland ordination symbol is 6W.

KlC—Klump sandy loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on upland hilltops. Areas range from 10 to 100 acres in size. Slopes average about 4 percent.

Typically, the surface layer is dark brown sandy loam about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 24 inches, is dark brown sandy clay loam. The lower part, from a depth of 24 to 45 inches, is strong brown sandy clay loam. The underlying material, from a depth of 45 to 60 inches, is brownish yellow fine sandy loam. Reaction is slightly acid throughout the soil and neutral in the underlying material.

This soil is well drained. Surface runoff is medium. Permeability, the available water capacity, and the hazard of erosion are moderate.

Included with this soil in mapping are small areas of Brenham, Carbengle, Crockett, Cuero, Frelsburg, and Knolle soils. Also included are a few areas of Klump fine sandy loam and Klump loamy sand. Included soils make up less than 15 percent of the map unit.

This Klump soil is used as pasture, range, or cropland. The main crops are small grain or forage sorghum.

This soil is well suited to pasture. Improved bermudagrass, bahiagrass, and lovegrass are suitable grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Forage sorghum, oats, wheat, grain sorghum, corn, and other crops are well suited to this soil. Leaving crop residue on the surface helps to maintain tilth and the content of organic matter and control erosion. Terraces and contour farming help to control erosion and runoff.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and weed and brush control.

This soil is well suited to urban and recreational uses. In some places the slope is a limitation affecting some recreational uses.

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

KlD—Klump sandy loam, 5 to 8 percent slopes. This very deep, moderately sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 50 acres in size. Slopes average about 7 percent.

Typically, the surface layer is very dark grayish brown, slightly alkaline sandy loam about 10 inches thick. The upper part of the subsoil, from a depth of 10 to 15 inches, is very dark brown, neutral sandy clay loam. The lower part, from a depth of 15 to 45 inches, is strong brown, slightly acid sandy clay loam. The underlying material, from a depth of 45 to 65 inches, is yellowish red, slightly acid fine sandy loam.

This soil is well drained. Surface runoff is medium. Permeability and the available water capacity are moderate. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Brenham, Carbengle, Crockett, Cuero, Frelsburg, and Knolle soils. Included soils make up less than 20 percent of the map unit.

This Klump soil is used as range, pasture, or cropland. The main crops are oats, wheat, and forage sorghum.

This soil is well suited to pasture. Improved bermudagrass, bahiagrass, and lovegrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to corn, grain sorghum, oats, wheat, and forage sorghum. Leaving crop residue on the surface helps to maintain the content of organic matter and tilth and control erosion.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and weed and brush control.

This soil is moderately well suited to urban and recreational uses. The slope is the main limitation.

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

KnC—Knolle loamy sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 4 percent.

Typically, the surface layer is brown, slightly acid loamy sand about 15 inches thick. The subsoil is sandy clay loam that extends to a depth of 55 inches. From a depth of 15 to 28 inches, it is strong brown and

moderately acid; from a depth of 28 to 40 inches, it is yellowish red and strongly acid; and from a depth of 40 to 55 inches, it is reddish brown and moderately acid. The underlying material, from a depth of 55 to 70 inches, is strong brown, moderately acid sandy loam.

This soil is well drained. Surface runoff is slow. Permeability, the available water capacity, and the hazard of water erosion are moderate.

Included with this soil in mapping are small areas of Brenham, Carbengle, Crockett, Frelsburg, Klump, and Latium soils. Also included are some areas of Knolle soils that have a texture of loamy fine sand. Included soils make up less than 15 percent of the map unit.

This Knolle soil is used as pasture, cropland, or range. The main crops are small grain or forage sorghum.

This soil is well suited to pasture. Improved bermudagrass, weeping lovegrass, and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, peanuts, small grain, forage sorghum, and grain sorghum grow well in areas of this soil. Leaving crop residue on the surface helps to control erosion and maintain the content of organic matter. Minimum tillage helps to control erosion.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The main limitation is the sandy surface layer. In some places the slope is a limitation affecting recreational development.

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

KnD—Knolle loamy sand, 5 to 8 percent slopes. This very deep, moderately sloping soil is on uplands. Areas are irregular in shape and are parallel to the contour of the landscape. They range from 10 to 50 acres in size. Slopes average about 7 percent.

Typically, the surface layer is brown, slightly acid loamy sand about 13 inches thick. The upper part of the subsoil, from a depth of 13 to 25 inches, is strong brown, moderately acid sandy clay loam. The lower part, from a depth of 25 to 50 inches, is reddish brown, moderately acid sandy clay loam. The underlying material, from a depth of 50 to 70 inches, is strong brown, moderately acid sandy loam.

This soil is well drained. Permeability and the available water capacity are moderate. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Brenham, Carbengle, Crockett, Frelsburg, Klump, and Latium soils. Also included are areas of Klump soils that have a surface texture of loamy fine sand. Included soils make up less than 15 percent of the map unit.

This Knolle soil is used as pasture or range. The main crops grown are forage sorghum and small grain.

This soil is well suited to pasture. Improved bermudagrass, weeping lovegrass, and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Forage sorghum and small grain grow well in areas of this soil. Leaving crop residue on the surface helps to control erosion and maintain the content of organic matter.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and weed and brush control.

This soil is moderately well suited to urban and recreational uses. The main limitation is the sandy surface layer. The slope is a limitation in some areas.

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

KrD—Koether-Rock outcrop complex, 1 to 8 percent slopes. This shallow, undulating map unit is on upland breaks. Areas are round to elongated and are parallel to the contour of the landscape. They range from 5 to 30 acres in size. Slopes average about 6 percent.

This unit is 50 percent Koether soil, 20 percent Rock outcrop, and 30 percent other soils. This soil and the areas of Rock outcrop are so intricately mixed that separating in mapping is not practical.

Typically, the Koether soil has a surface layer of dark grayish brown, moderately acid stony loamy sand about 12 inches thick. The underlying material, from a depth of 12 to 30 inches, is pale yellow, very strongly acid interbedded sandstone bedrock and thin layers of shale.

The Koether soil is somewhat excessively drained. Surface runoff is rapid. Permeability is rapid, and the available water capacity is very low. The hazard of erosion is severe.

Typically, the Rock outcrop consists of exposures of hard sandstone bedrock. In some places a thin covering of loamy sand that ranges from 1 to 4 inches in thickness overlies the bedrock.

Included with this unit in mapping are small areas of Arol, Elmina, Falba, Gomery, and Shiro soils. Also included is a soil that is similar to the Koether soil but

has a thin subsoil above the layer of rock. Included soils make up about 30 percent of the map unit.

This unit is used as range or wildlife habitat.

This unit is not suited to pasture because of the stones.

This unit is not suited to crops because of the stony surface layer and the slope.

This unit produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This unit is poorly suited to recreational and urban uses because of the the slope and stones.

This unit is in subclass VIIs and the Sandstone Hill range site.

LaC—Landman loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands and foot slopes. Areas are elongated. They range from 30 to 200 acres in size. Slopes average about 3 percent.

Typically, the surface layer is very strongly acid, grayish brown loamy fine sand about 8 inches thick. The subsurface layer, from a depth of 8 to 65 inches, is very pale brown loamy fine sand that has yellowish brown mottles. It is slightly acid in the upper part and moderately acid in the lower part. The subsoil extends to a depth of 90 inches. It is very strongly acid. From a depth of 65 to 69 inches, it is mottled light brownish gray and yellowish brown sandy clay loam; from a depth of 69 to 75 inches, it is light brownish gray clay that has dark red and yellowish brown mottles; from a depth of 75 to 83 inches, it is light brownish gray sandy clay loam that has dark red mottles; and from a depth of 83 to 90 inches, it is grayish brown clay that has yellowish brown mottles.

This soil is moderately well drained. Surface runoff is very slow. A perched water table is at a depth of 4 to 6 feet during the winter and spring. Permeability is rapid in the surface layer and subsurface layer and moderately slow in the subsoil, and the available water capacity is low. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Boy, Conroe, Depcor, and Fetzer soils. Included soils make up less than 15 percent of the map unit.

The Landman soil is used as woodland or pasture. It is well suited to pines and hardwoods. The use of equipment for planting and harvesting is moderately limited because of the sandy texture and seasonal wetness. The sandy texture also is a limitation affecting seedling mortality. The dominant trees include loblolly pine and shortleaf pine. Trees are harvested for sawlogs and pulpwood.

This soil is well suited to pasture. Improved bermudagrass, weeping lovegrass, and bahiagrass are adapted grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, peanuts, watermelons, and truck crops are well suited to this soil. Minimizing tillage and leaving crop residue on the surface helps to control erosion.

This soil produces a high amount of native grass forage. Most areas have a dense canopy of pines and hardwoods. Forage production is low in these areas. Good management practices include thinning the trees, proper stocking rates, and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The sandy texture, the seasonal wetness, and seepage are the main limitations. Cutbanks of excavations are subject to caving.

This soil is in capability subclass IIIs, and the woodland ordination symbol is 9S.

LtD—Latium clay, 5 to 8 percent slopes. This very deep, moderately sloping soil is in eroded areas on uplands. Areas range from 10 to 100 acres in size. Slopes average about 6 percent.

Typically, the surface layer is dark gray clay about 4 inches thick. The upper part of the subsoil, from a depth of 4 to 35 inches, is grayish brown clay. The lower part, from a depth of 35 to 60 inches, is olive gray clay. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is high. The hazard of erosion is severe.

Included with this soil in mapping are areas of Brenham, Carbengle, Frelsburg, Knolle, and Renish soils and a few areas of the strongly sloping and eroded Latium soils. Also included are a few gullies. Included areas make up less than 20 percent of the map unit.

This Latium soil is used mainly as range or pasture.

This soil is well suited to pasture. Improved bermudagrass and kleingrass are suitable grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Forage sorghum, grain sorghum, and small grain are suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Terraces and contour farming help to control runoff and erosion. Grassed waterways and minimum tillage help to control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include

proper stocking rates, controlled grazing, and weed and brush control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential and the very slow permeability.

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

LtD3—Latium clay, 4 to 12 percent slopes, severely eroded. This very deep, strongly sloping soil is in eroded areas on uplands that have rills and gullies. Areas are linear and are parallel to the contour of the landscape. They range from 5 to 100 acres in size. Slopes average about 10 percent.

Typically, the surface layer is grayish brown clay about 4 inches thick. The upper part of the subsoil, from a depth of 4 to 22 inches, is dark grayish brown clay that has black streaks. The lower part, from a depth of 22 to 48 inches, is light olive brown clay that has dark gray streaks. The underlying material, from a depth of 48 to 70 inches, is light olive brown clay that has light gray mottles. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Surface runoff is rapid. Permeability is very slow, and the available water capacity is high. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Brenham, Carbengle, Frelsburg, Klump, Knolle, and Renish soils. Also included along drainageways are a few gullies that are about 8 feet deep and a few gently sloping areas of Latium soils. Included areas make up less than 15 percent of the map unit.

This Latium soil is used as range or pasture.

This soil is moderately well suited to pasture. Improved bermudagrass and kleingrass are suitable grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suited to crops because of the slope and the hazard of erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, the slope, and low strength.

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

LuA—Lufkin fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil is in depressions and on broad flats on uplands and terraces. Areas are irregular in shape. They range from 5 to 100 acres in size. Slopes average 0.5 percent.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam that has a few dark brown mottles. It is about 7 inches thick. The upper part of the subsoil, from a depth of 7 to 20 inches, is dark gray, strongly acid clay. The lower part, from a depth of 20 to 62 inches, is gray, slightly acid clay. The underlying material, from a depth of 62 to 70 inches, is light brownish gray, neutral clay that has pale brown mottles.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 6 to 12 inches during the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is slight. The soil is saturated during the winter and spring. It is dry, hard, and crusty during the summer.

Included with this soil in mapping are small areas of Arol, Axtell, Chazos, Mabank, Rader, Robco, and Tabor soils. Included soils make up less than 20 percent of the map unit.

This Lufkin soil is used mainly as range or pasture.

This soil is moderately well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

Small grain and forage sorghum are moderately well suited to this soil. The soil cannot be easily tilled when dry because of the crusty surface layer. Crop residue helps to maintain the content of organic matter and tilth. A surface drainage system helps to overcome the seasonal wetness.

This soil produces a moderate amount of native grass forage. Many areas have a dense stand of hardwoods. Good management practices include thinning of trees, brush control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are wetness, the shrink-swell potential, the very slow permeability, and low strength.

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

LuB—Lufkin fine sandy loam, 1 to 3 percent slopes. This very deep, gently sloping soil is along drainageways and on broad divides on uplands and terraces. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average 2 percent.

Typically, the surface layer is grayish brown, moderately acid fine sandy loam about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 22

inches, is dark grayish brown, strongly acid clay. The next part, from a depth of 22 to 45 inches, is gray, moderately acid clay. The lower part, from a depth of 45 to 60 inches, is light brownish gray, neutral clay that has common fine faint pale brown mottles. The underlying material, from a depth of 60 to 80 inches, is light brownish gray, neutral clay loam.

This soil is somewhat poorly drained. Surface runoff is medium. A perched water table is at a depth of 6 to 12 inches during the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion also is moderate. The soil is saturated during the winter and spring. It is dry, hard, and crusty during the summer.

Included with this soil in mapping are small areas of Arol, Axtell, Chazos, Falba, Mabank, Robco, and Tabor soils. Also included are a few areas of a soil that is similar to the Lufkin soil but is more sloping. Included soils make up less than 15 percent of the map unit.

This Lufkin soil is used as range or pasture. Some areas support small grain or forage sorghum.

This soil is moderately well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to small grain or forage sorghum. Leaving crop residue on the surface helps to control erosion and maintain tilth and the content of organic matter.

This soil produces a moderate amount of native grass forage. Many areas have a dense stand of hardwoods. Good management practices include brush control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, wetness, and low strength.

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

LxB—Lufkin-Rader complex, gently undulating. These deep, gently undulating soils are on terraces and upland foot slopes and flats. Areas are elongated and are parallel to the contour of the landscape. They range from 10 to 400 acres in size. Slopes range from 0 to 5 percent but are mostly 1 to 2 percent.

The unit is 55 percent Lufkin soil, 25 percent Rader soil, and 20 percent other soils. The Rader soil is on mounds that are 1 to 3 feet higher than the Lufkin soil. These soils occur as areas so intricately mixed that separating in mapping is not practical.

Typically, the Lufkin soil has a surface layer of grayish brown, slightly acid fine sandy loam about 10 inches thick. The upper part of the subsoil, from a depth of 10 to 24 inches, is dark gray, strongly acid clay. The next part, from a depth of 24 to 45 inches, is gray, slightly acid clay. The lower part, from a depth of 45 to 60 inches, is light brownish gray, neutral clay that has pale brown mottles. The underlying material, from a depth of 60 to 80 inches, is light brownish gray, neutral clay loam.

The Lufkin soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 6 to 12 inches during the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is slight. The soil is saturated during the winter and spring. It is dry, hard, and crusty during the summer.

Typically, the Rader soil has a surface layer of brown, moderately acid fine sandy loam about 6 inches thick. The subsurface layer, from a depth of 6 to 25 inches, is light gray, moderately acid fine sandy loam. The upper part of the subsoil, from a depth of 25 to 35 inches, is light yellowish brown, strongly acid sandy clay loam that has vertical stripes of light gray fine sandy loam. The lower part, from a depth of 35 to 60 inches, is light gray, slightly acid clay that has brownish mottles.

The Rader soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 2 to 5 feet during the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is slight.

Included with these soils in mapping are small areas of Axtell, Chazos, Mabank, Robco, Tabor, Zack, and Zulch soils.

The Lufkin and Rader soils are used mainly as range or pasture.

These soils are suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

These soils are moderately well suited to crops. Small grain, forage sorghum, and ryegrass are suitable crops. These soils are difficult to work because of wetness and a surface that is crusty and hard when dry. Crop residue helps to maintain the content of organic matter and tilth.

These soils produce a moderate amount of native grass forage. Many areas have a dense stand of hardwoods. Good management practices include brush control, proper stocking rates, and controlled grazing.

These soils are poorly suited to urban and recreational uses. The main limitations are the seasonal

wetness, the shrink-swell potential, the very slow permeability, and low strength.

These soils are in capability subclass IIIe. The Lufkin soil is in the Claypan Savannah range site. The Rader soil is in the Sandy Loam range site.

MaA—Mabank fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil is on broad flats on uplands. Areas are 20 to 300 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 40 inches, is very dark gray, moderately acid clay. The next part, from a depth of 40 to 46 inches, is very dark gray, neutral clay. The lower part, from a depth of 46 to 65 inches, is grayish brown, moderately alkaline clay. The underlying material, from a depth of 65 to 70 inches, is light gray, moderately alkaline clay.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 6 to 12 inches during the winter. Permeability is very slow, and the available water capacity is moderate. Because of the seasonal wetness, the soil cannot always be easily tilled. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Burleson, Crockett, Wilson, Zack, and Zulch soils. Included soils make up less than 15 percent of the map unit.

This Mabank soil is used as pasture, range, or cropland. The main crops are corn, small grain, and forage sorghum.

This soil is moderately well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to corn, cotton, grain sorghum, small grain, or forage sorghum. Leaving crop residue on the surface helps to maintain the content of organic matter and tilth. A surface drainage system helps to overcome the seasonal wetness.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and weed and brush control.

This soil is poorly suited to urban and recreational development. The main limitations are the shrink-swell potential, wetness, the very slow permeability, and low strength.

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

MaB—Mabank fine sandy loam, 1 to 3 percent slopes. This very deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 5 to 80 acres in size. Slopes average about 1.5 percent.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 24 inches, is very dark gray, neutral clay. The next part, from a depth of 24 to 38 inches, is grayish brown, slightly alkaline clay. The lower part, from a depth of 38 to 65 inches, is grayish brown, moderately alkaline clay that has light yellowish brown mottles.

This soil is somewhat poorly drained. Surface runoff is medium. A perched water table is at a depth of 6 to 12 inches during the winter. Permeability is very slow, and the available water capacity is moderate. Because of the clayey subsoil, the soil cannot be easily penetrated by roots. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Axtell, Burleson, Crockett, Tabor, Wilson, Zack, and Zulch soils. Also included are small areas of Mabank loam and Mabank silt loam. Included soils make up less than 20 percent of the map unit.

This Mabank soil is used as pasture, range, or cropland. The main crops are forage sorghum and small grain.

This soil is moderately well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to corn, cotton, grain sorghum, forage sorghum, and small grain. Terraces and contour farming help to control erosion. Leaving crop residue on the surface helps to maintain tilth and control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include controlled grazing and brush and weed control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the seasonal wetness, the very slow permeability, and low strength.

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

Na—Nahatche clay loam, frequently flooded. This very deep, nearly level soil is on flood plains. Flooding occurs at least once every 1 or 2 years for a few hours to several days. Most of the flooding occurs in May and September. Areas are elongated. They range from 50 to 2,000 acres in size. Slopes are 0 to 1 percent but average 0.5 percent.

Typically, the surface layer is dark grayish brown, slightly acid clay loam about 6 inches thick. The upper part of the underlying material, from a depth of 6 to 15 inches, is grayish brown, slightly acid fine sandy loam. The next part, from a depth of 15 to 32 inches, is very dark gray, slightly acid loam that has yellowish brown mottles. The lower part, from a depth of 32 to 60 inches, is grayish brown, slightly alkaline fine sandy loam.

This soil is somewhat poorly drained. Surface runoff is slow. The water table is at a depth of 6 to 18 feet during the winter and spring. Permeability and the available water capacity are moderate. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Gowker, Hatliff, and Kaman soils. Also included are small areas of a soil that is similar to the Nahatche soil but has stratified sandy layers throughout. Included soils make up less than 30 percent of the map unit.

The Nahatche soil is used mainly as native pasture or woodland. It is moderately suited to hardwoods. During most of the year, the use of equipment is severely limited by wetness and the fine texture of the soil. Seedling mortality is a moderate limitation. The dominant trees include water oak, willow oak, cottonwood, and pecan. Some trees are harvested for sawlogs.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is not suitable for cultivation because of the frequent flooding.

This soil produces a high amount of native grass forage. Good management practices include weed and brush control, proper stocking rates, and controlled grazing. Some areas have a dense stand of hardwoods. Thinning the trees increases forage production.

This soil is not suited to urban and recreational development because of the frequent flooding.

This soil is in capability subclass Vw and the Loamy Bottomland range site. The woodland ordination symbol is 6W.

NdC—Navasan loamy sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on low stream terraces along the flood plain of the Navasota River. On rare occasions flooding occurs in the lowest areas. Areas are irregular in shape. They range from 15 to 200 acres in size. Slopes average about 3 percent.

Typically, the surface layer is light brown, slightly acid loamy sand about 6 inches thick. The subsurface layer, from a depth of 6 to 65 inches, is pink, slightly acid loamy sand. The upper part of the subsoil, from a depth of 65 to 75 inches, is reddish yellow, slightly acid sandy clay loam that has about 40 percent pockets and tongues of pink loamy sand. The next part, from a depth of 75 to 85 inches, is light brown, moderately acid sandy clay loam that has reddish and brownish mottles. The lower part, from a depth of 85 to 95 inches, is light gray, moderately acid sandy clay loam that has reddish and brownish mottles.

This soil is moderately well drained. Surface runoff is slow. The water table is at a depth of 4 to 6 feet during the winter. Permeability is rapid in the surface layer and subsurface layer and moderately slow in the subsoil. The available water capacity is low. The hazard of water erosion also is low.

Included with this soil in mapping are small areas of Chazos, Gladewater, Nahatche, Padina, Rader, and Robco soils. Included soils make up less than 15 percent of the map unit.

The Navasan soil is used mainly as pasture or range. A few areas support small grain that is used mainly for grazing by wildlife.

This soil is suited to pasture. Many areas support improved bermudagrass. Improved pastures need several applications of a complete fertilizer to maintain high forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. The major limitation is an insufficient amount of moisture in the sandy surface layer. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, brush control, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations include the sandy surface layer and the flooding.

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

NoA—Norwood silt loam, 0 to 1 percent slopes. This very deep, nearly level soil is along the slightly convex flood plain of the Brazos River. Flooding occurs about once every 20 years. Areas are elongated. They range from 10 to 200 acres in size. Slopes average about 0.3 percent.

Typically, the surface layer is reddish brown silt loam about 18 inches thick. The underlying material extends to a depth of 85 inches. From a depth of 18 to 28

inches, it is reddish brown silt loam; from a depth of 28 to 45 inches, it is dark reddish gray silt loam; from a depth of 45 to 63 inches, it is dark reddish brown silty clay loam; and from a depth of 63 to 85 inches, it is dark reddish gray silty clay loam that has thin layers of clay. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is high. The hazard of erosion is slight.

Included with this soil in mapping are areas of Brazoria and Oklared and Norwood silty clay loam. Also included is a soil that is similar to the Norwood soil but has a clayey layer at a depth of 20 to 40 inches. Included soils make up less than 20 percent of the map unit.

This Norwood soil is used mainly as pasture or cropland. Some areas are used as woodland. It is well suited to hardwoods. The dominant trees include pecan, elm, cottonwood, and green ash. Some trees are harvested for sawlogs.

This soil is well suited to pasture. Improved bermudagrass, alfalfa, and bahiagrass are adapted grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, cotton, soybeans, small grain, forage sorghum, and grain sorghum are well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and tilth.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is not suited to urban uses and most recreational uses because of the flooding.

This soil is in capability class I and the Loamy Bottomland range site. The woodland ordination symbol is 9A.

NrA—Norwood silty clay loam, 0 to 1 percent slopes. This very deep, nearly level soil is along the flood plain of the Brazos River. Flooding occurs about once every 20 years. Areas are linear along the river. They range from 20 to several hundred acres in size. Slopes average about 0.3 percent.

Typically, the surface layer is reddish brown silty clay loam about 16 inches thick. The upper part of the underlying material, from a depth of 16 to 36 inches, is reddish brown silt loam. The next part, from a depth of 36 to 52 inches, is light reddish brown stratified silt loam and very fine sandy loam. The lower part, from a depth of 52 to 72 inches, is stratified dark reddish brown silty clay loam and clay. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep. The soil is easily penetrated by roots. The hazard of erosion is slight.

Included in some areas of this soil are small areas of Brazoria and Oklared soils and Norwood silt loam. Also included is a soil that is similar to the Norwood soil but is clayey below a depth of 20 inches. Included soils make up less than 20 percent of the map unit.

This soil is used as cropland or pasture. Corn, grain sorghum, and truck crops grow well in areas of this soil. Some areas are wooded. They are well suited to pecan, green ash, elm, and cottonwood. Some trees are harvested for sawlogs.

This soil is well suited to pasture. Improved bermudagrass, alfalfa, and bahiagrass are suitable species. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, cotton, soybeans, small grain, forage sorghum, and grain sorghum are well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and tilth.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is not suited to urban uses and most recreational uses because of the flooding.

This soil is in capability class I and the Loamy Bottomland range site. The woodland ordination symbol is 9A.

OkA—Oklared very fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil is along the flood plain of the Brazos River. Flooding occurs for brief periods about once every 20 to 25 years. Areas are long and narrow and are adjacent to the river. They range from 8 to 200 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is reddish brown very fine sandy loam about 16 inches thick. Below this, from a depth of 16 to 73 inches, is reddish brown very fine sandy loam that has strata of loamy fine sand and silt loam. The underlying material, from a depth of 73 to 95 inches, is dark reddish gray silt loam that has thin strata of silty clay. The soil is moderately alkaline and calcareous throughout.

This soil is well drained. Surface runoff is slow. The water table is at a depth of 3.5 to 5.0 feet during the

spring. Permeability is moderately rapid, and the available water capacity is moderate. The root zone is deep, and the soil can be easily penetrated by roots. The hazard of erosion is slight.

Included in some areas of this soil are small areas of Norwood and Brazoria soils. Also included is a soil that is similar to the Oklared soil but has a clayey layer below a depth of 20 inches. Included soils make up less than 20 percent of the map unit.

This Oklared soil is used as cropland or pasture. Corn, grain sorghum, and truck crops grow well in areas of this soil. Some areas are wooded. The soil is well suited to pecan, cottonwood, ash, and sycamore. Some trees are harvested as sawlogs.

This soil is well suited to pasture. Improved bermudagrass, alfalfa, and bahiagrass are adapted grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, grain sorghum, small grain, forage sorghum, soybeans, and truck crops are well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and tilth.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is not suited to urban uses and to most recreational uses because of the flooding.

This soil is in capability class I and the Loamy Bottomland range site. The woodland ordination symbol is 9A.

On—Oklared-Norwood complex, frequently flooded. These gently undulating soils are on flood plain point bars near the Brazos River. Flooding occurs at least once every 1 or 2 years. Areas are irregular in shape. They range from 30 to 400 acres in size. Slopes range from 1 to 8 percent but average about 2 percent.

This unit is 55 percent Oklared soil, 35 percent Norwood soil, and 10 percent other soils. These soils occur as areas so intricately mixed that separating in mapping is not practical.

Typically, the Oklared soil has a surface layer of dark brown very fine sandy loam about 4 inches thick. The upper part of the underlying material, from a depth of 4 to 39 inches, is light brown very fine sandy loam that has thin strata of loam and fine sandy loam. The lower part, from a depth of 39 to 60 inches, is pink very fine sandy loam that has thin strata of silt loam and fine sandy loam. The soil is moderately alkaline and calcareous throughout.

The Oklared soil is well drained. Surface runoff is slow. The water table is within a depth of 3.5 to 5.0 feet in the spring. Permeability is moderately rapid, and the available water capacity is moderate. The hazard of erosion is slight.

Typically, the Norwood soil has a surface layer of dark brown loam about 8 inches thick. The upper part of the underlying material, from a depth of 8 to 15 inches, is dark reddish brown silty clay loam. The next part, from a depth of 15 to 35 inches, is reddish brown loam. The lower part, from a depth of 35 to 60 inches, is reddish brown, stratified very fine sandy loam and silt loam. The soil is moderately alkaline and calcareous throughout.

The Norwood soil is well drained. Surface runoff is slow. Permeability is moderate, and the available water capacity is high. The hazard of erosion is slight.

Included with these soils in mapping are small areas of Brazoria soils and areas of a soil that is similar to the Oklared soil but is sandy throughout. Also included are a few small areas of poorly drained soils. Included soils make up less than 15 percent of the map unit.

The Oklared and Norwood soils are used as pasture or range. Some areas are used as woodland. They are well suited to cottonwood, pecan, and elm trees and to bermudagrass and annual grasses in the understory. Some trees are harvested for sawlogs.

These soils are well suited to pasture. Improved bermudagrass is a suitable species. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

These soils are not suited to cropland because of the flooding.

These soils produce a high amount of tall native grass forage. Many areas have dense stands of trees that need thinning to maintain forage production. Good management practices include proper stocking rates and controlled grazing.

These soils are not suited to urban and recreational uses. The main hazard is the flooding. Areas of these soils are generally near the Brazos River and are prime sites for camping, hunting, and fishing.

These soils are in capability subclass Vw and the Loamy Bottomland range site. The woodland ordination symbol is 9A.

PaD—Padina loamy fine sand, 1 to 8 percent slopes. This very deep, gently sloping or moderately sloping soil is on uplands and high terraces. Areas range from 5 to 100 acres in size. Slopes average about 3 percent.

Typically, the surface layer is light yellowish brown,

slightly alkaline loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 65 inches, is loamy fine sand. It is neutral and light yellowish brown in the upper part and grades to slightly acid and yellowish brown with strong brown mottles in the lower part. The upper part of the subsoil, from a depth of 65 to 75 inches, is slightly acid, yellowish brown sandy clay loam that has light brown and reddish yellow mottles. The lower part, from a depth of 75 to 90 inches, is strongly acid, mottled red, strong brown, and light brownish gray sandy clay loam.

This soil is well drained. Surface runoff is very slow. The soil may be saturated at a depth of 3 to 6 feet for very brief periods following heavy rainfall. Permeability is rapid in the surface layer and subsurface layer and moderately slow in the subsoil, and the available water capacity is low. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Axtell, Chazos, Robco, Silawa, and Silstid soils. Also included are a few areas of Padina soils that have slopes of more than 8 percent. Included areas make up less than 15 percent of the map unit.

The Padina soil is used mainly as range or pasture.

This soil is well suited to pasture. Improved bermudagrass, weeping lovegrass, and bahiagrass are adapted grasses. Improved pastures need several light applications of a complete fertilizer to maintain high forage production. Overseeding legumes, such as arrowleaf clover, vetch and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Forage sorghum, small grain, peanuts, watermelons, and truck crops are suited to this soil. Minimum tillage and residue kept on the surface helps to control water erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation increases plant vigor and production.

This soil is moderately well suited to urban and recreational uses. The main limitations are the caving of cutbanks, the slope, and the sandy surface layer.

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

Pt—Pits. This map unit consists of areas where the soils, and often the underlying strata, have been removed and used as topsoil, gravel, rock, or fill material for roadbases or embankments.

Most pits are 5 to 20 feet deep and have vertical walls. These pits were dug to excavate sandstone or siltstone bedrock to be used as roadbase. Some of the pits resulted from the removal of clayey material for road construction or embankments. Many of these pits are filled with varying amounts of water. Pits are identified as bodies of water on the soil maps at the back of this survey in areas where the pit is filled with water throughout the year. Some areas identified as pits have had only the surface layer removed. These areas can be reclaimed. Reclamation of the larger pits is more difficult because little soil material is available to use in the reclamation.

Vegetation is sparse. Scattered clumps of grass and weeds are in areas that have a thin layer of soil.

No capability subclass, range site, or woodland ordination symbol is assigned.

RaA—Rader fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil in on uplands and ancient stream terraces. Areas are irregular in shape. They range from 10 to 500 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is dark grayish brown, fine sandy loam about 4 inches thick. The subsurface layer, from a depth of 4 to 12 inches, is grayish brown fine sandy loam. The upper part of the subsoil, from a depth of 12 to 21 inches, is light yellowish brown sandy clay loam that has light gray and very pale brown mottles. The next part, from a depth of 21 to 46 inches, is light gray clay that has yellowish red mottles. The lower part, from a depth of 46 to 72 inches, is light gray clay that has yellowish brown mottles. The surface layer and subsurface layer are slightly acid, and the subsoil is very strongly acid.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 2 to 5 feet during the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Axtell, Chazos, Lufkin, Mabank, Robco, and Tabor soils. Also included are small areas that are ponded in wet seasons. Included soils make up less than 20 percent of the map unit.

This Rader soil is used as range, pasture, or cropland.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, peanuts, soybeans, cotton, forage sorghum, small grain, and grain sorghum are moderately well suited to this soil. A surface drainage system helps to overcome the seasonal wetness. Leaving crop residue on the surface helps to maintain the content of organic matter and tilth.

This soil produces a moderate amount of native

grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The main limitations are the seasonal wetness, the moderate shrink-swell potential, and low strength.

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

RaB—Rader fine sandy loam, 1 to 3 percent slopes. This very deep, gently sloping soil is on uplands and ancient stream terraces. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 2 percent.

Typically, the surface layer is yellowish brown, slightly acid fine sandy loam about 6 inches thick. The subsurface layer, from a depth of 6 to 16 inches, is light yellowish brown, slightly acid fine sandy loam. The upper part of the subsoil, from a depth of 16 to 23 inches, is light brownish gray, slightly acid sandy clay loam that has light yellowish brown mottles. The next part, from a depth of 23 to 45 inches, is grayish brown, slightly acid clay that has ½-inch wide tongues of subsurface material. The lower part, from a depth of 45 to 66 inches, is grayish brown, very strongly acid clay.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 2 to 5 feet during the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Chazos, Lufkin, Mabank, Robco, and Wilson soils. Included soils make up less than 20 percent of the map unit.

This Rader soil is used as pasture, range, or cropland.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, peanuts, cotton, soybeans, small grain, forage sorghum, and grain sorghum are moderately well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and maintain tilth.

This soil produces a high amount of native grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The shrink-swell potential, wetness, and low strength are limitations.

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

ReF—Renish-Rock outcrop complex, 8 to 20 percent slopes. This rolling to hilly map unit is on upland ridges and breaks. Areas are irregular in shape. They range from 5 to 50 acres in size. Slopes average about 10 percent.

The unit is 40 percent Renish soil, 30 percent Rock outcrop, and 30 percent other soils. This soil and the areas of Rock outcrop are so intricately mixed that separating in mapping is not practical.

Typically, the Renish soil has a surface layer of very dark grayish brown, moderately alkaline loam and gravelly loam about 14 inches thick. The underlying material, from a depth of 14 to 40 inches, is calcareous, moderately alkaline sandstone bedrock.

The Renish soil is well drained. Surface runoff is rapid. Permeability is moderate, and the available water capacity is very low. The hazard of erosion is severe.

Typically, the Rock outcrop consists of areas along slopes where white, calcareous sandstone bedrock is exposed.

Included with this unit in mapping are small areas of Brenham, Carbengle, Cuero, Frelsburg, Klump, and Latium soils. Also included is a soil that is similar to the Renish soil but has more than 30 percent rock fragments in the surface layer.

This unit is used mainly as range. It is valuable as a source of rock for roadbase in the county.

This unit is not suited to pasture or cropland because of the rocks and stones and the slope.

This unit produces a low amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and brush and weed control.

This unit is not suited to urban and recreational development. The main limitations are the depth to bedrock and the slope.

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

RoC—Robco loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil in on broad upland foot slopes. Areas are irregular in shape. They range from 20 to 400 acres in size. Slopes average about 2 percent.

Typically, the surface layer is slightly acid, dark brown loamy fine sand about 5 inches thick. The subsurface layer, from a depth of 5 to 25 inches, is moderately acid, yellowish brown loamy fine sand. The subsoil extends to a depth of 75 inches. It is strongly acid. From a depth of 25 to 30 inches, it is yellowish

brown sandy clay loam; from a depth of 30 to 50 inches, it is mottled yellowish brown, red, and grayish brown clay loam; from a depth of 50 to 65 inches, it is grayish brown clay loam; and from a depth of 65 to 75 inches, it is light brownish gray clay loam.

This soil is moderately well drained. Surface runoff is slow. A perched water table is at a depth of 1.5 to 3.5 feet during the winter. Permeability is rapid in the surface layer and subsurface layer and slow in the subsoil, and the available water capacity is moderate. The hazard of water erosion also is moderate.

Included with this soil in mapping are small areas of Axtell, Chazos, Padina, Rader, and Silstid soils. Included in some areas is a soil that is similar to the Robco soil but has a surface layer that is thinner. Included soils make up less than 15 percent of the map unit.

This Robco soil is used as range, pasture, or cropland.

This soil is well suited to pasture. Improved bermudagrass, weeping lovegrass, and bahiagrass are adapted grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, peanuts, cotton, grain sorghum, small grain, truck crops, and forage sorghum are moderately well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Minimum tillage helps to control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include brush control, controlled grazing, proper stocking rates, and brush and weed control.

This soil is poorly suited to urban and recreational uses. The main limitations are wetness, the slow permeability, the sandy surface layer, and the shrink-swell potential.

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

RoD—Robco loamy fine sand, 5 to 8 percent slopes. This very deep, moderately sloping soil is on uplands. Areas are elongated. They range from 5 to 100 acres in size. Slopes average about 6 percent.

Typically, the surface layer is brown loamy fine sand about 6 inches thick. The subsurface layer, from a depth of 6 to 21 inches, is loamy fine sand that is pale brown in the upper part and very pale brown in the lower part. The subsoil, from a depth of 21 to 74 inches, is clay loam. It is grayish brown in the upper part, light brownish gray in the next part, and gray in the lower part. Brownish and reddish mottles occur throughout. The surface layer and subsurface layer are moderately acid, and the subsoil is strongly acid.

This soil is moderately well drained. Surface runoff is medium. A perched water table is at a depth of 1.5 to 3.5 feet during the winter. Permeability is rapid in the surface layer and subsurface layer and slow in the subsoil, and the available water capacity is moderate. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Axtell, Chazos, Padina, and Silstid soils. Also included are small areas of the gently sloping Robco soils. Included soils make up less than 15 percent of the map unit.

This Robco soil is used as range, pasture, or wildlife habitat. Some areas have a few pine trees, but the vegetation is mostly post oak. A few trees are harvested for sawlogs.

This soil is well suited to pasture. Improved bermudagrass, weeping lovegrass, and bahiagrass are adapted grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to small grain or forage sorghum. Leaving crop residue on the surface helps to control erosion and maintain the content of organic matter. Minimum tillage helps to control erosion.

This soil produces a moderate amount of forage. Good management practices include brush control, weed control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations include wetness, the slow permeability, the slope, and the shrink-swell potential.

This soil is in capability unit IVe and the Sandy range site.

SaC—Shalba fine sandy loam, 1 to 5 percent slopes. This shallow, gently sloping soil is on uplands. Areas are irregular in shape. They range from 10 to 200 acres in size. Slopes average about 2 percent.

Typically, the surface layer is grayish brown, moderately acid fine sandy loam about 3 inches thick. The subsoil, from a depth of 3 to 14 inches, is dark grayish brown, moderately acid clay. The underlying material, from a depth of 14 to 40 inches, is light brownish gray, slightly acid tuffaceous sandstone bedrock.

This soil is moderately well drained. Surface runoff is medium. A perched water table is at a depth of 12 to 18

inches during the winter and spring. Permeability is very slow, and the available water capacity is very low. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Arol, Burlewash, Falba, and Greenvine soils and small areas of rock outcrop. Included areas make up as much as 15 percent of the map unit.

This Shalba soil is used mostly as range. It is poorly suited to pasture and unsuited to crops because of the shallow rooting depth and the very low available water capacity. A few areas support improved bermudagrass, but yields are low. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil produces a moderate amount of forage. Good management practices include controlled grazing, proper stocking rates, and brush and weed control.

This soil is poorly suited to urban and recreational uses. The depth to bedrock and the seasonal wetness are the major limitations.

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

SbC—Shalba-Rock outcrop complex, 1 to 5 percent slopes. This map unit consists of gently sloping, shallow soils and areas of Rock outcrop on uplands. Areas range from 8 to 25 acres in size. Slopes average about 4 percent.

The unit is 45 percent Shalba soil, 35 percent Rock outcrop and rock that is covered by a thin layer of fine sandy loam, and 20 percent other soils. This soil and the areas of Rock outcrop are so intricately mixed that separating in mapping is not practical.

Typically, the Shalba soil has a surface layer of very dark gray, moderately acid fine sandy loam about 3 inches thick. The subsoil, from a depth of 3 to 18 inches, is mixed very dark gray and dark grayish brown, strongly acid clay. The underlying material, from a depth of 18 to 40 inches, is clayey tuff.

The Shalba soil is moderately well drained. Surface runoff is medium. A perched water table in the clayey subsoil saturates the surface layer during rainy periods. Permeability is very slow. The hazard of erosion is severe.

Typically, the Rock outcrop is light gray clayey tuff. In places the rock is covered by 3 or more inches of fine sandy loam.

Included with this unit in mapping are small areas of Arol, Falba, Greenvine, and Shiro soils. Also included are small areas of a soil that is similar to the Shalba soil but is less than 10 inches deep over clayey tuff.

This unit is used mainly as range. It also is used as a source of rock for roadbase.

This unit is not suited to pasture or cropland because of the areas of Rock outcrop and the depth to clayey tuff.

This unit produces a low amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and brush and weed control.

This unit is poorly suited to urban and recreational development because of the areas of Rock outcrop.

This unit is in capability subclass VIIs and the Claypan Savannah range site.

ShC—Shiro loamy fine sand, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Areas are round. They range from 10 to 50 acres in size. Slopes average about 3 percent.

Typically, the surface layer is pinkish gray, moderately acid loamy fine sand about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 18 inches, is yellowish red, very strongly acid clay. The lower part, from a depth of 18 to 31 inches, is light gray, very strongly acid clay that has red mottles. The underlying material, from a depth of 31 to 40 inches, is white, very strongly acid, weakly cemented sandstone bedrock.

This soil is moderately well drained. Surface runoff is slow. Permeability is slow, and the available water capacity is low. The hazard of water erosion is severe.

Included with this soil in mapping are small areas of Arol, Elmina, Falba, Koether, Singleton, and Tonkavar soils. Included soils make up less than 15 percent of the map unit.

This Shiro soil is used mainly as pasture or range. It is moderately suited to pines and hardwoods. Some areas have been invaded by pine forests. The use of equipment is moderately limited by the clayey subsoil and wetness. Seedling mortality and erosion also are moderate limitations. The dominant trees are post oak and some loblolly pine and shortleaf pine. Some trees are harvested for sawlogs.

This soil is well suited to pasture. Many areas support improved bermudagrass or bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is well suited to peanuts, small grain, or forage sorghum. Crop residue helps to maintain the content of organic matter and control erosion.

This soil produces a moderate amount of native

grass forage. Good management practices include proper stocking rates, brush and weed control, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential and low strength. The depth to sandstone affects the construction of urban structures.

This soil is in capability subclass IIIe and the Sandy Loam range site. The woodland ordination symbol is 6C.

ShD—Shiro loamy fine sand, 5 to 8 percent slopes. This moderately deep, moderately sloping soil is on upland breaks. Areas range from 10 to 130 acres in size. Slopes average about 6 percent.

Typically, the surface layer is moderately acid loamy fine sand about 10 inches thick. It is dark grayish brown in the upper part and pale brown in the lower part. The subsoil extends to a depth of 35 inches. The upper part is brown, strongly acid clay, and the lower part is gray, very strongly acid clay that has brownish yellow and dark red mottles. The underlying material, from a depth of 35 to 50 inches, is grayish brown, extremely acid interbedded tuffaceous sandstone bedrock and shale that has strong brown mottles.

This soil is moderately well drained. Surface runoff is slow. Permeability is also slow, and the available water capacity is low. The hazard of erosion is severe.

Included with this soil in mapping are Arol, Elmina, Falba, Koether, Shalba, Singleton, and Tonkavar soils. Included soils make up less than 15 percent of the mapped area.

This Shiro soil is used mainly as pasture or range. Some areas have been invaded by pine trees and are used as woodland. The soil is moderately suited to post oak, loblolly pine, and shortleaf pine. Trees are harvested for sawlogs and pulpwood. The use of equipment is moderately limited by the clayey subsoil and wetness. Seedling mortality and erosion are also moderate limitations.

This soil is well suited to pasture. Many areas support improved bermudagrass or bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the slope and the hazard of erosion.

This soil produces a moderate amount of forage. Good management practices include brush and weed control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential and low strength. The depth to sandstone affects the construction of urban structures.

This soil is in capability subclass IVe and the Sandy Loam range site. The woodland ordination symbol is 6C.

SlC—Silawa loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil in on slope breaks of ancient stream terraces. Areas are elongated. They range from 5 to 50 acres in size. Slopes average about 4 percent.

Typically, the surface layer is brown, loamy fine sand about 15 inches thick. The upper part of the subsoil, from a depth of 15 to 28 inches, is red sandy clay loam. The next part, from a depth of 28 to 40 inches, is yellowish red sandy clay loam. The lower part, from a depth of 40 to 48 inches, is strong brown fine sandy loam. The underlying material, from a depth of 48 to 65 inches, is reddish yellow loamy fine sand. The soil is strongly acid throughout.

This soil is well drained. Surface runoff is slow. Permeability, the available water capacity, and the hazard of erosion are moderate.

Included with this soil in mapping are small areas of Axtell, Chazos, Padina, Robco, Silstid, and Tabor soils. Also included is a soil that is similar to the Silawa soil has a subsoil that is more clayey. Also included are small areas of the more sloping Silawa soils. Included soils make up less than 20 percent of the map unit.

This Silawa soil is used as pasture, range, or cropland.

This soil is well suited to pasture. Improved bermudagrass, bahiagrass, and weeping lovegrass are adapted grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, peanuts, cotton, small grain, forage sorghum, grain sorghum, and truck crops are moderately suited to this soil. The soil also is suited to fruit orchards. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Minimum tillage helps to control erosion.

This soil produces a high amount of forage. Good management practices include brush and weed control, proper stocking rates, and controlled grazing.

This soil is well suited to recreational and urban uses. The slope is a limitation on sites for playgrounds.

This soil is in capability subclass IIIe and the Loamy Sand range site.

SlD—Silawa loamy fine sand, 5 to 8 percent slopes. This very deep, moderately sloping soil is on ridges and slope breaks of ancient stream terraces. Areas are elongated. They range from 5 to 50 acres in size. Slopes average about 7 percent.

Typically, the surface layer is slightly acid, brown loamy fine sand about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 20 inches, is very strongly acid, yellowish red sandy clay loam. The lower part, from a depth of 20 to 55 inches, is strongly acid, yellowish red sandy clay loam. The underlying material, from a depth of 55 to 80 inches, is moderately acid, yellowish red fine sandy loam.

This soil is well drained. Surface runoff is medium. Permeability and the available water capacity are moderate.

Included with this soil in mapping are small areas of Axtell, Chazos, Knolle, Robco, Silstid, and Tabor soils. Also included is a soil that is similar to the Silawa soil but has a subsoil that is more clayey. Also included are small areas of Silawa soils where much of the original surface layer has been removed for construction purposes. Included soils make up about 20 percent of the map unit.

This Silawa soil is used as pasture, range, or wildlife habitat. Some areas are used as cropland.

This soil is well suited to pasture. Improved bermudagrass, bahiagrass, and weeping lovegrass are adapted grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to small grain or forage sorghum. It also is suited to fruit orchards. Leaving crop residue on the surface helps to control erosion and maintain the content of organic matter. Minimum tillage helps to control erosion.

This soil produces a moderate amount of forage. Good management practices include brush and weed control, controlled grazing, and proper stocking rates.

This soil is moderately well suited to urban and recreational uses. The main limitation is the slope.

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

SmC—Silstid loamy fine sand, 1 to 5 percent slopes. This very deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 5 to 50 acres in size. Slopes average about 3 percent.

Typically, the surface layer is pale brown loamy fine sand about 4 inches thick. The subsurface layer, from a depth of 4 to 35 inches, is light brown loamy fine sand. The upper part of the subsoil, from a depth of 35 to 47 inches, is reddish yellow sandy clay loam that has red mottles. The next part, from a depth of 47 to 54 inches, is yellowish brown sandy clay loam that has red mottles. The lower part, from a depth of 54 to 80 inches, is yellowish red sandy clay loam. The soil is neutral in the surface layer and grades to strongly acid in the lower part of the subsoil.

This soil is well drained. Surface runoff is slow. Permeability is rapid in the surface layer and subsurface layer and moderate in the subsoil, and the available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Axtell, Chazos, Padina, Robco, and Tabor soils. Included soils make up less than 15 percent of the map unit.

This Silstid soil is used mainly as pasture or range. A few areas are used as cropland. The main crop grown in these areas is watermelons.

This soil is well suited to pasture. Some areas support improved bermudagrass and bahiagrass. Improved pastures need several light applications of a complete fertilizer to maintain high forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to crops. Suitable crops are corn, forage sorghum, and truck crops. Leaving crop residue on the surface helps to maintain the content of organic matter and control soil erosion. Minimum tillage helps to control erosion.

This soil produces a high amount of forage. A grazing system that includes pasture rotation increases plant vigor and production. Good management practices include proper stocking rates and weed and brush control.

This soil is moderately well suited to urban and recreational uses. The sandy surface layer and seepage are the major limitations.

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

SmD—Silstid loamy fine sand, 5 to 8 percent slopes. This very deep, moderately sloping soil is on uplands. Areas are irregular in shape. They range from 6 to 20 acres in size.

Typically, the surface layer is brown, neutral loamy fine sand about 10 inches thick. The subsurface layer, from a depth of 10 to 32 inches, is slightly acid, brown loamy fine sand. The upper part of the subsoil, from a depth of 32 to 52 inches, is moderately acid, strong

brown sandy clay loam. The lower part, from a depth of 52 to 60 inches, is moderately acid, yellowish red sandy clay loam.

This soil is well drained. Surface runoff is slow. Permeability is rapid in the surface and subsurface layer and moderate in the subsoil, and the available water capacity is moderate. The hazard of erosion also is moderate.

Included with this soil in mapping are small areas of Axtell, Chazos, Padina, Robco, and Tabor soils.

This Silstid soil is used mainly as pasture or range. A few areas are used as cropland. The main crop grown in these areas is watermelons.

This soil is well suited to pasture. Some areas support bermudagrass and bahiagrass. Improved pastures need several light applications of a complete fertilizer to maintain high forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to crops. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion.

This soil is well suited to range. A controlled grazing system helps to increase forage production and plant vigor. Good management practices include brush and weed control, proper stocking rates, and controlled grazing.

This soil is moderately well suited to urban and recreational uses. The sandy surface layer, the slope, and seepage are limitations.

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

SnA—Singleton fine sandy loam, 0 to 1 percent slopes. This moderately deep, nearly level soil is on uplands. Areas are irregular in shape. They range from 10 to 50 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is grayish brown fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 21 inches, is grayish brown clay. The lower part, from a depth of 21 to 35 inches, is light gray clay that has brown in the interior of the peds. White sandstone bedrock is at a depth of 35 to more than 60 inches. The soil is slightly acid in the surface layer, very strongly acid in the subsoil, and moderately alkaline in the underlying material.

This soil is moderately well drained. Surface runoff is slow. The water table is within a depth of 12 inches for short periods during the winter and spring. Permeability is very slow, and the available water capacity is low. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is moderate. The soil is droughty in the summer and wet in the winter.

Included with this soil in mapping are small areas of Arol, Burlewash, Elmina, Falba, Koether, and Shiro soils. Also included are a few small eroded areas. Included soils make up less than 15 percent of the map unit.

This Singleton soil is used mainly as range or pasture. A few areas are used as cropland. The main crops grown in these areas are small grain and forage sorghum. Some areas are used as woodland. The soil is moderately suited to post oak but poorly suited to loblolly pine and shortleaf pine. The seedling mortality rate is high because of the low available water capacity.

This soil is moderately well suited to pasture. Some areas support common bermudagrass and improved bermudagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility. The soil is wet during the winter and droughty during the summer. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production.

This soil is poorly suited to crops. Some areas support forage sorghum used for hay and small grain used for winter grazing. The soil is wet and difficult to work during the winter. it is droughty during the summer. Leaving crop residue on the surface helps to maintain the content of organic matter, control soil erosion, and conserve moisture during the summer.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation and deferred grazing increases plant vigor and production. Good management practices include proper stocking rates, controlled grazing, and brush and weed control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential and low strength.

This soil is in capability subclass IIIw and the Claypan Savannah range site. The woodland ordination symbol is 5W.

SnC—Singleton fine sandy loam, 1 to 5 percent slopes. This moderately deep, gently sloping soil is on uplands. Areas are irregular in shape. They range from 5 to 200 acres in size. Slopes average about 2 percent.

Typically, the surface layer is light brownish gray, strongly acid fine sandy loam about 5 inches thick. The subsurface layer, from a depth of 5 to 9 inches, is pale brown, strongly acid fine sandy loam. The upper part of the subsoil, from a depth of 9 to 20 inches, is dark grayish brown, very strongly acid clay that has dark brown in the interior of the peds. The next part, from a

depth of 20 to 32 inches, is grayish brown, very strongly acid clay that has brown in the interior of the peds. The lower part, from a depth of 32 to 38 inches, is brown, moderately acid clay loam. The underlying material, from a depth of 38 to 60 inches, is light gray, moderately acid, weakly cemented sandstone bedrock.

This soil is moderately well drained. Surface runoff is medium. The water table is within a depth of 12 inches for brief periods during the winter and spring. Permeability is very slow, and the available water capacity is low. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe. The soil is droughty during the summer.

Included with this soil in mapping are small areas of Arol, Burlewash, Elmina, Falba, Koether, and Shiro soils and small areas that are eroded or gullied. Included areas make up less than 20 percent of the map unit.

This Singleton soil is used mainly as pasture or range. A few small areas support crops. The soil is moderately suited to post oak but poorly suited to loblolly pine and shortleaf pine. The seedling mortality rate is high because of the low available water capacity. Some trees are harvested as sawlogs.

This soil is moderately well suited to pasture. Many areas support improved bermudagrass or bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility. The soil is wet during the winter and droughty during the summer.

This soil is poorly suited to crops. Some areas support forage sorghum used for hay and small grain used for winter grazing. The main limitations are the low available water capacity and the hazard of erosion.

This soil produces a moderate amount of forage. Good management practices include controlled grazing, proper stocking rates, and brush and weed control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential and low strength.

This soil is in capability subclass IVe and the Claypan Savannah range site. The woodland ordination symbol is 5W.

SpB—Splendora fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level to gently sloping soil is on broad uplands. Areas range from 20 to 1,000 acres in size. Slopes average about 0.8 percent.

Typically, the surface layer is fine sandy loam about 12 inches thick. It is yellowish brown and moderately acid in the upper part and light yellowish brown and strongly acid in the lower part. The upper part of the subsoil, from a depth of 12 to 30 inches, is very strongly acid, light yellowish brown sandy clay loam that has grayish and brownish mottles and interfingers of fine sandy loam. The next part, from a depth of 30 to 40 inches, is moderately acid, yellowish brown sandy clay loam that has brittle bodies of plinthite and tongues of fine sandy loam. The lower part, from a depth of 40 to 60 inches, is yellowish brown, moderately acid clay loam.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is at a depth of 6 to 24 inches during the winter and spring. Permeability is slow, and the available water capacity is moderate. The soil is difficult to work during periods of seasonal wetness. The hazard of erosion is slight.

Included with this soil in mapping ar small areas of Boy, Depcor, Fetzer, and Waller soils. Also included are small depressional areas that are ponded most of the time. Included areas make up less than 15 percent of the map unit.

The Splendora soil is used as pasture or woodland. It is well suited to pines and hardwoods. The wetness is a moderate limitation affecting the use of equipment, the seedling mortality rate, and plant competition. The dominant trees include loblolly pine, shortleaf pine, and water oak. Trees are harvested mainly for sawlogs.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer and lime are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is moderately well suited to corn, small grain, and forage sorghum. A surface drainage system helps to overcome the seasonal wetness. Leaving crop residue on the surface helps to maintain the content of organic matter and tilth.

This soil produces a high amount of native grass forage. Most areas currently have a dense stand of hardwoods and pines. Good management practices include thinning of trees, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational development. The main limitation is the seasonal wetness.

This soil is in capability subclass IIIe, and the woodland ordination symbol is 10W.

TaC—Tabor fine sandy loam, 1 to 5 percent slopes. This very deep, gently sloping soil is on ridges in the uplands. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 3 percent.

Typically, the surface layer is strongly acid, grayish

brown fine sandy loam about 14 inches thick. The subsoil, from a depth of 15 to 60 inches, is clay. The upper part is strongly acid and mottled brownish yellow and light brownish gray, the next part is slightly acid and light gray, and the lower part is neutral and dark grayish brown.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is high. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Axtell, Crockett, Lufkin, Rader, and Robco soils. Also included are small areas of Tabor soils that have slopes of less than 1 percent. Included soils make up less than 15 percent of the map unit.

The Tabor soil is used as pasture, range, or cropland.

This soil is well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as arrowleaf clover, crimson clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, cotton, forage sorghum, grain sorghum, small grain, and truck crops are moderately well suited to this soil. Leaving crop residue on the surface helps to maintain the content of organic matter and control erosion. Minimum tillage helps to control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include brush and weed control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, and low strength.

This soil is in capability subclass IVe and the Sandy loam range site.

Tn—Tinn clay, frequently flooded. This very deep, nearly level soil is along the flood plains of the major streams. Flooding occurs one or more times in most years for less than a week during the spring or fall. Areas are elongated. They range from 10 to more than 2,000 acres in size. Slopes are 0 to 1 percent but average about 0.3 percent.

Typically, the surface layer is black clay about 65 inches thick. From a depth of 65 to 96 inches, the soil is very dark gray clay. The soil is calcareous and moderately alkaline throughout.

This soil is somewhat poorly drained. Surface runoff is very slow. The water table is at a depth of 1.5 to 3.0 feet during the winter. Ponding occurs for a few hours following periods of rainfall. During the winter the soil is almost saturated. Water infiltrates the soil rapidly when the soil is dry and has cracks but infiltrates it very slowly when the soil is wet and does not have cracks. Permeability is very slow, and the available water capacity is high. The hazard of erosion is slight.

Included in some areas of this soil are small areas of Gowker, Hatliff, and Nahatche soils and small areas of Brazoria soils near the confluence of Beason Creek and the Brazos River. Also included in areas along stream banks is a soil that is loamy sand throughout. Included soils make up less than 15 percent of the map unit.

This soil is used as pasture, range, or wildlife habitat. A few areas support small grain or forage sorghum. Some areas are used as woodland. The soil is moderately suited to pecan, elm, cottonwood, and green ash. Some trees are harvested as sawlogs.

This soil is well suited to pasture. Improved bermudagrass and native grasses are suited to this soil. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility. Many native meadows are used for the production of hay.

This soil is not suited to cultivated crops because of the frequent flooding. Yields of most crops grown in the county are excellent; however, in areas that are protected from the flooding.

This soil produces a high amount of native grass forage. Good management practices include brush and weed control, proper stocking rates, and controlled grazing.

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

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

ToD—Tonkavar fine sand, 1 to 8 percent slopes. This very deep, gently sloping or moderately sloping soil is on ridges in the uplands. Areas are irregular in shape. They range from 10 to 200 acres in size. Slopes average about 4 percent.

Typically, the surface layer is dark grayish brown, slightly acid fine sand about 5 inches thick. The subsurface layer extends to a depth of 55 inches. It is slightly acid, light yellowish brown sand in the upper part, pale brown, slightly acid sand in the next part, and slightly acid, pale brown loamy sand in the lower part. The upper part of the subsoil, from a depth of 55 to 63 inches, is yellowish red, slightly acid sandy clay loam. The lower part, from a depth of 63 to 70 inches, is red, strongly acid sandy clay loam that has grayish brown mottles. The upper part of the underlying material, from

a depth of 70 to 78 inches, is light gray, strongly acid, weakly cemented sandstone bedrock. The lower part, from a depth of 77 to 85 inches, is yellowish red, weakly cemented sandstone bedrock.

This soil is well drained. Surface runoff is slow. A perched water table is at a depth of 4 to 6 feet for a few days during wet periods in the winter and spring. Permeability is rapid in the surface layer and subsurface layer and moderate in the subsoil. The available water capacity is low. The hazard of water erosion is slight.

Included with this soil in mapping are small areas of Burlewash, Elmina, Gomery, and Shiro soils. Also included is a soil similar to the Tonkavar soil but is sand to a depth of more than 80 inches. Included soils make up less than 20 percent of the map unit.

The Tonkavar soil is used mainly as range, pasture, or woodland. It is moderately suited to pines and hardwoods. The sandy texture is a moderate limitation affecting the use of equipment for planting and harvesting. The sandy texture and the low available water capacity are moderate limitations affecting the seedling mortality rate. Plant competition also is a problem. The dominant trees include loblolly pine and shortleaf pine. Trees are harvested mainly for sawlogs.

This soil is moderately well suited to pasture. Improved bermudagrass, weeping lovegrass, and bahiagrass are adapted species. Improved pastures need several light applications of a complete fertilizer to maintain high forage production. Overseeding legumes, such as arrowleaf clover, vetch, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops because of the low available water capacity. Watermelons and truck crops are suited to this soil. Minimum tillage and crop residue help to control erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation increases plant vigor and production. Good management practices include brush and weed control, proper stocking rates, and thinning of trees in wooded areas.

This soil is poorly suited to most urban and recreational uses because of the sandy surface layer and seepage.

This soil is in capability subclass IVs, and the woodland ordination symbol is 8S.

Wa—Waller loam, 0 to 1 percent slopes. This very deep, nearly level soil is in flat or concave depressional areas on uplands. Areas are nearly round. They range from 2 to 10 acres in size. Slopes are less than 1 percent.

Typically, the surface layer is grayish brown, moderately acid loam about 6 inches thick. The subsurface layer, from a depth of 6 to 26 inches, is light brownish gray, moderately acid loam. The upper part of the subsoil, from a depth of 26 to 45 inches, is grayish brown, moderately acid clay loam that has brown mottles. The lower part, from a depth of 45 to 65 inches, is light gray, moderately acid clay loam that has dark brown mottles.

This soil is poorly drained. Surface runoff is very slow, or the soil is ponded. Permeability is slow, and the available water capacity is high. The soil is difficult to work because of extended periods of saturation. For several weeks during the winter and spring, the soil is ponded or the water table is within a depth of 2.5 feet. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Depcor, Fetzer, and Splendora soils. Included soils make up less than 15 percent of the map unit.

The Waller soil is used as wildlife habitat, pasture, or woodland. It is poorly suited to pines and well suited to hardwoods. The wetness is a severe limitation affecting the use of equipment, the seedling mortality rate, and plant competition. The dominant trees include water oak, sweetgum, and a few pine trees. Some trees are harvested for sawlogs.

This soil is poorly suited to pasture. Improved bermudagrass and bahiagrass will grow, but most areas need drainage.

This soil is not suited to crops because of wetness. Drained areas of the soil, however, are suitable for growing crops.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates and controlled grazing.

This soil is poorly suited to urban and recreational development. The main limitations are wetness and ponding.

This soil is in capability subclass IVw, and the woodland ordination symbol is 8W.

WIA—Wilson clay loam, 0 to 1 percent slopes. This very deep, nearly level soil is on ancient terraces. Areas are irregular in shape. They range from 20 to several hundred acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is very dark gray clay loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 25 inches, is black clay. The lower part, from a depth of 25 to 60 inches, is dark gray clay that has dark grayish brown streaks. The underlying material, from a depth of 60 to 72 inches, is gray and pale brown clay. The soil is slightly acid in the upper part and grades to moderately alkaline in the lower part.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is within a depth of 1.5 feet during the winter. Permeability is very slow, and the available water capacity is high. The soil is difficult to work when it is wet or dry. It is droughty in the summer. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Bleiblerville, Burleson, Crockett, Frelsburg, Mabank, and Tabor soils. Included soils make up less than 20 percent of the map unit.

This Wilson soil is used as pasture, range, or cropland.

This soil is well suited to pasture. Improved bermudagrass and kleingrass are adapted grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, small grain, forage sorghum, soybeans, and grain sorghum are moderately well suited to this soil. Leaving crop residue on the surface helps to maintain tilth and the content of organic matter and control erosion. Bedding in the fall helps to overcome the wetness in the spring. Drainage helps to overcome the seasonal wetness.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and weed and brush control.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, and wetness.

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

WlB—Wilson clay loam, 1 to 3 percent slopes. This very deep, gently sloping soil is on ancient stream terraces. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average 2 percent.

Typically, the surface layer is very dark gray, clay loam about 8 inches thick. The upper part of the subsoil, from a depth of 8 to 27 inches, is dark gray silty clay. The next part, from a depth of 27 to 47 inches, is gray clay that has common fine faint dark gray and brown mottles. The lower part, from a depth of 47 to 61 inches, is clay mottled in shades of gray and brown. Reaction is neutral in the surface layer and grades to moderately alkaline in the subsoil.

This soil is somewhat poorly drained. Surface runoff is slow. A perched water table is within a depth of 1.5 feet during wet periods. Permeability is very slow, and the available water capacity is high. The soil is generally difficult to work because of wetness in the spring. It is saturated during much of the winter. It is droughty during the summer. The hazard of erosion is moderate.

Included with this soil in mapping are small areas of Bleiblerville, Burleson, Crockett, Frelsburg, Mabank, and Tabor soils. Included soils make up less than 20 percent of the map unit.

This Wilson soil is used as range, pasture, or cropland.

This soil is well suited to pasture. Improved bermudagrass and kleingrass are adapted grasses. Applications of nitrogen and phosphorus are needed to maintain forage production. Overseeding legumes, such as sweetclover, vetch, Berseem clover, and singletary peas, into the grasses lengthens the grazing season and improves fertility.

Corn, grain sorghum, small grain, soybeans, and forage sorghum are moderately well suited to this soil. Terraces and contour farming help to control erosion. Leaving crop residue on the surface helps to maintain tilth and the content of organic matter and control erosion.

This soil produces a moderate amount of native grass forage. Good management practices include proper stocking rates, controlled grazing, and weed and brush control.

This soil is poorly suited to urban and recreational uses. The main limitations are wetness, the shrink-swell potential, and the very slow permeability.

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

ZaC—Zack fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on uplands. It is moderately deep to siltstone bedrock. Areas are irregular in shape. They range from 10 to 200 acres in size. Slopes average about 3 percent.

Typically, the surface layer is dark brown, moderately acid fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 22 inches, is dark brown, moderately acid clay that has grayish brown mottles. The lower part, from a depth of 22 to 32 inches, is brown, slightly acid clay that has grayish brown mottles. The underlying material, from a depth of 32 to 48 inches, is pale brown, neutral siltstone bedrock.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is low. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe.

Included with this soil in mapping are small areas of Boonville, Lufkin, Mabank, Rader, Robco, Tabor, and

Zulch soils. Also included are small areas of eroded Zack soils. Included soils make up less than 15 percent of the map unit.

This Zack soil is used mainly as range or pasture. A few areas support small grain, forage sorghum, or winter pastures.

This soil is moderately well suited to pasture. Some areas support common bermudagrass, improved bermudagrass, and bahiagrass. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Some areas are farmed. Small grain, ryegrass, and forage sorghum are grown in these areas. Leaving crop residue on the surface helps to maintain the content of organic matter and control soil erosion. Terraces, minimum tillage, and contour farming help to control erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation increases production and plant vigor. Good management practices include brush and weed control.

This soil is poorly suited to urban and recreational uses. The high shrink-swell potential, the very slow permeability, and low strength are limitations.

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

ZaC2—Zack fine sandy loam, 2 to 5 percent slopes, eroded. This gently sloping soil is on uplands. It is moderately deep to mudstone bedrock. Areas are irregular in shape. They were formerly cultivated but are now used as range or pasture. Slopes average about 4 percent.

Typically, the surface layer is yellowish brown, strongly acid fine sandy loam about 4 inches thick. The upper part of the subsoil, from a depth of 4 to 14 inches, is brown, very strongly acid clay that has dark red mottles. The lower part, from a depth of 14 to 29 inches, is olive brown, moderately acid clay that has red mottles. The underlying material, from a depth of 29 to 60 inches, is light gray, moderately alkaline, thinly bedded mudstone bedrock that has a texture of clay loam.

This soil is moderately well drained. Surface runoff is medium. Permeability is very slow, and the available water capacity is low. The soil is difficult to work. Because of the clayey subsoil, the soil cannot be easily penetrated by roots, air, and water. The hazard of erosion is severe. Sheet erosion has removed more than half of the original surface layer in most areas. Rills are common, and the plow layer consists of a mixture of the original surface layer and the subsoil. A few areas have gullies that are 1 to 3 feet deep.

Included with this soil in mapping are small areas of Boonville, Lufkin, Mabank, Rader, Robco, Tabor, and Zulch soils. Also included are small areas of Zack soils that are not eroded. Included soils make up less than 15 percent of the map unit.

This Zack soil is used mainly as range or pasture. A few areas support small grain, ryegrass, or forage sorghum.

This soil is moderately well suited to pasture. Some areas support improved bermudagrass or native pasture. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to crops. Leaving crop residue on the surface helps to maintain the content of organic matter and control soil erosion. Terraces, minimum tillage, and contour farming help to control erosion.

This soil produces a moderate amount of forage. A grazing system that includes pasture rotation increases production and plant vigor.

This soil is poorly suited to urban and recreational uses. The high shrink-swell potential, the very slow permeability, and low strength are some of the properties affecting ratings.

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

ZuA—Zulch fine sandy loam, 0 to 1 percent slopes. This nearly level soil is on upland flats and in depressions. It is moderately deep to weakly cemented siltstone bedrock. Areas are irregular in shape to round. They range from 5 to 300 acres in size. Slopes average about 0.5 percent.

Typically, the surface layer is dark grayish brown, slightly acid fine sandy loam about 9 inches thick. The upper part of the subsoil, from a depth of 9 to 25 inches, is very dark grayish brown slightly acid clay. The lower part, from a depth of 25 to 39 inches, is dark grayish brown, slightly acid clay. The underlying material, from a depth of 39 to 60 inches, is light brownish gray, moderately alkaline, weakly cemented siltstone bedrock.

This soil is moderately well drained. Surface runoff is very slow. A perched water table is at a depth of 6 to 12 inches for a few days during wet periods. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is slight.

Included with this soil in mapping are small areas of Arol, Axtell, Chazos, Gredge, Lufkin, Mabank, Rader, Tabor, and Zack soils. Also included are small areas of Zulch fine sandy loam, 1 to 5 percent slopes. Included

soils make up less than 30 percent of the map unit.

This Zulch soil is used mainly as range or pasture. Some cultivated areas support winter pastures of ryegrass and small grain, and other areas support forage sorghum in the summer.

This soil is moderately well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

Small grain, ryegrass, and forage sorghum are suited to this soil. The soil cannot be easily tilled when dry because of the crusty surface layer. Crop residue helps to maintain the content of organic matter and tilth. A surface drainage system helps to overcome the seasonal wetness in some areas.

This soil produces a moderate amount of native grass forage. Some areas have a dense stand of hardwoods. Good management practices include brush control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are wetness, the shrink-swell potential, the very slow permeability, and low strength.

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

ZuC—Zulch fine sandy loam, 1 to 5 percent slopes. This gently sloping soil is on upland foot slopes and divides. It is moderately deep to weakly cemented siltstone bedrock. Areas are irregular in shape. They range from 10 to 100 acres in size. Slopes average about 2 percent.

Typically, the surface layer is dark grayish brown, moderately acid, fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 24 inches, is black, moderately acid clay. The lower part, from a depth of 24 to 35 inches, is dark grayish brown, slightly acid clay. The underlying material, from a depth of 35 to 60 inches, is grayish brown, neutral clay and weakly cemented siltstone bedrock.

This soil is moderately well drained. Surface runoff is medium. A perched water table is at a depth of 6 to 12 inches during wet periods. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion also is moderate. The soil is hard and crusty during the summer.

Included with this soil in mapping are small areas of Arol, Axtell, Chazos, Falba, Gredge, Lufkin, Tabor, and Zack soils. Also included are a few small areas of Zulch soils that have an eroded surface layer and a few small gullies along drains. Included areas make up less than 15 percent of the map unit.

This Zulch soil is used mainly as range or pasture. Some areas support small grain, ryegrass, and forage sorghum.

This soil is moderately well suited to pasture. Improved bermudagrass and bahiagrass are adapted grasses. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

Small grain, ryegrass, and forage sorghum are suited to this soil. The soil cannot be easily tilled when dry because of the crusty surface layer. Crop residue helps to maintain the content of organic matter and tilth. Terraces, contour farming, and minimum tillage help to control erosion.

This soil produces a moderate amount of native grass forage. Some areas have a dense stand of hardwoods. Good management practices include brush and weed control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, wetness, and low strength.

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

ZuC2—Zulch fine sandy loam, 1 to 5 percent slopes, eroded. This very deep, gently sloping soil is along upland divides and foot slopes. Areas are irregular in shape. They were formerly cultivated but are now used as range or pasture. They range from 10 to 50 acres in size. Slopes average about 3 percent.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam about 4 inches thick. The upper part of the subsoil, from a depth of 4 to 20 inches, is dark grayish brown, slightly acid clay. The lower part, from a depth of 20 to 36 inches, is gray, slightly acid clay. The underlying material, from a depth of 36 to 60 inches, is pale brown, moderately alkaline clay loam.

This soil is moderately well drained. Surface runoff is medium. A perched water table is at a depth of 6 to 12 inches during the winter. Permeability is very slow, and the available water capacity is moderate. The hazard of erosion is severe. Sheet erosion has removed more than half of the original surface layer in most areas. Rills are common, and the plow layer consists of a mixture of the original surface layer and the subsoil. A few areas have gullies that are 1 to 3 feet deep. The soil is hard, dry, and crusty in the summer.

Included with this soil in mapping are small areas of Arol, Axtell, Boonville, Falba, Gredge, Lufkin, Tabor, and Zack soils. Also included are a few small areas of Zulch soils that are not eroded. Included soils make up less than 15 percent of the map unit.

This Zulch soil is used mainly as range or pasture. A

few areas support small grain, ryegrass, or forage sorghum.

This soil is moderately well suited to pasture. Improved bermudagrass and bahiagrass are adapted species. Applications of a complete fertilizer are needed to maintain forage production. Overseeding legumes, such as vetch or singletary peas, into the grasses lengthens the grazing season and improves fertility.

This soil is poorly suited to small grain, ryegrass, and forage sorghum. It cannot be easily tilled because of the thin surface layer that is hard and crusty when dry. Crop residue helps to maintain the content of organic matter and tilth. Terraces, contour farming, and minimum tillage help to control erosion.

This soil produces a moderate amount of forage. Good management practices include brush and weed control, proper stocking rates, and controlled grazing.

This soil is poorly suited to urban and recreational uses. The main limitations are the shrink-swell potential, the very slow permeability, wetness, and low strength.

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

Prime Farmland

In this section, prime farmland is defined and discussed, and the soils in Grimes County that are considered prime farmland are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, State, and Federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by acceptable farming methods. The moisture supply must be adequate, and the growing season must be sufficiently long. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland, pasture, or woodland or for other purposes. They are used for food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in National forests, National parks, military reservations, and State parks.

Prime farmland soils usually receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 5 percent.

The following map units are considered prime farmland in Grimes County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. About 78,190 acres in Grimes County, or 15 percent of the total acreage, meets the soil requirements for prime farmland. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Some soils that have a high water table and all soils that are frequently flooded during the growing season qualify as prime farmland only in areas where these limitations have been overcome by drainage measures or flood control. If applicable, the need for these measures is indicated in parentheses after the map unit name in the following list. Onsite evaluation is necessary to determine if limitations have been overcome by the corrective measures.

The soils identified as prime farmland in Grimes County are:

BcA	Bleiblerville clay, 0 to 1 percent slopes
BcB	Bleiblerville clay, 1 to 3 percent slopes
BoA	Brazoria clay, 0 to 1 percent slopes
BoB	Brazoria clay, 1 to 3 percent slopes
Bp	Brazoria clay, depressional (if artificially drained)
BsA	Burleson clay, 0 to 1 percent slopes
CaC	Carbengle clay loam, 1 to 5 percent slopes
ChC	Chazos loamy fine sand, 1 to 5 percent slopes
CuC	Cuero clay loam, 1 to 5 percent slopes
FrC	Frelsburg clay, 1 to 5 percent slopes
GvC	Greenvine clay, 1 to 5 percent slopes
KlC	Klump sandy loam, 1 to 5 percent slopes
KnC	Knolle loamy sand, 1 to 5 percent slopes
NoA	Norwood silt loam, 0 to 1 percent slopes
NrA	Norwood silty clay loam, 0 to 1 percent slopes
OkA	Oklared very fine sandy loam, 0 to 1 percent slopes

RaA	Rader fine sandy loam, 0 to 1 percent slopes
RaB	Rader fine sandy loam, 1 to 3 percent slopes
SlC	Silawa loamy fine sand, 1 to 5 percent slopes
SpB	Splendora fine sandy loam, 0 to 3 percent slopes
Wa	Waller loam, 0 to 1 percent slopes (if artificially drained)

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland and woodland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Norman Bade, conservation agronomist, Natural Resources Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified and the system of land capability classification used by the Natural Resources Conservation Service is explained. The estimated yields of the main crops and hay and pasture plants are listed for each soil in table 5.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under the heading "Detailed Soil Map Units." Specific information can be obtained from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

Crops

Cropland is of minor extent and importance in Grimes County. Only about 15,000 acres in the county is currently used as cropland. About 500 of these acres are irrigated. The irrigated cropland is on bottom land that is protected from flooding. Some soils, such as the Norwood and Brazoria soils, have high potential for increased production of food. Most of the soils in the county, however, have medium to low potential for use as cropland because they are too sloping, have low natural fertility, or have very slow permeability.

The major crops grown include cotton, corn, and grain sorghum. Many small areas of cropland are associated with livestock units. These areas mainly produce sorghum, sudan, and small grain for grazing or haying.

Soil erosion is a management concern on most of the cropland in Grimes County. Erosion is a hazard on all soils that have a slope of more than 2 percent. These soils, however, may be cultivated if measures to control erosion are used.

Loss of the surface layer because of erosion decreases productivity. Productivity is reduced as erosion removes the topsoil and the subsoil is incorporated into the plow layer. This loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Crockett, Wilson, Mabank, and Chazos soils. In many sloping areas, tilling or preparing a good seedbed on clayey or hardpan soils is difficult because

erosion has removed the original, friable surface soil. Such areas are common on Frelsburg, Latium, Crockett, and Mabank soils. Erosion also results in sediments entering streams. Controlling erosion minimizes the pollution of streams by sediments and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

Erosion-control practices provide a protective surface cover, help to control runoff, and increase the rate of water infiltration. A cropping system that keeps a plant cover on the soil for long periods can hold soil erosion losses to amounts that do not reduce yields. Grasses and legumes grown on livestock farms help to control erosion on sloping soils and provide nitrogen and improve tilth for the following crop.

Minimizing tillage and leaving crop residue on the surface increase the rate of water infiltration and thus help to control runoff and erosion. Keeping crop residue on the surface also helps to protect the soil against crusting and the impact of raindrops. It also provides shade for the soil and thus reduces the soil temperature and the evaporation rate. Crop residue increases the content of organic matter and minimizes compaction caused by farm machinery. Minimizing tillage in areas planted to corn, cotton, and grain sorghum is effective in controlling erosion on sloping land. This practice is appropriate on most of the soils in the county.

Diversion terraces and field terraces reduce the length of the slope and the runoff rate. They are less suitable on soils that have an irregular slope, excessive wetness in the terrace channels, or bedrock within a depth of 40 inches.

Contour farming and terraces help to control water erosion. These practices are appropriate on most soils that have a slope of more than 1 percent. Leaving crop residue on the surface helps to control water erosion and conserve moisture.

Cover crops protect the surface after the crop has been harvested and before the next cultivated crop is planted. Examples of some of the cover crops that are suited to most of the soils in the county are small grain, vetch, and mixtures of annual grasses and legumes.

Drainage is needed in areas of soils on bottom land that are used for crops and pasture. The wetness of the Brazoria and Gladewater soils can result in lower production of crops.

Most of the crops in the county benefit from the addition of commercial fertilizer. Fertility can be maintained in areas where the proper amount and kind of fertilizer is applied and proper management is used. Fertility is naturally low in most of the soils on uplands in the county. The soils on flood plains, such as Tinn, Brazoria, Norwood, and Oklared soils, are moderately alkaline and are naturally higher in plant nutrients than most soils on uplands. The addition of organic material and fertilizer is needed on most of the soils in the uplands.

The Depcor, Elmina, and Gomery soils on uplands are very strongly acid. Applications of ground limestone can raise the pH level enough for the good growth of grasses and other crops. On all soils the amount and type of fertilizer should be based on the results of soil tests, the needs of the crop, and the expected level of yields. The Cooperative Extension Service can provide information about the kind and amount of fertilizer and lime to apply.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous. Most of the soils used for crops have a light colored surface layer and a low content of organic matter. Generally, the structure of these soils is poor and a surface crust tends to form after periods of intense rainfall. The crust is hard when dry and is nearly impervious to water. Once the crust forms, it reduces the rate of infiltration and increases the rate of runoff. Regularly adding crop residue, manure, and other organic material to the soil improves soil structure and mimimizes the formation of crusts.

Additional information about soil management practices can be obtained from the local office of the Natural Resources Conservation Service.

Pasture and Hayland

About 335,000 acres in Grimes County, or 65 percent of the total acreage, is used as pasture or hayland.

Pasture and hayland are important land uses in Grimes County because raising livestock is the major agricultural enterprise. Land used for pasture or hay is generally planted to adapted introduced grasses that respond well to good management. The species selected for pasture and hayland should be based on soil properties, such as surface texture, restrictive soil layers, and the plant-soil-moisture relationship. These soil properties may affect the potential productivity of the species planted.

Many of the grasses and legumes in Grimes County are adapted because of the wide variation of soils. The major species of adapted pasture grasses in the county are common bermudagrass, improved bermudagrass, bahiagrass, King Ranch bluestem, old world bluestem, indiangrass, kleingrass, weeping lovegrass, switchgrass, tall fescue, and Johnsongrass. The main species of adapted legumes are arrowleaf, Burseem clover, button clover, white clover, subterranean clover, lespedeza, vetch, and singletary peas.

Programs that provide year-round forage can be developed by planning land use and the kinds of forage

to be grown. Plants can be more effectively used if the potential productivity, the season of production, and the value of the plant when it is dormant are known. Legumes are often used with a warm-season grass or fescue for a more efficient forage program. Establishing a planned grazing system can increase production by providing for timely rest periods from grazing and for a more efficient harvest.

Well managed pasture requires adequate fencing to allow the rotation of grazing and the efficient harvest of forage (fig. 13). Proper use of forage ensures that plants retain vigor. In a well managed pasture, weeds are controlled, fertilizer is applied at the proper time and in the proper amount, and an adequate supply of water is available for livestock.

Good hay production requires the selection of the more productive kinds of grasses and the application of fertilizer at the correct time and in proper amounts. Forage must be cut at the proper time to provide high-quality hay, and the cutting height must be adequate to maintain plant vigor and to permit timely regrowth.

Incorporating plant selection into the planned grazing system and applying good management techniques can increase the number of areas that can be used for food, cover, and nesting for wildlife.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification also is shown the the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for woodland, and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

Class VIII soils and miscellaneous areas have

Figure 13.—An area of Chazos loamy fine sand, 1 to 5 percent slopes, where coastal bermudagrass has been cut and is being dried to the proper moisture content before being bailed for hay.

limitations that nearly preclude their use for commercial crop production.

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

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

The capability classification of each map unit is given in the section "Detailed Soil Map Units."

Rangeland

John Copeland, area plant specialist, Natural Resources Conservation Service, helped prepare this section.

In areas of rangeland the native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. Rangeland receives no regular or frequent cultural treatment. The composition and production of the plant community is determined by the soils, climate, topography, overstory canopy, and grazing management. Mnagement to conserve soil and

water and to improve production is accomplished by balancing the number of livestock with forage production and rotating livestock to allow desirable plants to improve vigor, produce seed, and establish seedlings.

About 50,000 acres in Grimes County, or 10 percent of the total acreage, is rangeland. The county has no large areas of range because most farms have been divided or because some areas are used for other purposes. Most farms, however, have some areas of range.

When Grimes County was first settled, the three types of rangeland were post oak-blackjack oak savanna; true blackland prairie of tall and mid grasses, legumes, and forbs; and bottom land along the Navasota and Brazos Rivers, having about a 40 percent canopy cover of hardwoods and underbrush. Originally, about 75 percent of the county was rangeland. Wildfire was a natural part of the rangeland ecosystem, repeatedly burning the area and controlling the spread and thickening of oaks and underbrush and increasing the extent of tall grasses, legumes, and forbs.

After settlement, a number of events affected the rangeland in the county. Most of the blackland area and some of the claypan area were plowed and planted to cotton and corn. Wildfires were suppressed. Fences were constructed, and domestic livestock were confined at very heavy stocking rates. These factors resulted in overgrazing of the tall-growing, productive grasses and led to a rapid increase in the canopy of oak and associated brush species on the claypan savanna and bottom land sites. The shade from the canopy reduced the extent of sun-loving tall grasses and increased the extent of shade-tolerant forage plants, such as longleaf uniola, and cool-season plants, such as Texas wintergrass. Plant composition on all types of rangeland changed from tall, high-quality grasses to a mixture of mid and short grasses and low-quality forbs.

Remnants of the original plant species still grow in protected areas on most rangeland. Some native meadows and areas of rangeland are managed to maintain the native species. Generally, good grazing management allows these high-quality plants to reestablish themselves.

Most local ranches and livestock farms are cow-calf operations. Some ranchers supplement their herds with stockers. These ranchers have greater flexibility in adjusting livestock numbers during periods of drought. Many horses are raised in the county. Most are ridden for pleasure, raced, or shown. Only a few are raised for ranch work.

Most livestock operations supplement native grasses with improved pasture grasses and forage produced on cropland. Grazing on native grassland is supplemented with high protein feed and hay throughout the winter. Common bermudagrass, improved bermudagrass, bahiagrass, kleingrass, and weeping lovegrass are common species used for supplemental pastures. Ryegrass and small grain also are used for supplemental winter pastures.

Forage is mainly produced on rangeland from April through October. About 60 percent of the annual growth occurs in April, May, and June when rainfall and moderate temperatures are favorable. A second period of growth usually occurs in September and October during periods of autumn rainfall and gradually cooling temperatures.

Extended droughty periods when rainfall amounts are less than three-fourths of the normal amount occur once every 5 years. Short, dry periods are common in midsummer.

Range Sites and Condition Classes

A *range site* is a distinctive kind of rangeland that produces characteristic vegetation that differs from the climax vegetation on other range sites in kind, amount, or proportion of range plants. Soils that produce about the same kinds and amounts of forage make up a range site. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

The climax vegetation on the range site is the stabilized plant community that reproduces itself and changes very little as long as the environment remains unchanged. Throughout the county the climax vegetation consists of the plants that grew in the area before settlement. The most productive combination of forage plants on a range site is generally the climax vegetation.

Decreasers are plants in the climax vegetation that 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 decreasers are reduced by close grazing. They are commonly shorter than decreasers and are less palatable to livestock.

Invaders are plants that increase in abundance as the decreasers and increasers decline. They cannot compete with the climax vegetation for moisture, nutrients, and light. They have little value for grazing.

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.

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 show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there. A range is in excellent condition if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand, in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

Table 6 shows, for nearly all soils, the range site and the potential annual production of vegetation in favorable, average, and unfavorable years. Only those soils that are suited to use as rangeland are listed.

Potential annual production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is in excellent condition. It includes the current year's growth of leaves, twigs, and fruits of woody plants, but does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

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 range management is keeping the range in excellent or good condition and thus conserving water, improving yields, and protecting the soil. The main management concern is recognizing important changes that occur in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Plant growth that occurs because of heavy rainfall can lead to the conclusion that the range is in good condition when the plant community actually has a large percentage of weeds and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods under careful supervision may have a degraded appearance that temporarily conceals its quality and ability to recover.

If range is subject to years of prolonged overuse, it loses the sources of seeds of desirable vegetation. Under these conditions, the vegetation must be reestablished before management can be effective. The condition of the range can be improved by controlling brush, range seeding, fencing, developing water sources, or applying other mechanical treatment to revitalize stands of native plants. Thereafter, deferred grazing, proper grazing use, and a planned grazing system can help to maintain or improve the range.

Good management results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs.

Thirteen range sites have been identified in Grimes County. They are Blackland, Chalky Ridge, Clayey Bottomland, Clay Loam, Claypan Savannah, Claypan Prairie, Deep Sand, Eroded Blackland, Loamy Bottomland, Loamy Sand, Sandy, Sandstone Hills, and Sandy Loam.

Blackland range site. The Bleiblerville, Burleson, and Frelsburg soils in map unit FrC and the Greenvine soils are in this site. The climax vegetation is a tall-grass prairie that has a few large live oak, elm, and hackberry trees along draws and in scattered motts. The composition, by weight, is about 85 percent grasses, 5 percent woody plants, and 10 percent forbs. This site has high natural fertility.

Little bluestem, indiangrass, and big bluestem make up about 75 percent of the forage in areas where the site is in climax condition. Many other grasses make up another 10 percent. The most important of these are switchgrass, sideoats grama, Texas wintergrass, Texas cupgrass, tall dropseed, silver bluestem, longspike tridens, Florida paspalum, and Virginia wildrye. Woody species, such as live oak, elm, hackberry, bumelia, and coralberry, make up about 5 percent. About 34 species of forbs grow on this site and make up 10 percent of the forage.

Overgrazing decreases the extent of little bluestem, big bluestem, indiangrass, switchgrass, and eastern gamagrass and increases the extent of silver bluestem, Texas wintergrass, sideoats grama, tall dropseed, and other mid grasses. If overgrazing continues, buffalograss and annual forbs dominate the site and mesquite, huisache, Osage-orange, winged elm, honeylocust, Texas grama, and tumblegrass invade the site.

Chalky Ridge range site. The Renish soils are in this site. The climax vegetation is a true prairie that has live oak trees in scattered motts. The composition, by weight, is about 85 percent grasses, 5 percent woody plants, and 10 percent forbs.

Little bluestem, indiangrass, sideoats grama, silver bluestem, and tall dropseed make up about 80 percent of the climax plant community. Other grasses include Virginia wildrye, Canada wildrye, Texas wintergrass, threeawn, low panicums, and buffalograss. Forbs include Maximilian sunflower, Engelmann daisy, gayfeather, bundleflower, sensitive briar, yellow

neptunia, prairie clover, snoutbean, vetch, ragweed, bluebonnet, paintbrush, verbena, wine-cup, and croton. Woody plants include live oak, hackberry, elm, bumelia, and coralberry.

Overgrazing decreases the extent of little bluestem and indiangrass and results in an increase in the extent of sideoats grama, Texas wintergrass, silver bluestem, buffalograss, and threeawns. If overgrazing continues, hairy grama, Texas grama, threeawns, broomweed, pricklypear, Texas wintergrass, and a large number of annual weeds and forbs dominate the site.

Clayey Bottomland range site. The Brazoria, Gladewater, and Tinn soils are in this site. The climax vegetation is a tall grass savanna that has grasses shading about 30 percent of the ground. The canopy is heavier in areas that are adjacent to streams. Cool-season grasses and sedges are dominant in the shaded areas. Warm-season grasses and forbs are dominant in the open areas. The composition, by weight, is about 70 percent grasses, 25 percent woody plants, and 5 percent forbs.

Sedges, Virginia wildrye, Canada wildrye, and rustyseed paspalum make up about 35 percent of the climax plant community. Beaked panicum, switchgrass, indiangrass, little bluestem, big bluestems, eastern gamagrass, vine-mesquite, and Florida paspalum make up about about 25 percent. Buffalograss, longleaf uniola, knotroot bristlegrass, and other grasses make up about 10 percent. Oaks, elm, cottonwood, hackberry, black willow, pecan, hawthorns, and woody vines make up about 25 percent. Tickclover, snoutbean, lespedeza, and gayfeather make up about 5 percent.

This range site is preferred by livestock. Overgrazing and fire suppression reduce the extent of warm-season grasses and forbs and enable the brush to form a dense canopy. Shade-tolerant grasses then dominate the herbaceous production, drastically reducing the total amount of usable forage.

Clay Loam range site. The Brenham, Carbengle, Cuero, and Flatonia soils are in this site. The climax vegetation is a highly productive tall grass prairie. The composition, by weight, is about 90 percent grasses, 5 percent woody plants, and 5 percent forbs.

Little bluestem, indiangrass, big bluestem, and switchgrass make up about 70 percent of the climax plant community. Sideoats grama, Florida paspalum, Canada wildrye, silver bluestem, tall dropseed, and Texas wintergrass make up about 15 percent. Other short grasses, such as buffalograss, make up about 5 percent. Hackberry, elm, pecan, and oaks make up about 5 percent. Many forbs, such as Maximilian sunflower, Engelmann daisy, and bundleflower, also make up about 5 percent.

Overgrazing decreases the extent of big bluestem, little bluestem, indiangrass, switchgrass, Florida paspalum, and palatable forbs and results in an increase in the extent of sideoats grama, silver bluestem, Texas wintergrass, tall dropseed, low panicums, and less palatable forbs. If overgrazing continues, buffalograss, Texas wintergrass, Texas grama, hairy grama, threeawn, windmillgrass, tumblegrass, western ragweed, and prairie coneflower and woody plants, such as mesquite, dominate the site.

Claypan Savannah range site. The Arol, Axtell, Burlewash, Falba, Gredge, Lufkin, Shalba, and Singleton soils are in this site. The climax vegetation is a post oak and blackjack oak savanna that has trees shading 20 to 25 percent of the ground. The composition, by weight, is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Little bluestem, indiangrass, and brownseed paspalum make up about 60 percent of the climax plant community. Other grasses include switchgrass, Florida paspalum, purpletop, low panicums, low paspalums, silver bluestem, tall dropseed, and Texas wintergrass. Woody plants include post oak, blackjack oak, elm, yaupon, hawthorns, and American beautyberry. Forbs include dayflower, bundleflower, sensitive briar, tickclover, wildbean, and lespedeza.

Overgrazing decreases the extent of little bluestem, indiangrass, and switchgrass and results in an increase in the extent of brownseed paspalum, silver bluestem, arrowfeather, threeawns, tall dropseed, purpletop, and low panicums. The extent of woody plants, such as post oak, elm, yaupon, and hackberry, also increases, forming a dense canopy that suppresses grass and forb production.

Claypan Prairie range site. The Boonville, Crockett, Mabank, Wilson, Zack, and Zulch soils are in this site. The climax vegetation is a tall grass prairie or very open savanna that has a few scattered live oak, elm, and hackberry trees adjacent to areas of water or in scattered motts.

Little bluestem and indiangrass make up about 65 percent of the climax plant community. Switchgrass, big bluestem, Virginia wildrye, Canada wildrye, Florida paspalum, sideoats grama, meadow dropseed, Texas wintergrass, and vine-mesquite make up about 15 percent. Purpletop, brownseed paspalum, longspike tridens, buffalograss, low panicums, fall witchgrass, and sedges make up about 5 percent. Live oak, elm, hackberry, bumelia, coralberry, and scattered post oak

also make up about 5 percent. Many forbs, such as Maximilian sunflower, Engelmann daisy, halfshrub sundrop, western indigo, and prairie clover, make up about 10 percent.

Overgrazing decreases the extent of big bluestem, little bluestem, indiangrass, and switchgrass and results in an increase in the extent of meadow dropseed, silver bluestem, sideoats grama, and Texas wintergrass. If overgrazing continues, mesquite and pricklypear invade the site and buffalograss, Texas wintergrass, Texas grama, windmillgrass, and weedy forbs dominate the site.

Deep Sand range site. The Navasan and Padina soils are in this site. The climax vegetation is a bluejack oak, blackjack oak, and post oak savanna that has a canopy of 20 to 25 percent. The composition, by weight, is about 80 percent grasses, 5 percent forbs, and 15 percent woody plants.

Little bluestem, indiangrass, switchgrass, sand lovegrass, and purpletop make up about 65 percent of the climax plant community. Other grasses include low panicums, low paspalums, purple lovegrass, sand dropseed, and splitbeard bluestem. Woody plants, such as bluejack oak, blackjack oak, and post oak, make up about 10 percent of the forage. Shrubs, such as yaupon, hawthorns, and American beautyberry, make up about 5 percent. Forbs, such as lespedeza, tickclover, wildbean, and partridge pea, also make up about 5 percent.

Overgrazing decreases the extent of little bluestem, sand lovegrass, indiangrass, and purpletop and results in an increase in the extent of low panicums, low paspalums, purple lovegrass, and woolysheath threeawn. Oak and yaupon also increase in extent to form a dense canopy. If overgrazing continues, red lovegrass, tumblegrass, crabgrass, red sprangletop, sandbur, bracken-fern, pricklypear, and queen's delight dominate the site and production of good-quality forage species is reduced to a very small amount.

Eroded Blackland range site. The Latium and Frelsburg soils in map unit FrC2 are in this site. The climax plant community has been destroyed by cultivation, and the natural productivity has been lowered by erosion. The potential plant community is a tall-grass prairie similar to that of Blackland range site. A long time is needed for secondary plant succession to reestablish the plant community. The potential plant community, by weight, is about 85 percent grasses, 5 percent woody plants, and 10 percent forbs.

Little bluestem, indiangrass, and big bluestem make up about 70 percent of the climax plant community. Virginia wildrye, Canada wildrye, switchgrass, Florida paspalum, sideoats grama, tall dropseed, silver bluestem, Texas wintergrass, and vine-mesquite make up about 15 percent. Live oak, hackberry, elm, bumelia, and coralberry make up about 5 percent. Many forbs, such as Maximilian sunflower, Engelmann daisy, and bundleflower, make up about 10 percent.

Most of this site is in an intermediate stage of secondary plant succession. Silver bluestem, tall dropseeds, Texas wintergrass, sideoats grama, and buffalograss dominate this site and respond as increasers. If overgrazing continues, buffalograss, Texas wintergrass, or both dominate the site.

Loamy Bottomland range site. The Nahatche, Norwood, and Oklared soils are in this site. The climax vegetation is a tall-grass savanna that has trees shading 30 percent of the ground. Cool-season grasses and sedges are dominant in the shaded areas. Warm-season plants are dominant in the open areas. The composition, by weight, is about 70 percent grasses, 25 percent woody plants, and 5 percent forbs.

Virginia wildrye, sedges, and rustyseed paspalum grow in the shaded and wet areas. They make up about 25 percent of the climax plant community. Switchgrass, beaked panicum, indiangrass, big bluestem, little bluestem, eastern gamagrass, vine-mesquite, and purpletop grow in the open areas. They make up about 35 percent of the climax plant community. Redtop panicum, gaping panicum, low panicums, uniolas, buffalograss, knotroot bristlegrass, Texas wintergrass, and other grasses make up about 10 percent. Oaks, pecan, hackberry, elm, cottonwood, black willow, sycamore, hickory, ash, and many other understory shrubs make up about 25 percent. Tickclover, lespedezas, snoutbean, partridge pea, and gayfeather make up about 5 percent.

This range site is preferred by livestock. Overgrazing and fire suppression reduce the extent of warm-season grasses and forbs and result in an increase in the extent of the canopy. Shade-tolerant grasses and forbs then dominate the herbaceous production, drastically reducing forage production.

Loamy Sand range site. The Silawa soils are in this site. The climax vegetation is a tall grass savanna that has scattered post oak, blackjack oak, and water oak. The composition, by weight, is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Little bluestem and indiangrass make up about 60 percent of the climax plant community. Switchgrass, purpletop, sand lovegrass, Florida paspalum, and low panicums make up about 10 percent. Balsamscale, purple lovegrass, silver bluestem, splitbeard bluestem, fall witchgrass, arrowfeather bluestem, and brownseed

paspalum make up about 5 percent. Post oak, blackjack oak, and water oak make up about 15 percent. Hickory, bluejack oak, American beautyberry, yaupon, and Alabama supplejack make up about 5 percent. Major forbs, such as dayflower, lespedeza, tickclover, sensitive briar, and partridge pea, also make up about 5 percent.

Overgrazing and fire suppression decrease the extent of tall grasses and result in an increase in the extent of the canopy of oaks, yaupon, and other woody species. The canopy may become so dense that very little grass is produced.

Sandstone Hills range site. The Koether soils are in this site. The climax vegetation is a post oak and blackjack oak savanna that has trees shading 20 to 25 percent of the ground. The composition, by weight, is about 75 percent grasses, 20 percent woody plants, and 5 percent forbs.

Little bluestem, indiangrass, and brownseed paspalum make up about 60 percent of the climax plant community. Other grasses include switchgrass, purpletop, low panicums, low paspalums, silver bluestem, tall dropseeds, and Texas wintergrass. Woody plants include post oak, blackjack oak, elm, yaupon, hawthorns, and American beautyberry. Forbs include dayflower, bundleflower, sensitive briar, tickclover, wildbean, and lespedezas.

Overgrazing and fire suppression decrease the extent of little bluestem, indiangrass, and switchgrass and result in an increase in the extent of brownseed paspalum, silver bluestem, arrowleaf threeawn, tall dropseeds, purpletop, and low panicums. The extent of woody plants, such as post oak, elm, yaupon, and hackberry, also increases, forming a dense canopy that suppresses grass and forb production.

Sandy range site. The Robco and Silstid soils are in this site. The climax vegetation is a post oak and blackjack oak open savanna that has trees shading 25 to 30 percent of the ground. Tall grasses are dominant in the unshaded areas. The composition, by weight, is about 75 percent grasses, 5 percent forbs, and 20 percent woody plants.

Little bluestem makes up about 50 percent of the climax plant community. Indiangrass makes up about 10 percent. Switchgrass, beaked panicum, sand lovegrass, purpletop, and brownseed paspalum also make up about 10 percent. Other grasses include fringeleaf paspalum, purple lovegrass, tall dropseeds, splitbeard bluestem, and low panicums. Forbs include lespedezas, tickclover, sensitive briar, snoutbean, tephrosia, partridge pea, and western ragweed. Woody plants make up about 15 percent of the climax plant community. They include post oak and blackjack oak and an understory of hawthorns, American beautyberry, greenbriar, yaupon, and berry vines.

Overgrazing and fire supression decrease the extent of the tall grasses and result in an increase in the extent of the canopy of woody species. Little bluestem, indiangrass, and switchgrass are replaced by brownseed paspalum, tall dropseed, and fall witchgrass. It overgrazing continues, red lovegrass, yankeeweed, bullnettle, snakecotton, and croton dominate the site and broomsedge bluestem, smutgrass, sandbur, pricklypear, queen's delight, beebalm, pricklepoppy, baccharis, and waxmyrtle invade the site. Woody species increase in extent and invade the site, forming dense thickets.

Sandy Loam range site. The Chazos, Klump, Knolle, Rader, Shiro, and Tabor soils are in this site. The climax vegetation is a post oak and blackjack oak savanna that has a canopy of 20 to 25 percent. Tall grasses are dominant in the unshaded areas. The composition, by weight, is about 80 percent grasses, 5 percent forbs, and 15 percent woody plants.

Little bluestem makes up about 50 percent of the climax plant community. Indiangrass makes up about 10 percent. Eastern gamagrass, switchgrass, big bluestem, beaked panicum, and longleaf uniola also make up about 10 percent. Many other grasses make up another 10 percent. Many forbs, such as Engelmann daisy, gayfeather, sensitive briar, and native legumes, make up about 5 percent. Post oak and blackjack oak make about 10 percent. Many other woody plants, such as elm, yaupon, greenbriar, American beautyberry, and berry vines, make up about 5 percent.

Overgrazing and fire supression reduce the extent of tall grasses, such as little bluestem, indiangrass, big bluestem, and eastern gamagrass, and result in an increase in brownseed paspalum. If overgrazing continues, thickets of oak and brush, annual grasses, forbs, and carpetgrass dominate the site.

Woodland Management and Productivity

Grimes County has approximately 36,000 acres of woodland. The woodland is scattered throughout the county in localized areas of pine-red oak-sweetgum-hickory forests. The majority of the woodland is in the southeastern part of the county. Most of the woodland originally supported hardwoods, but pine encroachment has produced many stands used for commercial timber (fig. 14). Some soils in transitional areas can be used for range or woodland. Because of rainfall, these areas support trees and rangeland vegetation.

Figure 14.—A stand of loblolly pine in an area of Depcor loamy fine sand, 1 to 5 percent slopes.

Large timber companies own most of the pine timber in the county. Private holdings are generally small tracts of land. Housing development has resulted in some loss of pine production.

Severe attacks by insects and diseases are cyclic. Damage from ice and snow is rare. Many stands of pine also support inferior hardwoods. The production of pine can be improved by removing these hardwoods.

Soils vary in their ability to produce trees. Available water capacity and depth of the root zone have major effects on tree growth. Fertility and texture also influence tree growth. Elevation, aspect, and climate determine the kinds of trees that can grow on a site.

This soil survey can be used by woodland managers planning ways to increase the productivity of forest land. Some soils respond better to applications of fertilizer than others, and some are more susceptible to landslides and erosion after roads are built and timber is harvested. Some soils require special reforestation efforts. Table 7 summarizes forestry information and rates the soils for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of the major soil limitations to be considered in forest management.

Table 7 lists the *ordination symbol* for each soil. The first part of the ordination symbol, a number, indicates the potential productivity of a soil for the indicator species based on its site index. The larger the number, the greater the potential productivity.

The second part of the ordination symbol, a letter, indicates the major kind of soil limitation affecting use and management. The letter *R* indicates a soil that has a significant limitation because of steepness of slope. The letter *X* indicates that a soil has restrictions because of stones or rocks on the surface. The letter *W* indicates a soil in which excessive water, either seasonal or year-round, causes a significant limitation. The letter *T* indicates a soil that has, within the root zone, excessive alkalinity or acidity, sodium salts, or other toxic substances that limit the development of desirable trees. The letter *D* indicates a soil that has a limitation because of a restricted rooting depth, such as a shallow soil that is underlain by hard bedrock, a hardpan, or other layers that restrict roots. The letter *C* indicates a soil that has a limitation because of the kind or amount of clay in the upper part of the profile. The letter *S* indicates a sandy soil. The letter *F* indicates a soil that has a large amount of coarse fragments. The letter *A* indicates a soil having no significant limitations that affect forest use and management. If a soil has more than one limitation, the priority is as follows: R, X, W, T, D, C, S, and F.

Ratings of the *erosion hazard* indicate the probability that damage may occur if site preparation or harvesting activities expose the soil. The risk is *slight* if no particular preventive measures are needed under ordinary conditions; *moderate* if erosion-control measures are needed for particular silvicultural activities; and *severe* if special precautions are needed to control erosion for most silvicultural activities. Ratings of moderate or severe indicate the need for construction of higher standard roads, additional maintenance of roads, additional care in planning harvesting and reforestation activities, or the use of special equipment.

Ratings of *equipment limitation* indicate limits on the use of forest management equipment, year-round or seasonal, because of such soil characteristics as slope, wetness, stoniness, and susceptibility of the surface layer to compaction. As slope gradient and length increase, it becomes more difficult to use wheeled equipment. On the steeper slopes, tracked equipment is needed. On the steepest slopes, even tracked equipment cannot be operated and more sophisticated systems are needed. The rating is *slight* if equipment use is restricted by wetness for less than 2 months and if special equipment is not needed. The rating is *moderate* if slopes are so steep that wheeled equipment cannot be operated safely across the slope, if wetness restricts equipment use from 2 to 6 months per year, if stoniness restricts the use of ground-based equipment, or if special eqipment is needed to prevent or minimize compaction. The rating is *severe* if slopes are so steep that tracked equipment cannot be operated safely across the slope, if wetness restricts equipment use for more than 6 months per year, if stoniness restricts the use of ground-based equipment, or if special equipment is need to prevent or minimize compaction. Ratings of moderate or severe indicate a need to choose the best suited equipment and to carefully plan the timing of harvesting and other management activities.

Ratings of *seedling mortality* refer to the probability of the death of naturally occurring or properly planted seedlings of good stock in periods of normal rainfall, as influenced by kinds of soil or topographic features. Seedling mortality is caused primarily by too much water or too little water. The factors used in rating a soil for seedling mortality are texture of the surface layer, depth to a seasonal high water table and the length of the period when the water table is high, rock fragments in the surface layer, rooting depth, and the aspect of the slope. The mortality rate generally is highest on soils that have a sandy or clayey surface layer. The risk is *slight* if, after site preparation, expected mortality is less than 25 percent; *moderate* if expected mortality is between 25 and 50 percent; and *severe* if expected mortality exceeds 50 percent. Ratings of moderate or severe indicate that it may be necessary to use containerized or larger than usual planting stock or to make special site preparations, such as bedding, furrowing, installing a surface drainage system, and providing artificial shade for seedlings. Reinforcement planting is often needed if the risk is moderate or severe.

Ratings of *plant competition* indicate the likelihood of the growth or invasion of undesirable plants. Plant competition is more severe on the more productive soils, on poorly drained soils, and on soils havding a restricted root zone that holds moisture. The risk is *slight* if competition from undesirable plants hinders adequate natural or artificial reforestation but does not necessitate intensive site preparation and maintenance. The risk is *moderate* if competition from undesirable plants hinders natural or artificial reforestation to the extent that some type of site preparation and maintenance are needed. The risk is *severe* if competition from undesirable plants prevents adequate natural or artificial reforestation unless the site is intensively prepared and maintained. A moderate or severe rating indicates the need for site preparation to ensure the development of an adequately stocked

stand. Managers must plan site preparation measures to ensure reforestation without delays.

The *potential productivity* of *common trees* on a soil is expressed as a *site index*. Common trees are listed in the order of their observed general occurrence. Generally, only two or three tree species dominate. The first tree listed for each soil is the indicator species for that soil. An indicator species is a tree that is common in the area and that is generally the most productive on a given soil.

Loblolly pine is the indicator species for soils that can be used for pine. The first part of the ordination symbol is 10 or 11 for soils that have a site index of 95 or more. A 9 indicates soils that have a site index of 90, an 8 indicates soils that have a site index of 80, a 7 indicates soils that have a site index of 70, a 6 indicates soils that have a site index of 65, and a 5 indicates soils that have a site index of 60 or less.

Sweetgum is the indicator species for soils that normally support only hardwoods. The first part of the ordination symbol is 10 or 11 for soils that have a site index of 100 or more. An 8 or 9 indicates soils that have a site index of 90 to 100, a 6 or 7 indicates soils that have a site index of 80 to 90, and a 4 or 5 indicates soils that have a site index of 70 to 80.

Cottonwood is the indicator species for the Norwood and Oklared soils. The first part of ordination symbol is 9, and the site index is 100.

The *site index* is determined by taking height measurements and determining the age of selected trees within stands of a given species. This index is the average height, in feet, that the trees attain in a specified number of years. This index applies to fully stocked, even-aged, unmanaged stands. The estimates of the productivity of the soils in this survey are mainly based on loblolly pine, but estimates based on other trees are used when appropriate.

The *volume* is the yield likely to be produced by the most important species in fully stocked natural stands, expressed in board feet (Doyle rule) per acre per year over a 50-year period. Because this volume is based on trees in natural stands that have had no intermediate cutting management, the listed yields can be significantly increased by applying sound forestry practices, such as scheduled thinnings.

Trees to plant are those that are used for reforestation or, under suitable conditions, natural regeneration. They are suited to the soils and can produce a commercial wood crop. The desired product, topographic position (such as a low, wet area), and personal preference are three factors among many that can influence the choice of trees for use in reforestation.

Woodland Understory Vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some woodland, if well managed, can produce enough understory vegetation to support grazing of livestock or wildlife, or both, without damage to the trees.

The quantity and quality of understory vegetation vary with the kind of soil, the age and kind of trees in the canopy, the density of the canopy, and the depth and condition of the litter. The density of the canopy determines the amount of light that understory plants receive.

Table 8 shows, for each soil suitable for woodland, the potential for producing understory vegetation. The total production of understory vegetation includes the herbaceous plants and the leaves, twigs, and fruit of woody plants up to a height of 4.5 feet. It is expressed in pounds per acre of air-dry vegetation in favorable, normal, and unfavorable years. In a favorable year, soil moisture is above average during the optimum part of the growing season; in a normal year, soil moisture is average; and in an unfavorable year, it is below average.

Table 8 also lists the common names of the characteristic vegetation on each soil and the *composition*, by percentage of air-dry weight, of each kind of plant. The table shows the kind and percentage of understory plants expected under a canopy density that is most nearly typical of woodland in which the production of wood crops is highest.

Surface Mine Reclamation

Lignite deposits underlie many of the soils in the county. Strip-mining the lignite results in large areas of disturbed land. Surface mining for lignite is accomplished by clearing the existing vegetation, removing all overburden using large draglines, mining the lignite, and replacing the overburden.

Current Texas regulations require that all lignite mine sites be reclaimed according to a prepared and approved reclamation plan, which includes the vegetation of the area. After vegetation has been established, it must be maintained for a designated period. National and State regulations should be considered in the planning, site selection, design, and application of any reclamation procedures.

Reclamation includes the reconstruction and revegetation of areas. After mining the lignite and replacing the overburden, the soil is graded to the planned contour and then revegetated in accordance with the planned land use. After reconstruction is complete, the land can be used for cropland, pasture,

range, woodland, wildlife habitat, orchards, or recreational, residential, or industrial development. The selected land use determines the type of plant material to be used and the procedures needed for reclamation.

Successful reclamation of strip-mined soils requires an understanding of the chemical, physical, and biological properties of the soils. Altering these soil properties can affect alternative uses of the land and soil productivity.

The objectives of reclamation are to restore the productivity of the soil, to prevent permanent damage, and to control erosion and sedimentation. Because mining results in soil disturbances, more soil amendments, plant seeds and sprigs, and subsequent management generally are needed in the initial stages of reclamation.

Revegetation of mined areas requires a good seedbed, adequate amounts of fertilizer, and the selection of plants that help to control erosion. The plants commonly used for cover and forage include coastal bermudagrass, common bermudagrass, selection 75 kleingrass, Pensacola bahiagrass, and King Ranch bluestem. Other important grasses include Haskell sideoats grama, T-587 old world bluestem, Alamo switchgrass, and Lometa indiangrass.

Including legumes, such as Yuchii arrowleaf clover, crimson clover, subterranean clover, and hairy vetch, in the areas to be regevetated increases forage production and provides nitrogen for the other plant species. Other forbs and legumes, such as Sabine Illinois bundleflower, singletary pea, Engelmann daisy, and Aztec Maximilian sunflower, increase the diversity of wildlife habitat.

Recreation

In table 9, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 9, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 9 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have gentle slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes, stones, or boulders that increase the cost of shaping sites or of building access roads and parking areas.

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the

surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Gary Valentine, biologist, and Joe Platt, soil conservationist, Natural Resouces Conservation Service, helped prepare this section.

Grimes County has valuable fish and wildlife resources. Streams, lakes, and small water impoundments provide habitat for fish. The diversity of land uses and vegetative types provides habitat for many diverse species of wildlife.

Many of the soils in Grimes County are suitable for water impoundments. Ponds, small lakes, and large impoundments are stocked and managed for largemouth bass, channel catfish, and bluegill. Many small ponds are stocked with channel catfish and fathead minnows to provide food and recreation for the owner of the pond. Other species found in streams include freshwater drum, flathead catfish, bullhead catfish, carp, gar, grass pickerel, bowfin, buffalofish, white bass, gizzard shad, and various sunfish. Many of these species find their way into numerous unmanaged ponds and lakes.

The Navasota River and the Brazos River are the major streams in the county. The Gibbons Creek Reservoir is the largest lake in the county.

The quality of water in ponds is variable. Ponds constructed in areas of acidic soils often are muddy. Applying agricultural lime can improve the quality of water. Ponds constructed in alkaline blackland soils are generally clear. Submerged and floating aquatic weeds pose some problems in areas of clear water.

Little aquaculture exists in Grimes County. Several landowners in the county produce fish for recreational stocking in ponds and small lakes.

The major game species in the county include white-tailed deer, bobwhite, mourning dove, squirrel, ducks, and geese. Eastern wild turkey is being reintroduced into the county. Raccoon, opossum, striped skunk, armadillo, cottontail rabbit, swamp rabbit, and numerous rodents and songbirds also inhabit the county. Common predators are coyote, gray fox, and bobcat.

Several reptiles and amphibians inhabit the county. The best known of these are the cottonmouth, copperhead, coral snake, timber rattlesnake, diamondback rattlesnake, water snakes, green bullfrog, tree frog, and snapping turtle. The American alligator inhabits some wetland areas in the county, mostly along the Navasota River and Bedias Creek.

During migration periods, ducks, such as teals, mallards, gadwalls, widgeons, shovelers, and pintails, and several species of geese use the existing cropland and water areas for feeding, resting, and roosting. Wood duck inhabit the county throughout the year and may be found in areas of flooded timber and in backwater sloughs.

Two federally-endangered species have been reported in Grimes County. The southern bald eagle, a migratory species, inhabits the county from mid-fall through mid-spring. Bald eagles have been observed around Gibbons Creek Reservoir and along the Navasota River. Navasota ladies' tresses, an orchid, occurs in the margins of open woodland along the slightly eroded, intermittent, minor tributaries of the Brazos and Navasota Rivers that are in areas of the post oak woodlands.

The number of wildlife in the county is increasing because of better habitat management and renewed interest in several game species. Most of the deer are in areas of the post oak woodlands, but deer also are present in smaller numbers throughout the county (fig. 15). Many landowners lease land for hunting deer, dove, quail, and duck. A higher demand and subsequently higher prices for hunting leases have increased income to landowners in recent years.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 10, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are

Figure 15.—An area of Brenham clay loam, 3 to 8 percent slopes, used as habitat for deer.

very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are

kleingrass, bahiagrass, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, goatweed, and partridge pea.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of these plants are oak, black cherry, hawthorn, dogwood, and hickory. Examples of fruit-producing shrubs that are suitable for planting on soils rated *good* are blackberry, blueberry, autumn-olive, and crabapple.

Coniferous plants furnish browse and seeds. Soil properties and features that affect the growth of coniferous trees, shrubs, and ground cover are depth of the root zone, available water capacity, and wetness. Examples of coniferous plants are pine, spruce, fir, cedar, and juniper.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, wildrice, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, meadowlark, field sparrow, cottontail, and red fox.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants or both and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, squirrels, gray fox, raccoon, and deer.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, mink, and beaver.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include deer, meadowlark, and quail.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt

fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

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

Building Site Development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm, dense layer; stone content; soil texture; and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrinking and swelling, and organic layers can cause the movement of footings. Depth to a high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, depth to a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or

maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfill. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability,

more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet and have a water table at a depth of less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred

for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant nutrients as it decomposes.

Water Management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage, irrigation, terraces and diversions, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind erosion or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 20.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 20.

Rock fragments 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-

weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence the shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre

per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 16, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to two hydrologic soil groups in table 17, the first letter is for drained areas and the second is for undrained areas.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year). *Frequent* means that flooding occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes. Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent*; and the months of the year that the water table commonly is highest. A water table that is seasonally high for less

than 1 month is not indicated in table 17.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. The rock is specified as either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low, moderate,* or *high.* It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 18 and the results of chemical analysis in table 19. The data are for soils sampled at carefully selected sites. Unless otherwise indicated, the pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(23).*

Sand—(0.05-2.0 mm fraction) weight percentage of materials less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1).
Water-retention difference—between ⅓ bar and 15 bars for whole soil (4C1).
Linear extensibility—change in clod dimension based on whole soil (4D).
Extractable cations—ammonium acetate pH 7.0, atomic absorption; calcium (6N2e), magnesium (6O2d), sodium (6P2b), potassium (6Q2b).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1f).
Electrical conductivity—saturation extract (8A3a).
Sodium adsorption ratio (5E).

Engineering Index Test Data

Table 20 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. Unless otherwise indicated, the pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Texas Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Particle density—T 99 (AASHTO), D 698 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(21)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 21 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning dry, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Calciustolls (*Calci*, meaning calcareous, plus *ustoll*, the suborder of the Mollisols that has a dry moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Calciustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, carbonatic, thermic Typic Calciustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the underlying material within a series.

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(22)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(21)*. Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Annona Series

The Annona series consists of very deep, somewhat poorly drained, loamy soils on uplands and ancient terraces. These soils formed in clayey and loamy

sediments. Slopes range from 1 to 8 percent.

Typical pedon of Annona fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 2819 and Farm Road 1486 south of Richards, 1.9 miles west and southwest on Farm Road 2819 to the eastern property fence of Champions Nature Trail, south along the fence 3,500 feet, and 200 feet west of the fence in an area of woodland:

A—0 to 7 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, nonplastic, nonsticky; common coarse and fine roots; common fine pores; slightly acid; abrupt smooth boundary.

Bt1—7 to 27 inches; red (2.5YR 4/8) clay, red (2.5YR 5/8) dry; common medium distinct grayish brown (10YR 5/2) and yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; very hard, very firm, very plastic, very sticky; common fine roots; common fine pores; very strongly acid; gradual smooth boundary.

Bt2—27 to 45 inches; red (2.5YR 4/8) clay, red (2.5YR 5/8) dry; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; very hard, very firm, very plastic; few fine roots and pores; common clay films on faces of peds; common pressure faces; strongly acid; gradual smooth boundary.

Bt3—45 to 65 inches; mottled light brownish gray (10YR 6/2), strong brown (7.5YR 5/6), and yellowish red (5YR 4/6) clay; weak medium subangular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots and pores; few pressure faces; strongly acid; clear smooth boundary.

BC—65 to 75 inches; light gray (10YR 7/2) clay loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure; hard, firm, sticky, plastic; few fine roots; strongly acid.

During dry periods the upper part of the subsoil has cracks that are 0.5 inch or more wide. Some pedons have siliceous pebbles.

Some pedons have an E horizon. The combined thickness of this horizon and the A horizon is generally less than 10 inches but may be as much as 15 inches. The A or Ap horizon is dark grayish brown, brown, dark brown, light brownish gray, or pale brown. Reaction ranges from very strongly acid to slightly acid.

The Bt1 horizon is red, yellowish red, or reddish yellow and is mottled in shades of gray, red, and brown. It is clay, clay loam, or sandy clay. Reaction is very strongly acid or strongly acid. The Bt2 and Bt3 horizons are brown, light gray, or light brownish gray and are mottled in shades of brown and red or they are mottled in these colors and do not have a dominant matrix color. They are clay or sandy clay. Reaction ranges from strongly acid to slightly acid.

The BC horizon is gray, light gray, or light brownish gray. In many pedons it has mottles in shades of brown and red. It is clay, clay loam, or sandy clay. Reaction ranges from strongly acid to moderately alkaline.

Arents

Arents consist of very deep, well drained, loamy and clayey soils that formed in spoil material derived from lignite mining. The spoil material resulted from the mixing of soils during surface mining. Slopes are mostly 1 to 5 percent but are much as 20 percent along the edge of spoil piles.

Typical pedon of Arents; from Texas Highway 30 in Carlos, 2.0 miles north on Farm Road 244, about 0.5 mile east along a private road, and 600 feet northeast to the top of a spoil pile:

Ap—0 to 6 inches; very pale brown (10YR 7/3) silt loam; rock structure; common fine sandstone and siltstone fragments, few strong brown (7.5YR 5/6) clayey fragments of a former Bt horizon; few fine roots; hard, firm, sticky, slightly plastic; slightly acid; abrupt boundary.

2C—6 to 60 inches; very pale brown (10YR 7/3) silty clay loam; common masses of reddish yellow (7.5YR 6/6) clay from former soil horizons; few sandstone and siltstone fragments; slightly acid.

The Ap horizon is 3 to 10 inches thick. It is light brownish gray, grayish brown, pale brown, brown, or very pale brown. It is fine sandy loam, loam, or silt loam. It may have small fragments of siltstone or sandstone and a few masses of clay or clay loam. Reaction ranges from strongly acid to slightly acid.

The 2C horizon is a mixture of surface soil, subsoil, and underlying rock and soil material. It is light brownish gray, grayish brown, pale brown, or very pale brown. It is fine sandy loam, loam, silt loam, or clay loam. It has common fragments of sandstone and siltstone and clayey masses of a former Bt horizon. Reaction ranges from very strongly acid to slightly acid.

Arol Series

The Arol series consists of moderately deep, moderately well drained, loamy soils on uplands. These soils formed in clayey and loamy tuffaceous material. Slopes range from 0 to 5 percent.

Typical pedon of Arol fine sandy loam, 0 to 1 percent slopes; from the railroad crossing on Texas Highway 30 in Shiro, 3.5 miles northeast on Texas Highway 30,

about 3.8 miles north and east on a county road and 100 feet south of the road in an old field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; hard, firm, nonsticky, nonplastic; common roots; moderately acid; abrupt smooth boundary.
Bt1—6 to 20 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, sticky, plastic; common clay films on faces of peds; moderately acid; gradual smooth boundary.
Bt2—20 to 25 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, sticky, plastic; few fine roots; moderately acid; gradual smooth boundary.
BC—25 to 30 inches; very dark grayish brown (10YR 3/2) clay, dark grayish brown (10YR 4/2) dry; common medium distinct light gray (10YR 7/2) mottles; weak fine subangular blocky structure; extremely hard, extremely firm, slightly sticky, slightly plastic; few fine roots; slightly acid; clear smooth boundary.
Cr—30 to 60 inches; light gray (5Y 7/2) clayey tuffaceous material; massive; extremely hard, extremely firm, sticky, plastic; neutral.

The solum ranges from 20 to 40 inches in thickness. During dry periods small cracks are at the surface.

The A horizon is less than 10 inches thick. It is dark gray, gray, grayish brown, or dark grayish brown. Reaction is strongly acid or moderately acid.

The Bt horizon is very dark gray, dark gray, very dark grayish brown, or black. It is clay or clay loam. The content of clay ranges from 35 to 50 percent. Reaction ranges from moderately acid to slightly alkaline.

The BC horizon is very dark gray, dark gray, black, grayish brown, dark grayish brown, or very dark grayish brown. It is mottled in shades of gray and white. Reaction ranges from slightly acid to slightly alkaline.

The Cr horizon is pale olive, light gray, or white. It is interbedded tuffaceous clays, ash beds, and sandstone bedrock. Reaction ranges from slightly acid to moderately alkaline.

The Arol soil in map unit ArC is outside the range defined for the series because it is slightly acid or neutral in the A horizon. This difference, however, does not affect the use and management of the soil.

Axtell Series

The Axtell series consists of very deep, moderately well drained, loamy soils on ancient stream terraces. These soils formed in clayey alluvium. Slopes range from 1 to 8 percent.

Typical pedon of Axtell fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Texas Highway 105 in Navasota, 1.0 mile east on Texas Highway 105, about 1.3 miles north and east on a county road, and 300 feet northwest of the county road in a wooded pasture:

A—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; very hard, friable, nonsticky, nonplastic; many fine roots; few siliceous pebbles; moderately acid; abrupt smooth boundary.
E—3 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; very hard, friable, nonsticky, nonplastic; many fine roots; few siliceous pebbles; moderately acid; abrupt wavy boundary.
Bt1—9 to 25 inches; red (2.5YR 4/6) clay; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; extremely hard, very firm, sticky, plastic; few fine roots; many distinct clay films on faces of peds; few siliceous pebbles; very strongly acid; gradual wavy boundary.
Bt2—25 to 50 inches; light gray (10YR 7/1) clay; common medium distinct red (2.5YR 4/6) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm, sticky, plastic; few fine roots; common distinct clay films on faces of peds; moderately acid; gradual wavy boundary.
BCk—50 to 65 inches; light gray (10YR 7/2) clay; weak coarse subangular blocky structure; extremely hard, very firm, sticky, plastic; few fine concretions of calcium carbonate; slightly alkaline.

During dry periods cracks that are 0.5 inch or more wide are within 20 inches of the surface. Some pedons have fine siliceous pebbles throughout. The solum is more than 60 inches thick.

The combined thickness of the A and E horizons is generally less than 10 inches but may be as much as 15 inches. The A horizon is dark grayish brown, light brownish gray, dark brown, brown, pale brown, or grayish brown. The E horizon is brown, grayish brown, very pale brown, light yellowish brown, or pale brown. The boundary between the E and the Bt horizons is abrupt over the subsoil crests and clear over the subsoil troughs. Reaction of the A and E horizons ranges

from strongly acid to slightly acid.

The Bt1 horizon is yellowish red, red, or reddish brown and is mottled in shades of yellow, red, gray, or brown. It is clay or clay loam. The content of clay is 35 to 55 percent. Reaction is very strongly acid or strongly acid. The Bt2 horizon is light gray and has red and brown mottles, or it is mottled in shades of red, gray, and brown and does not have a dominant matrix color. It is clay or sandy clay. The content of clay is 40 to 60 percent. Reaction ranges from strongly acid to neutral.

The content of clay in the BC horizon and the C horizon, if it occurs, ranges from 35 to 50 percent. Reaction ranges from moderately acid to moderately alkaline. Some pedons have concretions and soft masses of calcium carbonate.

Bleiblerville Series

The Bleiblerville series consists of very deep, moderately well drained, clayey soils on uplands. These soils formed in calcareous clays and marls. Slopes range from 0 to 3 percent.

Typical pedon of Bleiblerville clay, 1 to 3 percent slopes; from the intersection of Farm Road 362 and Texas Highway 105 about 5.0 miles east of Navasota, 2.8 miles east on Texas Highway 105, about 200 feet south of the road, and next to a right-of-way for a railroad:

A1—0 to 6 inches; black (10YR 2/1) clay, black (10YR 2/1) dry; weak fine granular structure; very hard, firm, very sticky, very plastic; common roots; calcareous; clear wavy boundary.

Bss1—6 to 40 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) dry; moderate medium blocky structure; extremely hard, very firm, very sticky, very plastic; common roots; large slickensides at an angle of 45 degrees; calcareous; clear wavy boundary.

Bss2—40 to 55 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common medium distinct black streaks; moderate medium blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; large slickensides at an angle of 45 degrees; calcareous; clear wavy boundary.

Bssk—55 to 65 inches; yellowish brown (10YR 5/6) clay, brownish yellow (10YR 6/6) dry; common medium prominent black streaks; moderate medium blocky structure; extremely hard, very firm, very sticky, very plastic; few soft masses of calcium carbonate; large slickensides at an angle of 45 degrees; calcareous.

During dry periods cracks as much as 3 inches wide extend from the surface to a depth of 50 inches. Intersecting slickensides are common below a depth of 6 inches. Microrelief that consists of microdepressions and microknolls is in areas of native vegetation. The microknolls are 4 to 12 inches higher than the microdepressions. The microdepressions have a darker and thicker surface layer than the microknolls. Microdepressions and microknolls occur every 5 to 10 feet.

The A horizon is black or very dark gray. The microdepressions have a thicker layer of dark colors, which extend into the lower horizons in old filled cracks.

The Bss horizon is dark gray, gray, grayish brown, or olive gray. The Bssk horizon is pale yellow, pale olive, olive, and yellowish brown.

Some pedons have a C horizon. This horizon is light brownish yellow, olive yellow, gray, or grayish brown clay or marl.

Boonville Series

The Boonville series consists of very deep, somewhat poorly drained, loamy soils on uplands. These soils formed in clayey and loamy sediments. Slopes range from 1 to 3 percent.

Typical pedon of Boonville fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 6.7 miles north on Farm Road 244, about 1.2 miles west on a private road, and 200 feet north of the road in an area of rangeland:

A—0 to 11 inches; very dark grayish brown (10YR 3/2) fine sandy loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine roots; few siliceous pebbles; neutral; abrupt wavy boundary.

E—11 to 13 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine roots; few siliceous pebbles; neutral; abrupt wavy boundary.

Btg1—13 to 20 inches; dark grayish brown (10YR 4/2) clay; common fine distinct brownish yellow (10YR 6/6) and reddish yellow (7.5YR 6/6) mottles; moderate medium subangular blocky structure; very hard, very firm, sticky, plastic; many fine roots; common clay films on faces of peds; few siliceous pebbles; strongly acid; clear wavy boundary.

Btg2—20 to 46 inches; grayish brown (10YR 5/2) clay; common medium distinct brownish yellow (10YR 6/6) and dark grayish brown (10YR 4/2) mottles; moderate coarse subangular blocky structure; very hard, very firm, sticky, plastic; common roots; few concretions of ferrous manganese; few gypsum

crystals; few soft lignite chips; strongly acid; clear wavy boundary.

Btg3—46 to 52 inches; light gray (10YR 7/2) clay loam; common medium distinct yellow (10YR 7/6), brownish yellow (10YR 6/6), and grayish brown (10YR 5/2) mottles; weak course subangular blocky structure; hard, very firm, sticky, plastic; moderately acid, abrupt boundary.

BC—52 to 60 inches; brown (7.5YR 5/4) clay loam; common coarse distinct reddish yellow (7.5YR 7/6) and very pale brown (10YR 7/3) mottles; weak coarse prismatic structure; hard, firm, sticky, plastic; moderately alkaline.

The A horizon is very dark grayish brown, dark brown, or dark grayish brown. Reaction ranges from strongly acid to neutral.

The E horizon, if it occurs, is grayish brown, light brownish gray, brown, or pale brown.

The Bt horizon is dark grayish brown, very dark grayish brown, dark gray, or grayish brown. Reaction ranges from strongly acid to neutral.

The BC horizon is brown, light gray, or gray. It has mottles in shades of gray, brown, and yellow. Reaction is slightly alkaline or moderately alkaline.

Boy Series

The Boy series consists of very deep, somewhat poorly drained, sandy soils on uplands. These soils formed in unconsolidated sandy and loamy sediments. Slopes range from 1 to 8 percent.

Typical pedon of Boy fine sand, 1 to 8 percent slopes; from the intersection of Texas Highway 105 and Farm Road 1774 in Plantersville, 5.2 miles south and 1.9 miles west on Finke Road, and 50 feet north of the road in an area of woodland:

A—0 to 7 inches; dark grayish brown (10YR 4/2) fine sand, grayish brown (10YR 5/2) dry; single grained; loose, nonsticky, nonplastic; many fine roots; moderately acid; gradual smooth boundary.

E—7 to 49 inches; light yellowish brown (10YR 6/4) fine sand, very pale brown (10YR 7/4) dry; few faint pale brown mottles; single grained; loose, nonsticky, nonplastic; many fine and few coarse roots; moderately acid; clear smooth boundary.

Btv—49 to 58 inches; light yellowish brown (10YR 6/4) sandy clay loam, very pale brown (10YR 7/4) dry; few medium distinct brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky; few fine roots; about 5 percent nodules of plinthite; strongly acid; gradual wavy boundary.

Bt—58 to 70 inches; brown (10YR 5/3) sandy clay loam, pale brown (10YR 6/3) dry; common medium distinct red (2.5YR 4/6) and brownish yellow (10YR 6/8) mottles; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky; about 5 percent nodules of plinthite; few thin clay films on faces of peds; very strongly acid.

The solum ranges from 70 to more than 100 inches in thickness.

The combined thickness of the A and E horizons ranges from 40 to 58 inches. The A horizon is dark grayish brown, light brownish gray, brown, or pale brown. It ranges from very strongly acid to neutral. The E horizon is light yellowish brown or very pale brown. It ranges from strongly acid to slightly acid.

The Btv horizon is light yellowish brown, yellowish brown, and brownish yellow. It is mottled in shades of brown, gray, yellow, and red. It is sandy clay loam. The content of clay ranges from 20 to 35 percent. The content of plinthite ranges from 5 to 10 percent. Reaction is very strongly acid or strongly acid.

The Bt horizon is brown or light gray. It is mottled in shades of gray, red, and yellow. It is sandy clay loam. The content of clay ranges from 20 to 35 percent. The content of plinthite ranges from 5 to 10 percent. Reaction is very strongly acid or strongly acid.

Brazoria Series

The Brazoria series consists of very deep, moderately well drained and somewhat poorly drained, clayey soils on flood plains. These soils formed in thick, clayey alluvial sediments along the Brazos River (fig. 16). Slopes range from 0 to 3 percent.

Typical pedon of Brazoria clay, 0 to 1 percent slopes; from the intersection of Farm Road 1227 and Texas Highway 6 south of Navasota, 1.9 miles west on Farm Road 1227, about 400 feet west along a field road, and 50 feet south in the field:

Ap—0 to 6 inches; dark reddish brown (5YR 3/2) clay, dark reddish gray (5YR 4/2) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; many fine roots; few fine concretions of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

A—6 to 15 inches; dark reddish brown (5YR 3/2) clay, dark reddish gray (5YR 4/2) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; common fine roots; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bw1—15 to 32 inches; dark reddish gray (5YR 4/2)

clay, reddish gray (5YR 5/2) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; few fine concretions of calcium carbonate; common intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

Bw2—32 to 60 inches; dark reddish gray (5YR 4/2) clay, reddish gray (5YR 5/2) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; few fine concretions of calcium carbonate; few intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

BC—60 to 85 inches; dark reddish brown (2.5YR 3/4) clay; common streaks of dark reddish brown (5YR 3/2); moderate coarse blocky structure; extremely hard, extremely firm, very sticky, very plastic; common fine concretions of calcium carbonate; common intersecting slickensides; calcareous; moderately alkaline; abrupt smooth boundary.

2C—85 to 98 inches; reddish brown (2.5YR 4/4) silty clay; structureless; hard, firm; few fine concretions of calcium carbonate; common fine bedding planes; calcareous; moderately alkaline.

The solum is more than 40 inches thick. During dry periods cracks that are more than 1 centimeter wide extend from the surface to a depth of 40 inches or more. The soil is calcareous and moderately alkaline throughout.

The combined thickness of the A and Ap horizons is 15 to 40 inches. They are dark reddish brown, reddish brown, or dark brown.

The Bw horizon is reddish brown or dark reddish brown. The content of clay ranges from 60 to 80 percent.

The C horizon is brown, reddish brown, or dark reddish brown. It is mainly clay or silty clay but has strata of silt loam, silty clay loam, or loam.

Brenham Series

The Brenham series consists of very deep, well drained, loamy soils on uplands. These soils formed in calcareous, silty and clayey sediments (fig. 17). Slopes range from 3 to 8 percent.

Typical pedon of Brenham clay loam, 3 to 8 percent slopes; from the intersection of Texas Highway 90 and Farm Road 149 in Anderson, 1.1 miles east on Farm Road 149, about 0.4 mile north on a private drive, 0.3 mile north through a field to a property line fence, and 100 feet north in an area of rangeland:

A—0 to 12 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; hard, friable; many fine roots; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk1—12 to 30 inches; yellowish brown (10YR 5/4) silty clay loam, very pale brown (10YR 7/4) dry; few fine distinct pale brown wormcasts in worm channels; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; common medium concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk2—30 to 55 inches; light yellowish brown (2.5Y 6/4) silty clay loam, pale yellow (2.5Y 7/4) dry; common medium faint light brownish gray mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; common medium concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

BCk—55 to 80 inches; yellowish brown (10YR 5/6) silty clay loam, brownish yellow (10YR 6/6) dry; strata of light yellowish brown (10YR 6/4) siltstone bedrock; structureless; very hard, friable, slightly sticky; common concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The soil is calcareous and moderately alkaline throughout.

The A horizon is very dark brown or very dark grayish brown. The number of concretions of calcium carbonate ranges from few to many. The calcium carbonate equivalent ranges from 10 to 40 percent.

The Bk horizon is light olive brown, yellowish brown, light yellowish brown, very pale brown, or brownish yellow. It is silty clay loam, clay loam, or clay. The content of clay ranges from 36 to 52 percent. The content of silicate clay ranges from 20 to 35 percent. The number of concretions, films, and threads of calcium carbonate ranges from common to many. The calcium carbonate equivalent ranges from 40 to 60 percent.

The BCk horizon, if it occurs, is pale yellow, yellowish brown, or light yellowish brown. It is silty clay loam, clay loam, or silt loam. The number of concretions and soft masses of calcium carbonate ranges from few to many.

Burleson Series

The Burleson series consists of very deep, moderately well drained, clayey soils on uplands and terraces. These soils formed in clayey sediments. Slopes are 0 to 1 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Farm Road 1227 and Texas Highway 6 south of Navasota, 1.3 miles west on Farm Road 1227, and 100 feet south of a right-of-way for a highway in a field:

A1—0 to 6 inches; black (10YR 2/1) clay, black (10YR 2/1) dry; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; slightly alkaline; gradual wavy boundary.

A2—6 to 42 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; common intersecting slickensides; pressure faces on surfaces of peds; moderately alkaline; gradual wavy boundary.

Bss1—42 to 60 inches; dark gray (10YR 4/1) clay; common streaks of dark grayish brown (2.5Y 4/2); weak medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

Bw2—60 to 81 inches; gray (10YR 5/1) clay; common medium distinct olive yellow (2.5Y 6/6) mottles; weak medium subangular structure; extremely hard, very firm, very sticky, very plastic; few intersecting slickensides; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C—81 to 95 inches; light gray (10YR 6/1) clay; common medium distinct brownish yellow (10YR 6/6) mottles; structureless; extremely hard, very firm, very sticky, very plastic; few concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 60 inches thick in the microdepressions and more than 30 inches thick in the microknolls. Slickensides extend to within 12 inches of the surface. During dry periods cracks as much as 2 inches wide extend from the surface to a depth of about 40 inches. Microdepressions and microknolls occur every 8 to 12 feet. The microknolls are 3 to 10 inches higher than the microdepressions.

The A horizon is very dark gray or black. Reaction ranges from moderately acid to moderately alkaline.

The Bw horizon is very dark gray, gray, grayish brown, dark gray, dark grayish brown, light gray, or light brownish gray. The number of distinct mottles in shades of brown, gray, and yellow ranges from few to many.

The C horizon, if it occurs, is light gray. It has mottles of light brownish gray or brownish yellow.

Burlewash Series

The Burlewash series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in tuffaceous shale and sandstone bedrock. Slopes range from 1 to 15 percent.

Typical pedon of Burlewash fine sandy loam, 5 to 12 percent slopes; from the intersection of Farm Road 244 and Texas Highway 30 in Carlos, 1.4 miles east on Texas Highway 30, and 100 feet south of a right-of-way for the highway in an area of woodland:

A—0 to 6 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; many roots and pores; slightly acid; abrupt wavy boundary.

Bt1—6 to 12 inches; brown (7.5YR 5/4) clay, light brown (7.5YR 6/4) dry; moderate medium subangular blocky structure, very hard, extremely firm, sticky, plastic; many medium roots and pores; common clay films on faces of peds; few sandstone pebbles; very strongly acid; clear smooth boundary.

Bt2—12 to 21 inches; brown (7.5YR 5/2) clay; few fine faint strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, extremely firm, sticky, plastic; many fine roots; few patchy clay films on faces of peds; few sandstone pebbles; very strongly acid; clear smooth boundary.

BC—21 to 25 inches; brown (10YR 5/3) clay; common medium distinct streaks of very pale brown (10YR 7/3); weak medium blocky structure; very hard, extremely firm, sticky, plastic; few fine roots; very strongly acid; abrupt smooth boundary.

Cr—25 to 60 inches; very pale brown (10YR 7/3) thinly bedded tuffaceous sandstone bedrock and light gray (10YR 7/1) shale; rock structure; very strongly acid.

The solum ranges from 20 to 40 inches in thickness. The content of siliceous pebbles ranges from 0 to 15 percent throughout.

The A horizon is light brownish gray, grayish brown, pale brown, brown, or dark grayish brown. Reaction ranges from very strongly acid to moderately acid.

The Bt and BC horizons are brown, strong brown, pinkish gray, or light brown. The Bt horizon is clay or sandy clay. The BC horizon is clay, sandy clay, loam, or sandy clay loam. Reaction of the Bt and BC horizons is extremely acid to strongly acid.

The Cr horizon consists of tuffaceous siltstone bedrock, sandstone bedrock, or shale. Colors are in shades of gray, brown, and yellow.

Carbengle Series

The Carbengle series consists of moderately deep, well drained, loamy soils on uplands. These soils formed in weakly cemented calcareous sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Carbengle clay loam, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Farm Road 2 east of Courtney, 2.6 miles east on Farm Road 2, and 100 feet south of the road in an area of rangeland:

A—0 to 12 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; few fine calcium carbonate films and threads; calcareous; moderately alkaline; clear smooth boundary.

Bk1—12 to 17 inches; dark grayish brown (10YR 4/2) clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine roots; few fine sandstone fragments; few soft masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk2—17 to 24 inches; yellowish brown (10YR 5/4) sandy clay loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky, slightly plastic; few fine roots; few fine sandstone fragments; common masses of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

Bk3—24 to 30 inches; yellowish brown (10YR 5/4) loam, light yellowish brown (10YR 6/4) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky, slightly plastic; few fine roots; few fine sandstone fragments; common masses of calcium carbonate; moderately alkaline; abrupt smooth boundary.

Cr—30 to 60 inches; stratified calcareous weakly cemented sandstone bedrock interbedded with loamy material; moderately alkaline; calcareous.

The solum ranges from 20 to 40 inches in thickness.

The A horizon ranges from 8 to 13 inches in thickness. It is very dark brown, dark brown, very dark grayish brown, or dark grayish brown. The number of concretions and soft masses of calcium carbonate ranges from few to common.

The B horizon is dark yellowish brown, grayish brown, dark grayish brown, yellowish brown, light olive brown, light yellowish brown, or light brownish gray. It is clay loam, sandy clay loam, or loam. The number of concretions, films, threads, and soft masses of calcium carbonate ramges from common to many.

The Cr horizon is cemented to strongly cemented sandstone bedrock that is interbedded with marl and loamy material. It can be cut with a spade or auger. Soft calcium carbonate is common in interbedded loamy layers.

Chazos Series

The Chazos series consists of very deep, moderately well drained, sandy soils on old stream terraces. These soils formed in ancient clayey and loamy alluvium. Slopes range from 1 to 8 percent.

Typical pedon of Chazos loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Farm Road 2 east of Courtney, 1.3 miles south on Texas Highway 6, about 1.1 miles west on West Road, and 0.2 mile south of the road in a pasture:

Ap—0 to 6 inches; pinkish gray (7.5YR 6/2) loamy fine sand, pinkish gray (7.5YR 7/2) dry; weak fine subangular blocky structure; soft, friable, nonsticky, nonplastic; many fine roots; slightly acid; abrupt smooth boundary.

E—6 to 15 inches; pinkish gray (7.5YR 7/2) loamy fine sand, pinkish white (7.5YR 8/2) dry; weak fine subangular blocky structure; soft, friable, nonsticky, nonplastic; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—15 to 27 inches; strong brown (7.5YR 5/6) clay, reddish yellow (7.5YR 6/6) dry; common medium distinct red (2.5YR 4/6) and grayish brown (10YR 5/2) mottles; moderate fine subangular blocky structure; very hard, very firm, sticky, plastic; few fine roots; many clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—27 to 52 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; many medium distinct red (2.5YR 4/6) and strong brown (7.5YR 5/2) mottles; strong medium subangular blocky structure; very hard, very firm, sticky, plastic; few fine roots; moderately acid; gradual smooth boundary.

Bt3—52 to 65 inches; red (2.5YR 4/6) clay, red (2.5YR 5/6) dry; common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; very hard, very firm, sticky, plastic; moderately alkaline; gradual smooth boundary.

BCt—65 to 90 inches; yellowish red (5YR 5/6) sandy clay loam, reddish yellow (5YR 6/6) dry; moderate medium angular blocky structure; hard, firm, slightly sticky, slightly plastic; many thin yellowish red (5YR 4/6) coatings on peds; moderately alkaline.

The solum ranges from 58 to more than 80 inches in

thickness. The content of rounded siliceous pebbles ranges from 0 to 5 percent, by volume.

The Ap horizon is dark grayish brown, brown, dark brown, pale brown, pinkish gray, or very dark grayish brown. The E horizon is brown, pinkish gray, or very pale brown. The combined thickness of the A and E horizons ranges from 10 to 15 inches. Reaction is moderately acid or slightly acid.

The Bt1 horizon is brown, red, reddish brown, yellowish red, or strong brown. It is mottled in shades of brown, gray, red, or yellow. It is clay, clay loam, or sandy clay. The content of clay ranges from 35 to 45 percent. Reaction is moderately acid or slightly acid.

The Bt2 and Bt3 horizons are brown, brownish yellow, dark grayish brown, strong brown, reddish brown, or red. They are mottled in shades of brown, gray, or red. They are clay, clay loam, or sandy clay. The content of clay ranges from 35 to 45 percent. Reaction ranges from moderately acid to moderately alkaline.

The BC horizon is red and yellowish red. It is mottled in shades of gray. It is sandy clay loam or clay loam. The content of clay ranges from 25 to 35 percent. Reaction ranges from moderately acid to moderately alkaline.

Conroe Series

The Conroe series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in thick, loamy, unconsolidated coastal plain sediment. Slopes range from 1 to 5 percent.

Typical pedon of Conroe loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 105 and Farm Road 1774 in Plantersville, 6.7 miles south on Farm Road 1774, about 0.05 mile southwest on a private road, 0.4 mile northwest and west on a private road, and 50 feet south of the road:

A—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; single grained; loose, nonsticky, nonplastic; many coarse roots; few nodules of ironstone; moderately acid; clear smooth boundary.

E—5 to 24 inches; light yellowish brown (10YR 6/4) gravelly loamy fine sand, pink (10YR 7/4) dry; single grained; loose, nonsticky, nonplastic; many coarse roots; about 20 percent nodules of ironstone; moderately acid; abrupt smooth boundary.

Bt1—24 to 30 inches; yellowish brown (10YR 5/6) clay, brownish yellow (10YR 6/6) dry; weak medium subangular blocky structure; very hard, very firm, sticky, slightly plastic; few fine roots; few nodules of ironstone; strongly acid; gradual smooth boundary.

Bt2—30 to 40 inches; yellowish brown (10YR 5/6) clay, brownish yellow (10YR 6/6) dry; common medium distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm, sticky, slightly plastic; few nodules of ironstone; strongly acid; gradual smooth boundary.

Btv1—40 to 60 inches; light gray (10YR 7/2) clay, white (10YR 8/2) dry; common medium distinct red (2.5YR 4/6) and reddish yellow (5YR 5/6) mottles; weak medium subangular blocky structure; very hard, very firm, sticky, slightly plastic; about 10 percent nodules of plinthite; strongly acid; gradual smooth boundary.

Btv2—60 to 74 inches; mottled light gray (10YR 7/1), reddish yellow (7.5YR 6/6), and red (2.5YR 4/6) clay; weak medium subangular blocky structure; very hard, very firm, sticky, slightly plastic; about 10 percent nodules of plinthite; strongly acid.

The combined thickness of the A and E horizons is 20 to 30 inches. They are loamy fine sand or gravelly loamy fine sand. Reaction ranges from very strongly acid to moderately acid. The A horizon is brown, dark grayish brown, grayish brown, or light brownish gray. The E horizon is light yellowish brown, light brown, pale brown, brownish yellow, light brownish gray, or grayish brown.

The Bt horizon is yellowish brown, brownish yellow, or reddish yellow. It has red mottles that increase in number with increasing depth. It is sandy clay or clay. The content of ironstone nodules ranges from 0 to 25 percent, by volume. Reaction is very strongly acid or strongly acid.

The Btv horizon is mottled in shades of red, brown, yellow, and gray. It is clay or sandy clay. The content of plinthite nodules ranges from 5 to 20 percent. Reaction is very strongly acid or strongly acid.

The Conroe soil in map unit CpC is outside the range defined for the series because because most of the original surface layer and subsurface layer have been removed by erosion. This difference, however, does not affect the use and management of the soil.

Crockett Series

The Crockett series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in alkaline clay and shale. Slopes range from 1 to 8 percent.

Typical pedon of Crockett fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Texas Highway 105 in Navasota, 0.8 mile north on Highway 6, and 100 feet east of a fence in an old field:

Ap—0 to 9 inches; dark brown (10YR 4/3) fine sandy

loam, brown (10YR 5/3) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine roots; many fine pores; moderately acid; abrupt smooth boundary.

Bt1—9 to 27 inches; dark brown (10YR 4/3) clay; many fine distinct yellowish brown (10YR 5/6) and red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; few thin clay films on faces of peds; neutral; gradual wavy boundary.

Bt2—27 to 42 inches; olive brown (2.5Y 4.4) clay; common fine distinct gray (10YR 5/1) and yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; common clay films on faces of peds; neutral; gradual wavy boundary.

Bt3—42 to 55 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; weak medium subangular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few fine concretions of calcium carbonate; slightly alkaline; gradual wavy boundary.

Ck—55 to 65 inches; light brownish gray (2.5Y 6/2) clay, white (2.5Y 8/2) dry; massive; hard, very firm, very sticky, very plastic; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness. The depth to carbonates is 42 to 60 inches. During dry periods the upper part of the subsoil has cracks that are 1 centimeter or more wide.

The A horizon is mainly less than 10 inches thick but may be as much as 15 inches thick. It is very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. Reaction ranges from moderately acid to neutral.

The Bt horizon is clay or sandy clay. The content of clay in the upper 20 inches is 40 to 50 percent. The Bt1 horizon is mottled in shades of yellow, brown, red, and gray. It is moderately acid to slightly alkaline. The Bt2 and Bt3 horizons are mainly shades of olive, yellow, and brown. The number of concretions of calcium carbonate ranges from few to many. Reaction ranges from slightly acid to moderately alkaline.

The C horizon is clay, sandy clay loam, or shale. It is calcareous in some pedons.

Cuero Series

The Cuero series consists of very deep, well drained, loamy soils on uplands. These soils formed in calcareous, loamy material weathered from sandstone bedrock. Slopes range from 1 to 5 percent.

Typical pedon of Cuero clay loam, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Farm Road 2988 south of Navasota, 1.8 miles east on Farm Road 2988, about 0.2 mile northeast on a county road, 0.3 mile east on a private road, 300 feet south along a fence, and 50 feet west of the fence in an old field:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; common fine pores; slightly acid; abrupt smooth boundary.

A—6 to 15 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; common fine pores; slightly acid; clear smooth boundary.

Bt1—15 to 23 inches; very dark brown (10YR 2/2) clay loam, very dark grayish brown (10YR 3/2) dry; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; common fine pores; slightly acid; clear smooth boundary.

Bt2—23 to 30 inches; dark brown (7.5YR 4/2) clay loam, brown (7.5YR 5/2) dry; common medium distinct strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; common fine roots; common fine pores; common thin clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—30 to 40 inches; yellowish red (5YR 4/6) clay loam, yellowish red (5YR 5/6) dry; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, firm, slightly sticky, slightly plastic; few fine roots; few fine pores; many thin clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt4—40 to 48 inches; yellowish brown (10YR 5/6) sandy clay loam, brownish yellow (10YR 6/6) dry; common medium distinct yellowish red (5YR 5/6) and few medium distinct gray (10YR 5/1) mottles; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few thin clay films on faces of peds; slightly acid; gradual smooth boundary.

BC—48 to 65 inches; strong brown (7.5YR 5/8) sandy clay loam, reddish yellow (7.5YR 6/8) dry; common medium distinct yellowish red (5YR 5/6) mottles; weak medium subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; slightly acid; gradual smooth boundary.

C—65 to 72 inches; brownish yellow (10YR 6/6) fine sandy loam, yellow (10YR 7/6) dry; few fine faint yellowish brown mottles; weak medium subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; slightly acid.

The dark A and B1 horizons have a combined thickness of 20 to 25 inches. The depth to films, threads, and soft masses of calcium carbonate ranges from 25 to 36 inches.

The A horizon is very dark brown, very dark grayish brown, or dark brown. Reaction ranges from slightly acid to slightly alkaline.

The Bt1 horizon is very dark brown, very dark grayish brown, or dark brown. It is sandy clay loam or clay loam. Reaction ranges from slightly acid to slightly alkaline.

The lower part of the Bt horizon and the BC horizon are dark brown, dark grayish brown, yellowish brown, brown, strong brown, yellowish red, or reddish brown. They are sandy clay loam or clay loam. Reaction is slightly alkaline or moderately alkaline. The number of films and threads of calcium carbonate ranges from few to common in the lower part of the horizon.

The C horizon is strong brown, brownish yellow, or reddish brown fine sandy loam or weakly cemented sandstone bedrock. Some pedons have layers of clay and clay loam interbedded with sandstone bedrock.

Depcor Series

The Depcor series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in unconsolidated loamy sediment (fig. 18). Slopes range from 1 to 8 percent.

Typical pedon of Depcor loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 1774 and Finke Road 5.2 miles south of Plantersville, 5.0 miles west on Finke Road, 300 feet north on Dyermill Road, and 200 feet west of the road:

A—0 to 7 inches; grayish brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; single grained; loose, nonsticky, nonplastic; many fine roots; slightly acid; clear smooth boundary.

E—7 to 28 inches; pale brown (10YR 6/3) loamy fine sand, very pale brown (10YR 7/3) dry; single grained; loose, nonsticky, nonplastic; many fine roots; slightly acid; clear smooth boundary.

Bt1—28 to 35 inches; brownish yellow (10YR 6/6) sandy clay loam, yellow (10YR 7/6) dry; few medium distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky, nonplastic; common clay films on faces of peds; many fine roots; very strongly acid; gradual smooth boundary.

Bt2—35 to 40 inches; brownish yellow (10YR 6/6) sandy clay loam, yellow (10YR 7/6) dry; common medium distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky, nonplastic; common clay films on faces of peds; few fine roots; few nodules of plinthite; very strongly acid; gradual smooth boundary.

Btv—40 to 60 inches; red (2.5YR 4/6) sandy clay loam, red (2.5YR 5/6) dry; common medium distinct dark yellowish brown (10YR 4/4) and few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky, nonplastic; few clay films on faces of peds; few fine roots; about 5 percent nodules of plinthite; very strongly acid.

The thickness of the solum ranges from 60 to 80 inches. The depth to horizons that have more than 5 percent plinthite is 25 to 40 inches. The number of nodules of ironstone ranges from few to common.

The combined thickness of the A and E horizons is 20 to 35 inches. The A horizon is brown, grayish brown, pale brown, dark brown, dark grayish brown, or dark yellowish brown. The E horizon is light brownish gray, pinkish gray, pale brown, light yellowish brown, or brown. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is yellowish brown, strong brown, or brownish yellow. The number of mottles in shades of yellow, brown, and red ranges from few to common. The content of clay ranges from 22 to 32 percent. Reaction ranges from very strongly acid to moderately acid.

The Btv horizon is mottled in shades of red, yellow, gray, or brown. It is sandy clay loam or clay loam. The content of plinthite ranges from 5 to 25 percent. Reaction ranges from very strongly acid to moderately acid.

Elmina Series

The Elmina series consists of deep, somewhat poorly drained, sandy soils on uplands. These soils formed in tuffaceous clay and sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Elmina loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 90 and Farm Road 244 north of Anderson, 1.4 miles north on Texas Highway 90, about 0.1 mile northeast on a private road, and 25 feet southeast in a pasture:

A—0 to 5 inches; dark grayish brown (10YR 4/2) loamy

fine sand, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; loose, very friable, nonsticky, nonplastic; many fine roots; slightly acid; clear smooth boundary.

E—5 to 22 inches; brown (10YR 5/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; loose, very friable, nonsticky, nonplastic; many fine roots; slightly acid; abrupt smooth boundary.

Bt1—22 to 28 inches; light brownish gray (10YR 6/2) sandy clay, light gray (10YR 7/2) dry; few medium prominent dark red (2.5YR 3/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm, sticky, plastic; common fine roots; strongly acid; gradual smooth boundary.

Bt2—28 to 55 inches; grayish brown (10YR 5/2) sandy clay, light brownish gray (10YR 6/2) dry; common medium prominent red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; extremely hard, very firm, sticky, plastic; few fine roots; strongly acid; gradual smooth boundary.

Cr—55 to 72 inches; light yellowish brown (10YR 6/4) sandy clay loam, very pale brown (10YR 7/4) dry; massive to platy rock structure; extremely hard, very firm; 20 to 30 percent tuffaceous clay fragments; very strongly acid.

A few siliceous pebbles are in some pedons, mainly in the upper part of the B horizon.

The combined thickness of the A and E horizons is 20 to 40 inches. The A horizon is dark grayish brown, grayish brown, dark brown, or brown. The E horizon is brown or pale brown. Reaction of the A and E horizons ranges from very strongly acid to slightly acid.

The Bt1 horizon is dark grayish brown, gray, grayish brown, or light brownish gray. It has mottles of strong brown or red. It is clay or sandy clay. Reaction is very strongly acid or strongly acid.

The Bt2 horizon is gray, grayish brown, light brownish gray, or light gray. It has mottles of reddish yellow, dark red, or red. It is clay or sandy clay. Reaction ranges from extremely acid to strongly acid.

The Cr horizon is tuffaceous clay and sandstone bedrock that is compact and weakly cemented.

Falba Series

The Falba series consists of moderately deep, moderately well drained, loamy soils on uplands. These soils formed in tuffaceous clay and sandstone bedrock. Slopes range from 1 to 5 percent.

Typical pedon of Falba fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 90 and Farm Road 149 in Anderson, 1.0 mile west on Farm Road 149, about 0.3 mile north-northwest on a dirt road, 300 feet west on a private road, and 50 feet south of the road:

Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; many fine and medium roots; slightly acid; abrupt smooth boundary.

Bt1—6 to 21 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; moderate medium angular blocky structure; extremely hard, very firm, sticky, plastic; many fine roots; slightly acid; clear smooth boundary.

Bt2—21 to 35 inches; light gray (10YR 7/2) clay, light gray (10YR 7/2) dry; few medium distinct grayish brown (10YR 5/2) streaks; moderate medium angular blocky structure; extremely hard, very firm, slightly sticky; very strongly acid; clear smooth boundary.

Cr—35 to 40 inches; white (5Y 8/1) sandstone bedrock; massive; slightly alkaline.

The solum ranges from 20 to 40 inches in thickness. During dry periods small cracks are at the surface.

The A horizon is less than 10 inches thick. It is dark grayish brown, grayish brown, or brown. Reaction ranges from strongly acid to slightly acid.

The B horizon is gray, dark gray, grayish brown, light brownish gray, or light gray. It is clay or clay loam. The content of clay ranges from 35 to 55 percent. Reaction ranges from very strongly acid to slightly acid. In some pedons the lower part of the B horizon has few medium distinct grayish brown streaks.

The Cr horizon is white, very pale brown, or light gray. It is interbedded clayey tuff, ash, sandstone bedrock, and siltstone bedrock. Reaction ranges from strongly acid to moderately alkaline.

Fetzer Series

The Fetzer series consists of very deep, somewhat poorly drained, sandy soils on uplands. These soils formed in loamy and clayey unconsolidated coastal plain sediment. Slopes range from 1 to 5 percent.

Typical pedon of Fetzer loamy fine sand, 1 to 5 percent slopes; from the intersection of Dyermill Road and Texas Highway 105 in Stoneham, 1.7 miles south on Dyermill Road, 0.8 mile east and 0.1 mile south in a subdivision, and 50 feet east of a road in an area of woodland:

A—0 to 6 inches; brown (10YR 5/3) loamy fine sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky,

nonplastic; many fine roots; moderately acid; abrupt smooth boundary.

E—6 to 25 inches; pale brown (10YR 6/3) loamy fine sand, very pale brown (10YR 7/3) dry; common fine faint yellowish brown mottles; slightly hard, very friable, nonsticky, nonplastic; many fine roots; moderately acid; clear smooth boundary.

Bt1—25 to 34 inches; mottled yellowish brown (10YR 5/4 and 5/8) and grayish brown (10YR 5/2) clay loam; moderate medium subangular blocky structure; hard, very firm, slightly sticky, slightly plastic; few fine roots; common clay films and dark stains on faces of peds; moderately acid; clear smooth boundary.

Bt2—34 to 48 inches; light brownish gray (10YR 6/2) sandy clay; many medium distinct yellowish brown (10YR 5/8) mottles; moderate medium subangular blocky structure; hard, very firm, slightly sticky, slightly plastic; few fine roots; few black concretions of ferrous manganese; moderately acid; gradual smooth boundary.

Bt3—48 to 58 inches; yellowish brown (10YR 5/8) sandy clay loam; common medium distinct grayish brown (10YR 5/2) and few fine distinct red (2.5YR 4/8) mottles; moderate medium subangular blocky structure; hard, very firm, slightly sticky, slightly plastic; few fine roots; slightly acid; gradual smooth boundary.

Bt4—58 to 65 inches; yellowish brown (10YR 5/6) sandy clay; many medium distinct light gray (10YR 6/1) mottles; weak medium subangular blocky structure; hard, very firm, sticky, plastic; slightly alkaline; gradual smooth boundary.

Bt5—65 to 75 inches; light gray (10YR 7/1) clay; common medium distinct yellowish brown (10YR 5/8) mottles; weak medium subangular blocky structure; hard, very firm, sticky, plastic; slightly alkaline.

The solum is more than 60 inches thick.

The combined thickness of the A and E horizons ranges from 20 to 40 inches. The A horizon is dark yellowish brown, pale brown, yellowish brown, or brown. The E horizon is pale brown, very pale brown, or pink. Reaction of the A and E horizons ranges from very strongly acid to slightly acid.

The Bt1 horizon is grayish brown, yellowish brown, or light brownish gray. It is mottled in shades of brown, yellow, and red. It is clay loam or sandy clay loam. The content of clay ranges from 30 to 35 percent. Reaction ranges from very strongly acid to moderately acid.

The lower part of the Bt horizon is prominently to distinctly mottled in shades of brown, gray, red, and yellow. It is clay, sandy clay, sandy clay loam, or clay loam. The content of clay averages 35 to 50 percent. Reaction ranges from strongly acid to slightly alkaline.

Flatonia Series

The Flatonia series consists of deep, moderately well drained, loamy soils on uplands. These soils formed in clayey tuffaceous material. Slopes range from 0 to 4 percent.

Typical pedon of Flatonia clay loam, 1 to 4 percent slopes; from the intersection of Texas Highway 30 and Texas Highway 90 in Roans Prairie, 0.6 mile east on Texas Highway 30, about 1.0 mile north on a county road, and 100 feet east of the road in a pasture:

A—0 to 6 inches; very dark gray (10YR 3/1) clay loam, gray (10YR 5/1) dry; moderate medium subangular blocky structure; very hard, very firm, sticky, plastic; common fine roots; slightly acid; clear smooth boundary.

Bt1—6 to 22 inches; very dark gray (10YR 3/1) clay, gray (10YR 5/1) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; common fine roots; few thin clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt2—22 to 32 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common medium distinct very dark gray (10YR 3/1) mottles; weak fine subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; common fine roots; few thin clay films on faces of peds; slightly acid; clear smooth boundary.

Bt3—32 to 45 inches; gray (10YR 5/1) clay, light gray (10YR 6/1) dry; weak fine subangular blocky structure; hard, firm, very sticky, very plastic; common fine roots; few lens of siltstone in the lower part; neutral; clear smooth boundary.

Cr—45 to 55 inches; weakly cemented light gray (10YR 7/2) siltstone bedrock; few fractures; neutral.

The solum ranges from 40 to 60 inches in thickness. During dry periods wide cracks extend to the surface. The mollic epipedon ranges from 20 to 35 inches in thickness.

The A horizon is 5 to 15 inches thick. It is very dark gray, very dark grayish brown, or black. Reaction is slightly acid or neutral.

The Bt1 horizon is very dark gray, very dark grayish brown, or black. It is clay. The content of clay ranges from 40 to 50 percent. Reaction is slightly acid or neutral.

The Bt2 and Bt3 horizons are gray, light gray, light brownish gray, or dark gray. They are mottled in shades of very dark gray, brown, and yellowish brown. The

content of clay ranges from 40 to 50 percent. Reaction ranges from slightly acid to moderately alkaline.

The Cr horizon is gray, light gray, white, or light brownish gray weakly cemented siltstone bedrock that can be crushed to silty clay loam or silty clay. Reaction ranges from neutral to moderately alkaline.

Frelsburg Series

The Frelsburg series consists of very deep, moderately well drained, clayey soils on uplands. These soils formed in weakly consolidated calcareous clays and marls (fig. 19). Slopes range from 1 to 5 percent.

Typical pedon of Frelsburg clay, 1 to 5 percent slopes; from the intersection of Texas Highway 90 and Farm Road 149 in Anderson, 0.7 mile north on Texas Highway 90, about 1,200 feet west to a field, and 100 feet west in the field:

Ap—0 to 10 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) dry; moderate medium granular structure; extremely hard, very firm, very sticky, very plastic; common roots; calcareous; moderately alkaline; clear wavy boundary.

Bss—10 to 32 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common roots; intersecting slickensides; few concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bssk1—32 to 52 inches; grayish brown (2.5Y 5/2) clay, light brownish gray (2.5Y 6/2) dry; common fine faint streaks of light olive brown; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few roots; intersecting slickensides; common concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Bssk2—52 to 70 inches; olive yellow (2.5Y 6/6) clay, yellow (2.5Y 7/6) dry; common medium distinct light brown (7.5YR 6/4) mottles and very dark gray (10YR 3/1) vertical streaks; massive; extremely hard, very firm, very sticky, very plastic; intersecting slickensides; common concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 40 inches thick in the microknolls and more than 60 inches thick in the microdepressions. Intersecting slickensides extend from the Ap horizon to the solum. They are at an angle of 30 to 60 degrees. During dry periods cracks as much as 3 inches wide extend from the surface to a depth of 40 inches or more. Microdepressions and microknolls occur every 5 to 10 feet. In uncultivated areas the microknolls are 3 to 8 inches higher than the microdepressions.

The Ap horizon is black or very dark gray.

The B horizon is grayish brown, pale olive, dark gray, olive yellow, grayish brown, light yellowish brown, light olive gray, or pale yellow.

Gibbonscreek Series

The Gibbonscreek series consists of very deep, well drained, loamy soils on uplands. These soils formed in spoil material derived from lignite mines. Slopes range from 1 to 20 percent.

Typical pedon of Gibbonscreek clay loam, 1 to 5 percent slopes; from the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 2.6 miles west on Texas Highway 30, about 2.1 miles south on a county road, and 1,500 feet east of the road in a pasture:

Ap—0 to 8 inches; light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; common medium distinct olive (5Y 4/3) and brown (10YR 5/3) mottles; weak fine granular and weak thin platy structure; hard, firm, sticky, plastic; many fine roots; few fine fragments of lignite or carbonaceous shale; common fine and medium fragments of weakly cemented siltstone and glauconite; electrical conductivity is 3.0 mmhos/cm; slightly acid; clear wavy boundary.

C1—8 to 17 inches; light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; common medium distinct mottles and fragments of dark brown (10YR 4/3) and olive (5Y 4/3); massive; hard, firm, sticky, plastic; few fine roots; few fine fragments of lignite; common fine and medium fragments of weakly cemented siltstone and glauconite; electrical conductivity is 2.6 mmhos/cm; moderately acid; clear wavy boundary.

C2—17 to 80 inches; light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; massive; hard, firm, sticky, plastic; few fine and medium fragments of lignite; common medium and large fragments of weakly cemented sandstone and olive (5Y 4/3) glauconite; electrical conductivity is 2.3 mmhos/cm; neutral.

The rooting depth is more than 80 inches. Reaction is mainly slightly acid or neutral but ranges from strongly acid to moderately alkaline. The content of rock fragments and gravel ranges from 0 to 5 percent. Fragments of lignite and carbonaceous shale are commonly less than 3 inches in size. The content of these fragments ranges from 0 to 5 percent.

The A horizon is light gray, gray, dark gray, grayish brown, light brownish gray, light yellowish brown, light

olive brown, olive gray, or olive. It is clay loam. The number of lighter and darker fragments ranges from few to many. Some pedons have small fragments of iron pyrite.

The C horizon is light gray, gray, dark gray, grayish brown, light brownish gray, light yellowish brown, light olive brown, olive gray, or olive. It is clay loam, silty clay loam, sandy clay loam, silty clay, or clay. The content of clay in the control section ranges from 20 to 35 percent. The number of mottles in shades of red, yellow, brown, and gray ranges from none to few. The content of fragments of siltstone and sandstone ranges from 0 to 15 percent. The exchangeable sodium percentage ranges from 5 to 12 percent. The electrical conductivity ranges from 1 to 4 millimhos per centimeter.

Gladewater Series

The Gladewater series consists of very deep, somewhat poorly drained, clayey soils on flood plains. These soils formed in clayey sediment. Slopes are 0 to 1 percent.

Typical pedon of Gladewater clay, frequently flooded; from the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 6.7 miles north on Farm Road 244, about 1.4 miles west on a private road, 1.9 miles south and 1.7 miles west on a subdivision road, and 50 feet north of the road in a pasture:

A—0 to 8 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; many fine roots; slightly acid; clear wavy boundary.

Bg—8 to 25 inches; light brownish gray (10YR 6/2) clay; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common roots; moderately acid; gradual wavy boundary.

Bgss1—25 to 35 inches; light gray (10YR 6/1) clay; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common large slickensides; moderately acid; gradual wavy boundary.

Bgss2—35 to 60 inches; gray (10YR 5/1) clay; common fine distinct dark yellowish brown (10YR 4/4) mottles; weak coarse blocky structure; extremely hard, very firm, very sticky, very plastic; common large slickensides; slightly acid.

During dry periods cracks that are 0.5 inch to 2 inches wide are at a depth of 15 to 35 inches. Reaction ranges from very strongly acid to slightly acid throughout.

The A horizon is dark gray, gray, or dark brown. It has few or common, faint to distinct mottles of brown or dark grayish brown.

The Bg horizon is light brownish gray, grayish brown, light gray, or gray. It has mottles of brown or yellowish brown.

The Bgss horizon is grayish brown, gray, light gray, or light brownish gray. The number of yellowish brown and brown mottles ranges from few to common.

Gomery Series

The Gomery series consists of deep, somewhat poorly drained, sandy soils on uplands. These soils formed in loamy material weathered from sandstone bedrock. Slopes range from 1 to 5 percent.

Typical pedon of Gomery loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 3.5 miles east on Texas Highway 30, about 0.6 mile north on a county road, and 100 feet west of the road in a forest:

A—0 to 6 inches; grayish brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; single grained; loose, nonsticky, nonplastic; common fine roots; slightly acid; clear smooth boundary.

E—6 to 30 inches; light brownish gray (10YR 6/2) loamy fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky, nonplastic; common fine roots; slightly acid; abrupt smooth boundary.

Btg1—30 to 35 inches; grayish brown (10YR 5/2) sandy clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, very firm, slightly sticky, slightly plastic; few fine roots; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btg2—35 to 45 inches; grayish brown (10YR 5/2) sandy clay loam; common medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, extremely firm, slightly sticky, slightly plastic; few fine roots; patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

Btg3—45 to 59 inches; gray (10YR 5/1) sandy clay loam; common medium distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, extremely firm, slightly sticky, slightly plastic; few fine roots; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

Cr—59 to 65 inches; brown (10YR 5/3) weakly cemented sandstone bedrock; rock structure;

extremely hard, extremely firm; very strongly acid.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is dark grayish brown, very dark grayish brown, grayish brown, or brown. Reaction ranges from very strongly acid to slightly acid.

The E horizon is light brownish gray, very pale brown, brown, pale brown, or light yellowish brown. Reaction ranges from very strongly acid to slightly acid.

The Bt horizon is light brownish gray, grayish brown, dark grayish brown, dark gray, gray, or light gray. It has many brownish and reddish mottles. It is clay loam or sandy clay loam. Reaction ranges from very strongly acid to moderately acid.

The Cr horizon is stratified soft shale and clay or weakly to strongly cemented sandstone bedrock.

Gowker Series

The Gowker series consists of very deep, moderately well drained, loamy soils on flood plains along small streams. These soils formed in loamy and clayey alluvial sediments. Slopes are 0 to 1 percent.

Typical pedon of Gowker clay loam, frequently flooded; from the intersection of Farm Road 3090 and Farm Road 149 west of Anderson, 3.5 miles west and north on Farm Road 3090, and 300 feet south of the bridge over Rocky Creek in a pasture:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; hard, friable, sticky, plastic; many roots and pores; slightly acid; clear smooth boundary.

A2—8 to 24 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak fine subangular blocky structure; hard, friable, sticky, plastic; many roots and pores; slightly acid; abrupt smooth boundary.

C1—24 to 28 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; structureless; extremely hard, extremely firm, very sticky, very plastic; common fine roots; bedding planes; slightly acid; abrupt smooth boundary.

C2—28 to 60 inches; gray (10YR 5/1) clay loam that has strata of light brownish gray (10YR 6/2) and dark yellowish brown (10YR 4/4) fine sandy loam; few fine roots; bedding planes; neutral.

Reaction is neutral to moderately acid throughout.

The A horizon is 22 to 40 inches thick. It is very dark grayish brown, very dark brown, very dark gray, black, or dark brown. It is loam or clay loam. Some pedons have brownish and grayish mottles in the lower part.

The C horizon is light brownish gray, grayish brown, dark grayish brown, gray, dark gray, very dark gray, or brown. It is clay, clay loam, or sandy clay loam that has strata of fine sandy loam, loam, or loamy fine sand.

The Gowker soil in map unit Go is outside the range defined for the series because it is calcareous in most layers and because it has slightly better drainage and permeability. These differences, however, do not affect the use and management of the soil.

Gredge Series

The Gredge series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in clayey and loamy sediments. Slopes range from 1 to 12 percent.

Typical pedon of Gredge fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 6.7 miles north on Farm Road 244, about 1.4 miles west on a private road, 2.0 miles southwest on a private road, 0.2 mile west on a private road, and 100 feet south of the road in an area of rangeland:

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; very hard, very firm, nonsticky, nonplastic; many fine roots; few siliceous fragments of gravel; moderately acid; abrupt wavy boundary.

Bt1—7 to 15 inches; brown (7.5YR 5/4) clay, light brown (7.5YR 6/4) dry; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; many fine roots; few siliceous pebbles; clay films on faces of peds; strongly acid; gradual wavy boundary.

Bt2—15 to 25 inches; light yellowish brown (10YR 6/4) clay, very pale brown (10YR 7/4) dry; common medium distinct light brownish gray (10YR 6/2) mottles; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; few patchy clay films on faces of peds; slightly acid; gradual wavy boundary.

Bt3—25 to 31 inches; light brownish gray (10YR 6/2) clay, light gray (10YR 7/2) dry; common medium distinct brownish yellow (10YR 5/4) mottles; moderate coarse angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; moderately alkaline; clear smooth boundary.

BC1—31 to 45 inches; light brownish gray (10YR 6/2) clay loam, light gray (10YR 7/2) dry; common medium distinct brownish yellow (10YR 5/4) mottles; weak coarse subangular blocky structure; hard, firm, very sticky, very plastic; moderately alkaline; gradual boundary.

Figure 16.—Profile of Brazoria clay.

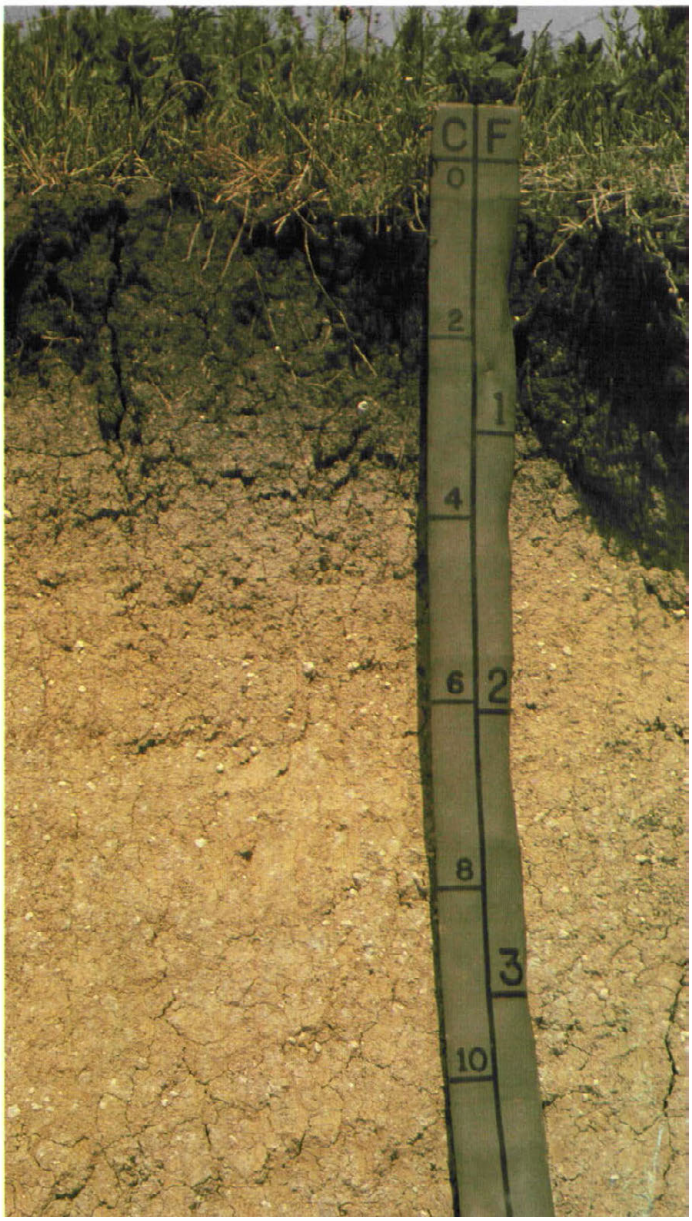

Figure 17.—Profile of Brenham clay loam.

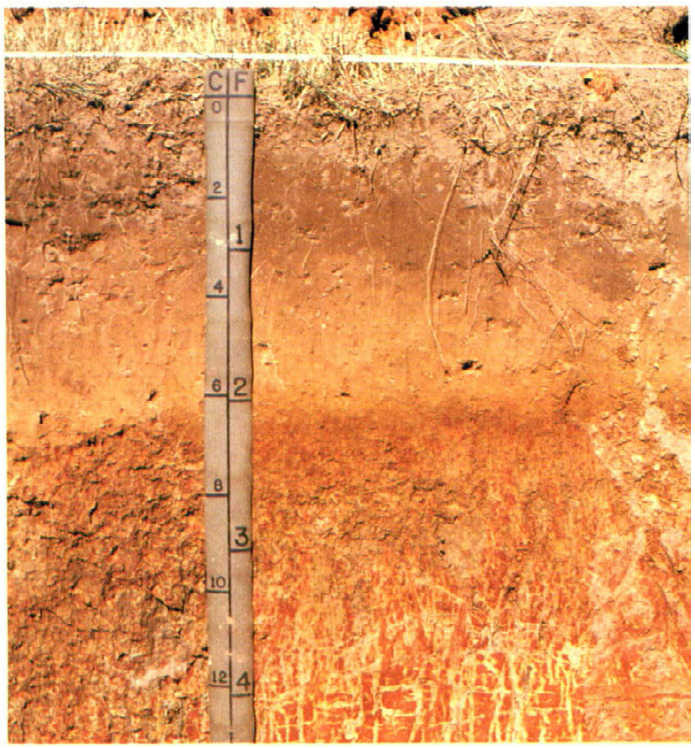

Figure 18.—Profile of Depcor loamy fine sand.

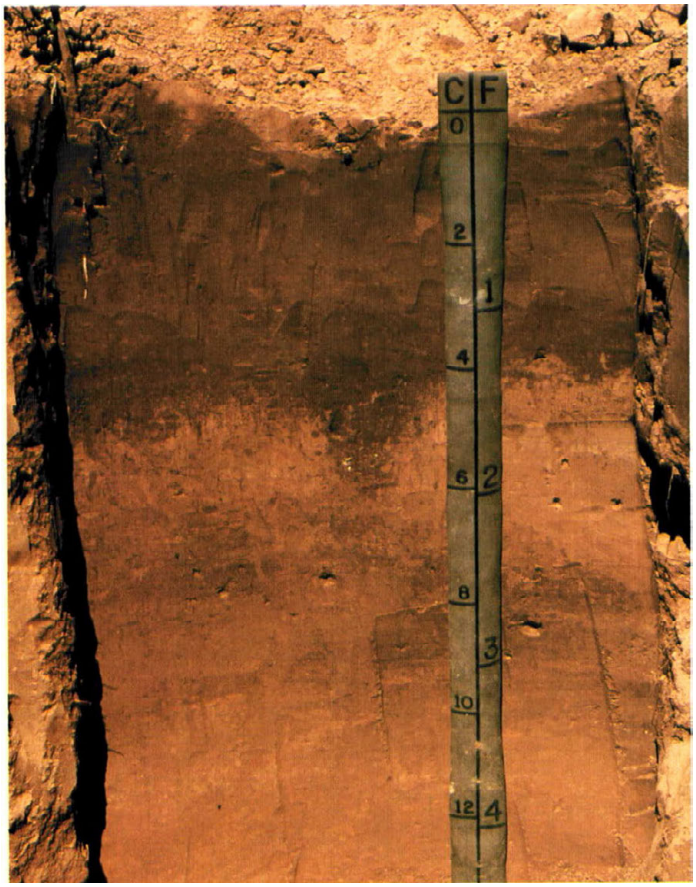

Figure 19.—Profile of Norwood silt loam.

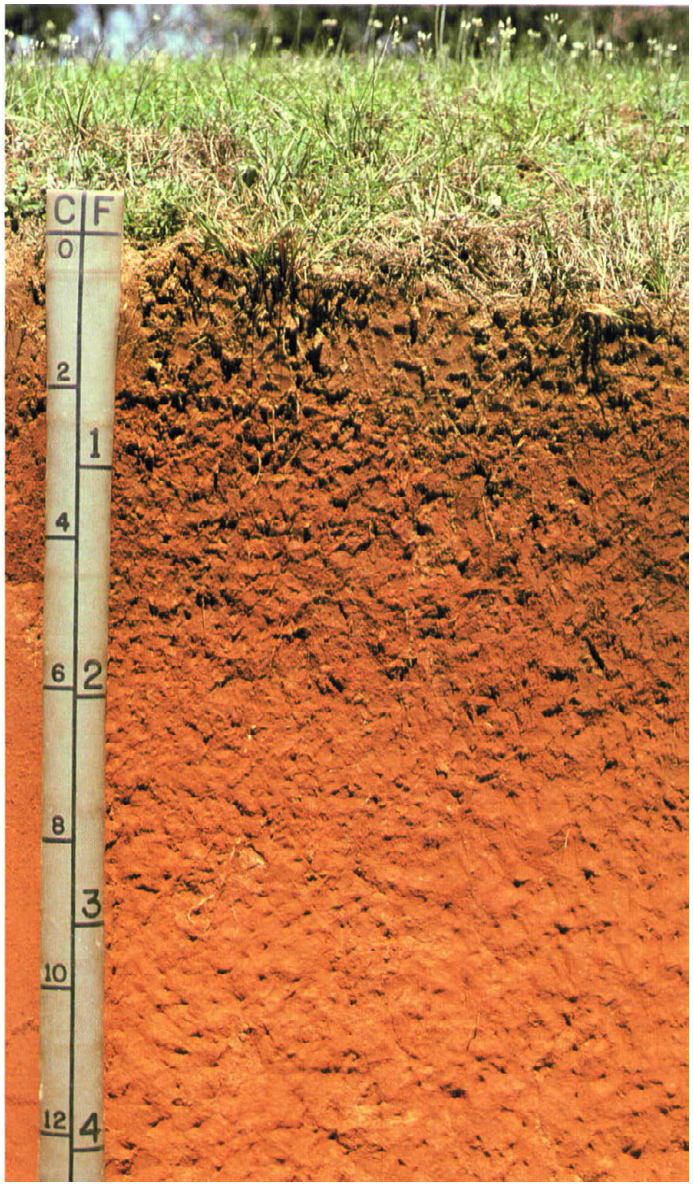

Figure 20.—Profile of Silawa loamy fine sand.

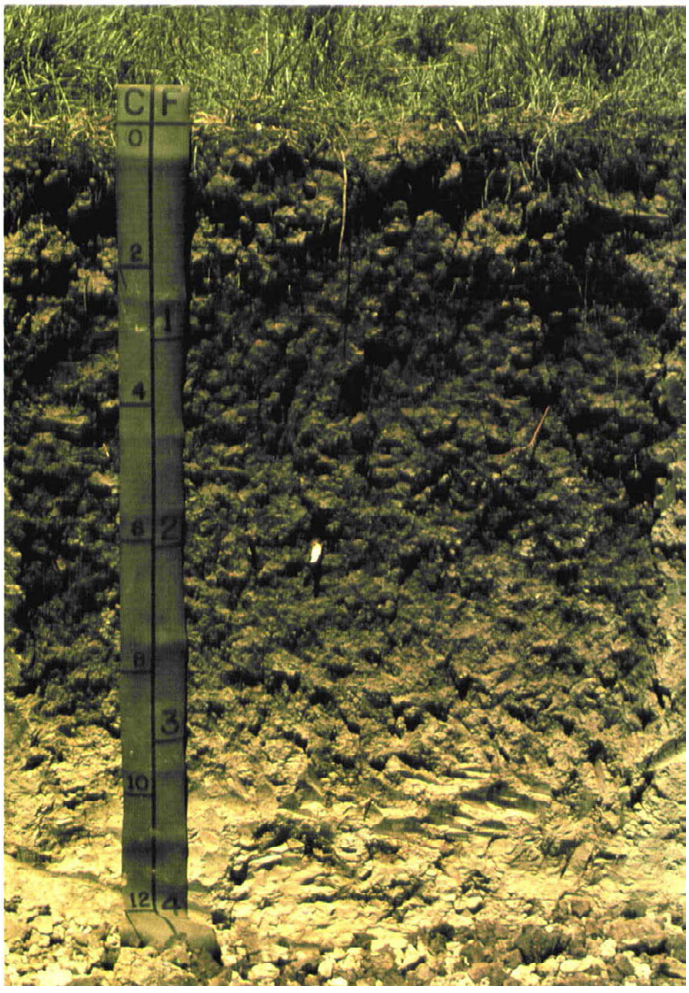

Figure 21.—Profile of Singleton fine sandy loam.

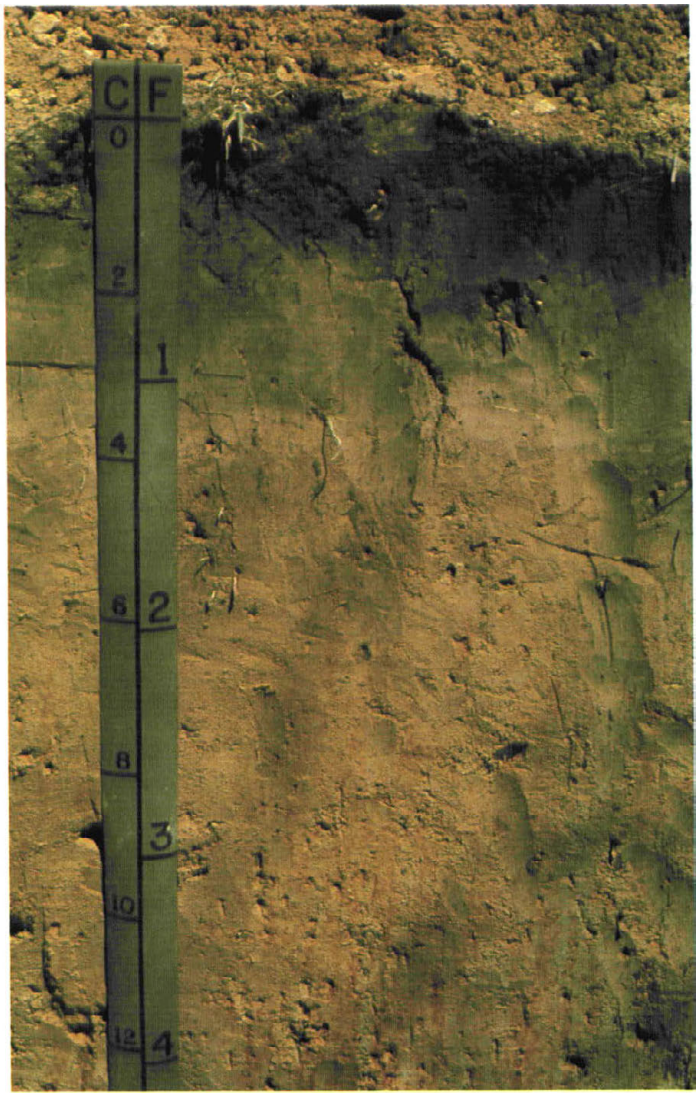

Figure 22.—Profile of Splendora fine sandy loam.

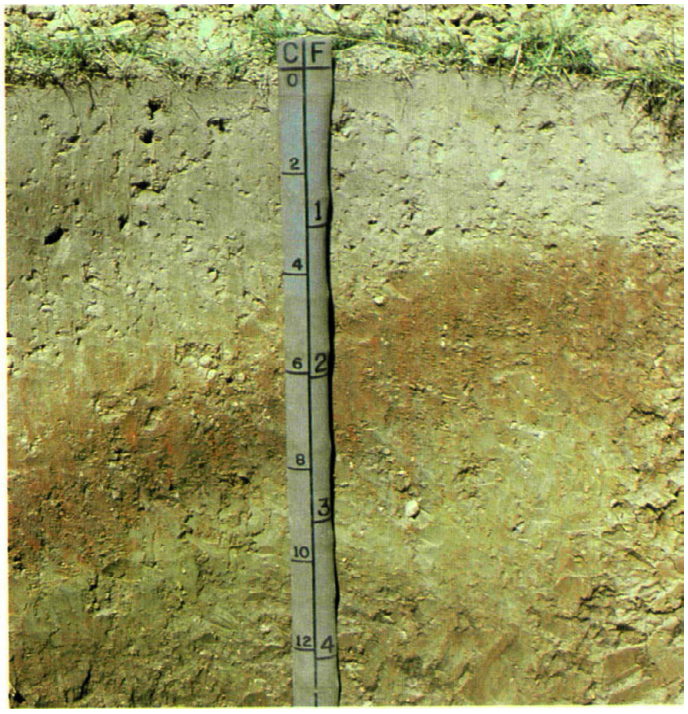

Figure 23.—Profile of Tabor fine sandy loam.

BC2—45 to 60 inches; very pale brown (10YR 7/4) and light gray (10YR 7/2) sandy clay loam; weak coarse subangular blocky structure; hard, firm, sticky, plastic; moderately alkaline.

The solum ranges from 60 to 80 inches in thickness. The combined thickness of the A and E horizons is less than 10 inches but may be as much 15 inches. The A horizon is dark grayish brown, light brownish gray, dark brown, pale brown, or grayish brown. The E horizon is brown, grayish brown, very pale brown, light yellowish brown, or pale brown. Reaction of the A and E horizons is very strongly acid to slightly acid.

The Bt horizon is red, yellowish red, reddish brown, or light brownish gray. It is mottled in shades of yellow, red, gray, or brown. It is clay or clay loam. The content of clay ranges from 35 to 50 percent. Reaction is very strongly acid or strongly acid.

The BC horizon is mottled in shades of brown, red, yellow, or gray. It is sandy clay loam, clay, or clay loam. Reaction ranges from moderately acid to moderately alkaline. Some pedons have concretions of calcium carbonate.

The C horizon has strata of red, gray, or brown. It is sandy clay loam, clay loam, fine sandy loam, or loamy fine sand. Some pedons have shale that has a texture of clay. Some pedons have concretions of calcium carbonate. Reaction ranges from slightly acid to moderately alkaline.

Greenvine Series

The Greenvine series consists of moderately deep, moderately well drained, clayey soils on uplands. These soils formed in tuffaceous clay and siltstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Greenvine clay, 1 to 5 percent slopes; from the intersection of Farm Road 3090 and Farm Road 149 west of Anderson, 0.75 mile south on Farm Road 3090, about 0.2 mile west on a private road, and 100 feet west in a cultivated field:

AP—0 to 5 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; fine granular structure; very hard, very firm, very sticky, very plastic; common fine roots; calcareous; moderately alkaline; abrupt wavy boundary.

A—5 to 15 inches; very dark gray (10YR 3/1) clay, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; calcareous; moderately alkaline; gradual wavy boundary.

Bss—15 to 30 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; streaks of light brownish gray (10YR 6/2); moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; intersecting slickensides; calcareous; moderately alkaline; clear wavy boundary.

Cr—30 to 60 inches; light brownish gray (10YR 6/2) interbedded tuffaceous clays; calcareous; moderately alkaline.

The solum ranges from 25 to 40 inches in thickness. During dry periods cracks that are 1 to 2 inches wide extend from the surface to the Cr horizon. Carbonates extend from the surface to the depth of the paralithic contact.

The A horizon ranges from 3 to 26 inches in thickness. It has moist colors of black, dark gray, or very dark gray. Reaction is neutral to moderately alkaline.

The Bw horizon has moist colors of gray, dark gray, or very dark gray. If streaks occur, they are grayish brown, light brownish gray, light gray, very pale brown, or white. Reaction is slightly alkaline or moderately alkaline.

The Cr horizon ranges from clayey tuff or shale that has a texture of clay to siltstone bedrock or fine grained sandstone bedrock. Reaction is slightly alkaline or moderately alkaline.

Hatliff Series

The Hatliff series consists of very deep, moderately well drained, loamy soils on flood plains along local creeks and drainageways. These soils formed in loamy and sandy alluvium. Slopes are 0 to 1 percent.

Typical pedon of Hatliff fine sandy loam, frequently flooded; from the intersection of Texas Highway 6 and Texas Highway 105 in Navasota, 3.6 miles east on Texas Highway 105, and 300 feet north of the highway on a wooded flood plain:

A—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; many roots; strong brown stains along root channels; slightly acid; abrupt smooth boundary.

C1—6 to 24 inches; brown (7.5YR 5/2) fine sandy loam, pinkish gray (7.5YR 6/2) dry; common fine distinct gray (10YR 5/1) and strong brown (7.5YR 5/6) mottles; slightly hard, friable, nonsticky, nonplastic; many roots; thin bedding planes; slightly acid; abrupt smooth boundary.

C2—24 to 28 inches; grayish brown (10YR 5/2) fine sandy loam, thin strata of yellowish brown (10YR 5/6) loamy fine sand; slightly hard, friable,nonsticky,

nonplastic; common fine roots; bedding planes; slightly acid; abrupt smooth boundary.

C3—28 to 42 inches; pale brown (10YR 6/3) loamy fine sand; few medium distinct strong brown (7.5YR 5/6) and light gray (10YR 7/2) mottles; few strong brown stains along root channels; common thin strata of fine sandy loam; loose, very friable, nonsticky, nonplastic; common fine roots; slightly acid; abrupt smooth boundary.

C4—42 to 50 inches; light brownish gray (10YR 6/2) fine sandy loam; common medium distinct dark yellowish brown (10YR 4/4) and gray (10YR 5/1) mottles; common thin strata of pale brown loamy fine sand; slightly hard, very friable, nonsticky, nonplastic; common fine roots; slightly acid; abrupt smooth boundary.

C5—50 to 65 inches; light gray (10YR 7/2) loamy sand, thin strata of loamy fine sand; common medium distinct dark yellowish brown (10YR 5/4) mottles; loose, very friable, nonsticky, nonplastic; slightly acid; abrupt smooth boundary.

C6—65 to 72 inches; dark grayish brown (10YR 4/2) loam; common medium distinct strong brown (7.5YR 5/6) mottles; slightly hard, firm; few fine roots; slightly acid.

Reaction ranges from strongly acid to neutral throughout.

The A horizon is 5 to 14 inches thick. It is grayish brown, light brownish gray, dark grayish brown, very dark grayish brown, gray, or dark gray. It has strong brown or yellowish brown mottles.

The C horizon is brown, grayish brown, pale brown, light brownish gray, light gray, dark grayish brown, or yellowish brown. It has common mottles of grayish brown, light brownish gray, or dark gray. It is fine sandy loam and loamy fine sand that has a few thin strata of loam or sandy clay loam. The content of clay in the 10- to 40-inch control section averages 8 to 18 percent.

Huntsburg Series

The Huntsburg series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in clayey and loamy sediments (fig. 20). Slopes range from 1 to 8 percent.

Typical pedon of Huntsburg loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 2445 and Farm Road 1774 about 5.6 miles north of Plantersville, 1.0 mile north on Farm Road 1774, about 3.5 miles east on a county road, and 50 feet north of the road in an area of woodland:

A—0 to 5 inches; grayish brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; common roots and pores; slightly acid; clear smooth boundary.

E—5 to 11 inches; light gray (10YR 7/2) loamy fine sand, white (10YR 8/2) dry; weak fine subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; common roots and pores; slightly acid; abrupt smooth boundary.

Bt1—11 to 16 inches; yellowish brown (10YR 5/8) clay; common medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; extremely hard, very firm, nonsticky, nonplastic; few fine roots; thin patchy clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—16 to 40 inches; light gray (10YR 7/1) clay; common medium distinct red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; very hard, very firm, nonsticky, nonplastic; thin patchy clay films on faces of peds; few fine roots; very strongly acid; gradual smooth boundary.

Bt3—40 to 55 inches; light gray (10YR 7/1) sandy clay; common medium prominent strong brown (7.5YR 5/6) mottles; moderate medium subangular blocky structure; very hard, very firm, sticky, plastic; few fine roots; few nodules of plinthite; few patchy clay films on faces of peds; very strongly acid; gradual smooth boundary.

Bt4—55 to 65 inches; white (10YR 8/2) sandy clay; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, firm, sticky, plastic; few fine roots; few nodules of plinthite; strongly acid.

The solum is more than 60 inches thick. The content of plinthite nodules ranges from 0 to 10 percent, by volume.

The A horizon is grayish brown, brown, very dark gray, dark gray, dark grayish brown, or gray. The E horizon is brown, grayish brown, gray, light gray, light brownish gray, pale brown, or white. Reaction of the A and E horizons is moderatately acid or slightly acid. The content of ironstone nodules ranges from 0 to 5 percent.

The Bt1 horizon is yellowish brown or dark yellowish brown. It is mottled in shades of red, dark red, yellowish red, or brown. The other Bt horizons are light gray or light brownish gray. They have mottles of red, brown, and yellow. They are clay, sandy clay, or clay loam. Reaction is very strongly acid or strongly acid.

Kaman Series

The Kaman series consists of very deep, poorly drained, clayey soils on flood plains. These soils formed

in thick clayey alluvial sediments. Slopes are mainly less than 1 percent.

Typical pedon of Kaman clay, frequently flooded; from the intersection of Farm Road 1486 and Farm Road 2819 south of Richards, 1.4 miles west and south on Farm Road 2819, and 200 feet west of the road in a native pasture:

A1—0 to 15 inches; very dark gray (10YR 3/1) clay, very dark grayish brown (10YR 3/2) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; common roots; slightly alkaline; clear smooth boundary.

A2—15 to 24 inches; black (10YR 2/1) clay, very dark brown (10YR 2/2) dry; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few roots; common pressure faces; few slickensides; mildly alkaline; clear smooth boundary.

Bss—24 to 60 inches; black (10YR 2/1) clay, very dark brown (10YR 2/2) dry; weak medium subangular blocky structure; extremely hard, firm, very sticky, very plastic; few roots; common pressure faces; common slickensides; slightly alkaline.

Reaction ranges from moderately acid to slightly alkaline throughout. Some pedons are calcareous below a depth of 30 inches.

The A horizon is black or very dark gray.

Some pedons have Bg or Cg horizons. These horizons are very dark gray, dark gray, or gray. They have yellowish brown and brownish yellow mottles. They are clay or silty clay.

The Kaman soil is outside the range defined for the series because it has low values that are at a depth of more than 48 inches. This difference, however, does not affect the use and management of the soil.

Klump Series

The Klump series consists of very deep, well drained, loamy soils on uplands. These soils formed in loamy material weathered from sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Klump sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Farm Road 2988 south of Navasota, 1.8 miles east on Farm Road 2988, about 0.2 mile northeast on a county road, 0.1 mile east on a private road, and 50 feet south in a pasture:

Ap—0 to 6 inches; dark brown (7.5YR 3/2) sandy loam, dark brown (7.5YR 4/2) dry; single grained; slightly hard, friable, nonsticky, nonplastic; many fine and medium roots; slightly acid; abrupt smooth boundary.

A—6 to 12 inches; dark brown (7.5YR 3/2) sandy loam, dark brown (7.5YR 4/2) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; common fine roots; slightly acid; clear smooth boundary.

Bt1—12 to 24 inches; dark brown (7.5YR 3/4) sandy clay loam, dark brown (7.5YR 4/4) dry; coarse medium subangular blocky structure; hard, friable, nonsticky, nonplastic; few fine roots; slightly acid; gradual smooth boundary.

Bt2—24 to 45 inches; strong brown (7.5YR 5/6) sandy clay loam, reddish yellow (7.5YR 6/6) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; slightly acid; clear smooth boundary.

C—45 to 60 inches; brownish yellow (10YR 6/6) fine sandy loam, yellow (10YR 7/6) dry; single grained; hard, firm, nonsticky, nonplastic; few sandstone fragments; few fine concretions of calcium carbonate; neutral.

The thickness of the solum ranges from 40 to 60 inches. Some pedons may have a few sandstone fragments throughout the solum.

The A and Ap horizons are dark brown or very dark grayish brown. Reaction ranges from moderately acid to neutral.

The Bt horizon is strong brown, dark brown, yellowish red, or brown. It is sandy clay loam or clay loam. The content of clay ranges from 20 to 35 percent. Reaction ranges from moderately acid to neutral.

The C horizon is brownish yellow, light yellowish brown, or yellow. It ranges from fine sandy loam to sand. Reaction ranges from moderately acid to slightly alkaline.

Knolle Series

The Knolle series consists of very deep, well drained, sandy soils on uplands. These soils formed in thick beds of sandy and loamy materials weathered from sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Knolle loamy sand, 1 to 5 percent slopes; from the intersection of Farm Road 2988 and Texas Highway 6 south of Navasota, 0.9 mile north on Texas Highway 6, about 0.1 mile east on a private road, and 300 feet northeast in a pasture:

Ap—0 to 8 inches; brown (10YR 5/3) loamy sand, pale brown (10YR 6/3) dry; weak fine subangular blocky structure; loose, nonsticky, nonplastic; common roots; slightly acid; abrupt smooth boundary.

A—8 to 15 inches; brown (10YR 5/3) loamy sand, pale brown (10YR 6/3) dry; weak fine subangular blocky

structure; loose, nonsticky, nonplastic; common roots; slightly acid; clear wavy boundary.
Bt1—15 to 28 inches; strong brown (7.5YR 5/6) sandy clay loam, reddish yellow (7.5YR 6/6) dry; common medium distinct dark brown (7.5YR 4/2) mottles; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine roots; common clay films on faces of peds; moderately acid; gradual wavy boundary.
Bt2—28 to 40 inches; yellowish red (5YR 5/6) sandy clay loam, reddish yellow (5YR 6/6) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few roots; patchy clay films on faces of peds; strongly acid; gradual wavy boundary.
Bt3—40 to 55 inches; reddish brown (5YR 5/4) sandy clay loam, light reddish brown (5YR 6/4) dry; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; few fine roots; few patchy clay films on faces of peds; moderately acid; gradual wavy boundary.
C—55 to 70 inches; strong brown (7.5YR 5/6) sandy loam; single grained; loose, very friable, nonsticky, nonplastic; moderately acid.

The solum ranges from 40 to 60 inches in thickness.

The A and Ap horizons are brown, grayish brown, dark grayish brown, very dark grayish brown, or dark brown. Reaction ranges from moderately acid to neutral.

The Bt1 horizon is reddish brown, dark reddish brown, strong brown, or dark brown. It has common or many mottles of reddish brown, dark reddish brown, strong brown, dark brown, red, and grayish brown. The Bt2 and Bt3 horizons are yellowish brown, brownish yellow, reddish yellow, yellowish red, or reddish brown. The number of mottles of brownish yellow and yellowish brown ranges from none to common. The Bt horizon is sandy clay loam, loam, or sandy loam. Reaction ranges from strongly acid to slightly acid.

The C horizon is strong brown or reddish yellow. It is sandy clay loam, loam, or sandy loam. Reaction ranges from strongly acid to slightly acid.

Koether Series

The Koether series consists of shallow, somewhat excessively drained, sandy soils on uplands. These soils formed in strongly cemented sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Koether stony loamy sand in an area of Koether-Rock outcrop complex, 1 to 8 percent slopes; from the intersection of Texas Highway 30 and Texas Highway 90 in Roans Prairie, 2.1 miles west on Texas Highway 30, about 0.1 mile north and east on a county road, and 100 feet north of the road in an area of rangeland:

A—0 to 12 inches; dark grayish brown (10YR 4/2) stony loamy sand, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; loose, nonsticky, nonplastic; about 40 percent, by volume, sandstone fragments about 6 inches wide, 12 inches long, and 2 inches thick; common roots and pores; moderately acid; abrupt smooth boundary.
R—12 to 30 inches; pale yellow (2.5Y 7/4) fractured sandstone bedrock interbedded with thin layers of light yellowish brown (2.5Y 6/4) shale that has a texture of clay; structureless; extremely hard, extremely firm, slightly sticky, slightly plastic; very strongly acid.

The depth to hard sandstone bedrock is 7 to 20 inches. The content of coarse angular sandstone fragments is 35 to 70 percent, by volume.

The A horizon is grayish brown, dark grayish brown, brown, light brownish gray, or pale brown. Reaction ranges from very strongly acid to moderately acid.

Landman Series

The Landman series consists of very deep, moderately well drained, sandy soils on uplands. These soils formed in thick, loamy unconsolidated sediments. Slopes range from 1 to 5 percent.

Typical pedon of Landman loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 1774 and Texas Highway 105 in Plantersville, 5.2 miles south on Farm Road 1774, about 0.2 mile southeast on Wildwood Lane, 100 feet northeast on a subdivision road, and 50 feet east of the road in an area of woodland:

A—0 to 8 inches; grayish brown (10YR 5/2) loamy fine sand, light brownish gray (10YR 6/2) dry; weak granular structure; loose, nonsticky, nonplastic; few fine and coarse roots; very strongly acid; clear smooth boundary.
E1—8 to 26 inches; very pale brown (10YR 7/3) loamy fine sand, very pale brown (10YR 7/3) dry; weak medium subangular blocky structure; loose, nonsticky, nonplastic; few fine and coarse roots; slightly acid; clear smooth boundary.
E2—26 to 65 inches; very pale brown (10YR 7/3) loamy fine sand, very pale brown (10YR 7/3) dry; common medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; soft, very friable, nonsticky, nonplastic; few brittle brownish yellow (10YR 6/8) masses and some A horizon material deposited on faces of peds;

moderately acid; clear smooth boundary.

Bt1—65 to 69 inches; mottled yellowish brown (10YR 5/6) and light brownish gray (10YR 6/2) sandy clay loam, brownish yellow (10YR 6/6) and light gray (10YR 7/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; few fine roots; few thin clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—69 to 75 inches; light brownish gray (10YR 6/2) sandy clay, light gray (10YR 7/2) dry; many medium prominent dark red (2.5YR 3/6) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; slightly hard, firm, sticky, plastic; common thin clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt3—75 to 83 inches; light brownish gray (10YR 6/2) sandy clay loam, light gray (10YR 7/2) dry; many medium prominent dark red (2.5YR 3/6) mottles; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky, slightly plastic; many thin clay films on faces of peds; small pockets of clay 2 to 3 centimeters across; very strongly acid; gradual wavy boundary.

B24t—83 to 90 inches; grayish brown (10YR 5/2) sandy clay, light brownish gray (10YR 6/2) dry; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; slightly hard, firm, sticky, plastic; very strongly acid.

The sandy A and E horizons range from 40 to 72 inches in thickness. The A horizon is grayish brown or dark grayish brown. It is very strongly acid or strongly acid. The E horizon is very pale brown or light gray. Reaction of the A and E horizons is moderately acid or slightly acid.

The Bt horizon is light brownish gray or light gray. It has mottles of dark red and yellowish brown. In some places the Bt1 horizon has matrix colors of brown and gray. Texture is sandy clay loam, clay loam, or sandy clay. Some horizons have small pockets of clay. The average content of clay is 20 to 35 percent in the upper 20 inches. Reaction ranges from very strongly acid to slightly acid. In some pedons the content of plinthite is 5 to 10 percent below a depth of 60 inches.

Latium Series

The Latium series consists of very deep, well drained, clayey soils on uplands. These soils formed in weakly consolidated calcareous clays and marls. Slopes range from 4 to 12 percent.

Typical pedon of Latium clay, 4 to 12 percent slopes, severely eroded; from the intersection of Texas Highway 6 and Farm Road 2 east of Courtney, 2.5 miles east on Farm Road 2, about 0.5 mile south on a county road, and 0.4 mile east in a pasture:

Ap—0 to 4 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; common medium distinct dark gray (10YR 4/1) mottles; moderate medium angular blocky structure parting to granular; very hard, very firm, very sticky, very plastic; many fine roots; calcareous; moderately alkaline; clear wavy boundary.

Bss1—4 to 22 inches; dark grayish brown (2.5Y 4/2) clay, light brownish gray (2.5Y 6/2) dry; dark gray (10YR 4/1) vertical streaks; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic; common fine roots; common concretions of calcium carbonate; many intersecting slickensides; calcareous; moderately alkaline; gradual wavy boundary.

Bss2—22 to 48 inches; light olive brown (2.5Y 5/4) clay, light yellowish brown (2.5Y 6/4) dry; dark gray (10YR 4/1) vertical streaks; moderate medium angular blocky structure; very hard, very firm, very sticky, very plastic; few fine roots; common concretions of calcium carbonate; many intersecting slickensides; calcareous; moderately alkaline; clear wavy boundary.

C—48 to 70 inches; light olive brown (2.5Y 5/4) clay, light yellowish brown (2.5Y 6/4) dry; common medium distinct light gray (2.5Y 7/1) mottles; massive; hard, firm, very sticky, very plastic; common concretions of calcium carbonate; common intersecting slickensides; calcareous; moderately alkaline.

The thickness of the solum ranges from 40 to 60 inches. The texture is clay or silty clay. During dry periods cracks extend from a depth of 20 to 40 inches. Untilled areas have gilgai microrelief.

The A horizon is grayish brown, dark brown, dark gray, very dark grayish brown, or dark olive gray. The A horizon is less than 12 inches thick in more than 50 percent of the pedon. Concretions of calcium carbonate are common.

The Bk horizon is pale olive, olive, olive gray, grayish brown, light olive brown, dark grayish brown, brown, or light olive brown. Most pedons are mottled with these colors and have streaks of darker material in the cracks of old channels. The number of intersecting slickensides ranges from common to many. The number of concretions and masses of calcium carbonate ranges from few to many.

The C horizon is coarsely mottled in shades of brown, yellow, or gray. It is clay or partially weathered marl. The number of concretions and soft masses of calcium carbonate ranges from few to many.

Lufkin Series

The Lufkin series consists of very deep, somewhat poorly drained, loamy soils on uplands and terraces. These soils formed in clayey sediments. Slopes range from 0 to 3 percent.

Typical pedon of Lufkin fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 149 and Texas Highway 90 in Anderson, 4.4 miles west on Farm Road 149, about 2.4 miles west and north on Farm Road 3090, about 0.4 mile west on a county road, and 400 feet south in an area of woodland:

Ap—0 to 8 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 7/2) dry; weak fine subangular blocky structure; very hard, friable, nonsticky, nonplastic; common roots and pores; moderately acid; abrupt wavy boundary.

Btg1—8 to 22 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium angular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few roots; common clay films on faces of peds; strongly acid; gradual wavy boundary.

Btg2—22 to 45 inches; gray (10YR 5/1) clay, light gray (10YR 6/1) dry; moderate medium angular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; common clay films on faces of peds; moderately acid; gradual wavy boundary.

Btg3—45 to 65 inches; light brownish gray (10YR 6/2) clay, light gray (10YR 7/2) dry; common fine faint pale brown mottles; weak medium subangular blocky structure; extremely hard, firm, sticky, plastic; common fine gypsum crystals; neutral; clear smooth boundary.

Cg—65 to 80 inches; light brownish gray (10YR 6/2) clay loam, light gray (10YR 7/2) dry; few fine faint yellowish brown mottles; structureless; extremely hard, firm, slightly sticky, slightly plastic; common fine gypsum crystals; neutral.

The thickness of the solum ranges from 60 to 80 inches. Some pedons contain siliceous pebbles in the upper horizons. During dry periods the upper part of the subsoil has cracks 1 centimeter or more wide.

The A horizon is less than 10 inches thick. Some pedons have an E horizon. The combined thickness of this horizon and the A horizon is also less than 10 inches. The A horizon is very dark grayish brown, dark gray, dark grayish brown, grayish brown, light brownish gray, or light gray. The E horizon is lighter in color than the A horizon. The boundary between the A or E horizon and the B horizon is abrupt and is wavy or irregular. Reaction ranges from strongly acid to slightly acid.

The Btg horizon is dark gray, grayish brown, light brownish gray, dark grayish brown, or gray. It has few mottles of yellowish brown, gray, strong brown, or pale brown. It is clay or clay loam. Reaction ranges from strongly acid in the Btg1 horizon to slightly alkaline in the Btg2 horizon.

The Cg horizon or the 2C horizon, if it occurs, is grayish brown, yellowish brown, light brownish gray, or light gray. It is clay, sandy clay loam, or clay loam. Some pedons have mottles of dark grayish brown, grayish brown, brownish yellow, or pale brown. Reaction ranges from moderately acid to slightly alkaline.

Mabank Series

The Mabank series consists of very deep, somewhat poorly drained, loamy soils on uplands. These soils formed in thick, unconsolidated, clayey sediments. Slopes range from 0 to 3 percent.

Typical pedon of Mabank fine sandy loam, 0 to 1 percent slopes; from the intersection of Business Highway 6 and Farm Road 379 in Navasota, 0.2 mile west on Farm Road 379, about 0.7 mile south to the end of a county road, and 100 feet south in a pasture:

A—0 to 9 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; few fine faint yellowish brown mottles; weak fine subangular blocky structure; soft, friable, nonsticky, nonplastic; many fine and medium roots; slightly acid; abrupt wavy boundary.

Btg1—9 to 40 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; patchy clay films on faces of peds; moderately acid; gradual smooth boundary.

Btg2—40 to 46 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; thin clay films on faces of peds; neutral; gradual smooth boundary.

Btg3—46 to 65 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; moderate medium angular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; thin clay films on faces of peds; few soft masses of calcium carbonate; moderately alkaline; gradual smooth boundary.

C—65 to 70 inches; light gray (10YR 7/2) clay, white (10YR 8/2) dry; massive; extremely firm, very sticky,

very plastic; few soft masses of calcium carbonate; few black concretions; moderately alkaline.

The solum ranges from 60 to 80 inches in thickness. During dry periods cracks extend from the top of the B horizon to a depth of 20 inches or more.

The A horizon ranges from 5 to 12 inches in thickness but averages 8 inches. It is grayish brown, dark grayish brown, dark gray, or gray. The number of mottles ranges from few to none. Reaction ranges from moderately acid to neutral.

The Btg1 and Btg2 horizons are very dark gray or dark gray. They are clay or clay loam. Reaction ranges from moderately acid to neutral.

The Btg3 horizon is grayish brown, light brownish gray, light gray, or gray. It is clay or clay loam. Reaction ranges from neutral to moderately alkaline.

Some pedons have a BC horizon. This horizon and the C horizion are light gray, gray, grayish brown, or light brownish gray. They are clay or clay loam. Some pedons have masses of calcium carbonate, black concretions, and crystals of gypsum. Reaction ranges from neutral to moderately alkaline.

Nahatche Series

The Nahatche series consists of very deep, somewhat poorly drained, loamy soils on flood plains. These soils formed in loamy alluvium. Slopes are mainly less than 1 percent.

Typical pedon of Nahatche clay loam, frequently flooded; from Bedias, 2.7 miles southeast on Farm Road 2620, about 1.1 miles east on Hopewell Road, 1.2 miles north on a farm trail, and 50 feet north of a creek:

A—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; very hard, firm, nonsticky, nonplastic; many fine roots; slightly acid; clear smooth boundary.

Cg1—6 to 15 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; few fine faint dark brown mottles; weak medium subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine roots; slightly acid; abrupt smooth boundary.

Cg2—15 to 32 inches; very dark gray (10YR 3/1) loam, dark gray (10YR 4/1) dry; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard, friable, nonsticky, nonplastic; few fine roots; slightly acid; abrupt smooth boundary.

Cg3—32 to 60 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; structureless; hard, friable, nonsticky, nonplastic; few fine roots; slightly alkaline.

Reaction is moderately acid to slightly alkaline throughout.

The A horizon is dark brown, brown, dark grayish brown, grayish brown, or light brownish gray. Some pedons have mottles of gray, dark gray, or yellowish brown.

The Cg horizon is light brownish gray, grayish brown, light gray, gray, dark gray, very dark gray, or pinkish gray. The number of mottles in shades of brown ranges from few to many. The lower part of the Cg horizon has strata of loam, silt loam, sandy clay loam, fine sandy loam, or clay loam. Thin strata of sandier textures are common.

Navasan Series

The Navasan series consists of very deep, moderately well drained, sandy soils on low stream terraces. These soils formed in sandy sediments. Slopes range from 1 to 5 percent.

Typical pedon of Navasan loamy sand, 1 to 5 percent slopes; from the intersection of Texas Highway 39 and Farm Road 1696 north of Iola, 0.4 mile north on Texas Highway 39, about 4.5 miles west on Democrat Road, and 500 feet north of the road in a pasture:

Ap—0 to 6 inches; light brown (7.5YR 6/4) loamy sand, pink (7.5YR 7/4) dry; structureless; single grained; loose, nonsticky, nonplastic; many fine roots; slightly acid; clear smooth boundary.

E1—6 to 30 inches; pink (7.5YR 8/4) loamy sand, pink (7.5YR 8/4) dry; structureless; single grained; loose, nonsticky, nonplastic; common fine roots; slightly acid; gradual wavy boundary.

E2—30 to 65 inches; pink (7.5YR 8/4) loamy sand, pink (7.5 YR 8/4) dry; single grained; loose, nonsticky, nonplastic; slightly acid; few fine roots; gradual wavy boundary.

B/E—65 to 75 inches; reddish yellow (7.5YR 6/6) sandy clay loam, reddish yellow (7.5YR 7/6) dry; moderate medium subangular blocky structure; about 40 percent, by volume, pink loamy sand in pockets and tongues; structureless; single grained; loose, nonsticky, nonplastic; few fine roots; slightly acid; clear wavy boundary.

Bt—75 to 85 inches; light brown (7.5YR 6/4) sandy clay loam; common medium distinct red (2.5YR 5/6) and light yellowish brown (10YR 6/4) mottles; moderate medium subangular blocky structure; hard, firm, nonsticky, nonplastic; few fine roots; few patchy clay films on faces of peds; moderately acid; clear smooth boundary.

Btg—85 to 95 inches; light gray (10YR 7/2) sandy clay

loam; common medium distinct strong brown (7.5YR 5/6) and red (2.5YR 5/6) mottles; weak coarse blocky structure; hard, very firm, nonsticky, nonplastic; few roots; few patchy clay films on faces of peds; moderately acid.

The A or Ap horizon is light gray, very pale brown, light yellowish brown, pink, pinkish gray, or light brown. Reaction ranges from strongly acid to neutral.

The E horizon is pinkish white, pink, light brown, pinkish gray, white, or light gray. It is loamy sand or loamy fine sand. Reaction ranges from strongly acid to neutral.

The B/E horizon consists of masses, tongues, or interfingers of B and E material.

The Bt horizon is brown, pale brown, light yellowish brown, light brown, or reddish yellow. It is sandy clay loam or fine sandy loam. Reaction ranges from very strongly acid to moderately acid.

The Btg horizon is light gray. It has mottles in shades of gray, red, and brown. It is sandy clay loam or clay loam. Reaction is strongly acid or moderately acid.

Some peonds have a C horizon. This horizon is loamy fine sand, fine sandy loam, or loam. Some pedons are underlain by sandstone bedrock or shale.

Norwood Series

The Norwood series consists of very deep, well drained, loamy soils along the flood plain of the Brazos River. These soils formed in recent loamy alluvium (fig. 21). Slopes range from 0 to 2 percent.

Typical pedon of Norwood silt loam, 0 to 1 percent slopes; from the intersection of Texas Highway 6 and Farm Road 1227 south of Navasota, 1.9 miles west and north on Farm Road 1227, about 0.5 mile west on a field road, and 100 feet south in the field:

Ap—0 to 6 inches; reddish brown (5YR 4/3) silt loam, reddish brown (5YR 5/3) dry; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, nonplastic; few fine roots; moderately alkaline; abrupt smooth boundary.

A—6 to 18 inches; reddish brown (5YR 4/3) silt loam, reddish brown (5YR 5/3) dry; weak coarse subangular blocky structure; slightly hard, friable, slightly sticky, nonplastic; few fine roots; moderately alkaline; clear smooth boundary.

C1—18 to 28 inches; reddish brown (5YR 4/3) silt loam, reddish brown (5YR 5/3) dry; structureless; slightly hard, friable, slightly sticky, nonplastic; few fine roots; common bedding planes; moderately alkaline; abrupt smooth boundary.

C2—28 to 45 inches; dark reddish gray (5YR 4/2) silt loam, dark reddish gray (5YR 4/2) dry; structureless; slightly hard, friable, slightly sticky, nonplastic; few fine roots; common bedding planes; moderately alkaline; abrupt smooth boundary.

C3—45 to 63 inches; dark reddish brown (5YR 3/3) silty clay loam, reddish brown (5YR 4/3) dry; structureless; hard, firm, sticky, plastic; few fine roots; common bedding planes that have thin strata of silty clay; moderately alkaline; abrupt smooth boundary.

C4—63 to 85 inches; dark reddish gray (5YR 4/2) silty clay loam, reddish gray (5YR 5/2) dry; structureless; common bedding planes that have thin strata of clay; very hard, very firm, very sticky, very plastic; moderately alkaline.

The depth to bedding planes ranges from a few inches to 30 inches.

The Ap and A horizons are reddish brown or dark brown. They are silty clay loam, loam, or silt loam.

Some pedons have a B horizon. This horizon is reddish brown, brown, or yellowish red. It is silty clay loam or silt loam.

The C horizon is reddish brown, dark reddish brown, dark reddish gray, light reddish brown, brown, or yellowish red. It is silt loam or silty clay loam but has thin strata of very fine sandy loam, silty clay, clay, or clay loam in most pedons.

Oklared Series

The Oklared series consists of very deep, well drained, loamy soils along the flood plain of the Brazos river. These soils formed in recent alluvium. Slopes range from 0 to 2 percent.

Typical pedon of Oklared very fine sandy loam, 0 to 1 percent slopes; from the junction of Texas Highway 6 and Farm Road 1227 northeast of Courtney, 1.9 miles west and north on Farm Road 1227, about 0.7 mile west on a private unpaved road, and 100 feet south in an area of cropland:

Ap—0 to 6 inches; reddish brown (5YR 5/3) very fine sandy loam, pink (5YR 7/3) dry; weak medium angular blocky structure; soft, very friable, nonsticky, nonplastic; many fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

A—6 to 16 inches; reddish brown (5YR 5/3) very fine sandy loam, light reddish brown (5YR 6/3) dry; weak coarse angular blocky structure; soft, very friable, nonsticky, nonplastic; many fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

C1—16 to 54 inches; reddish brown (5YR 5/4) very fine sandy loam, light reddish brown (5YR 6/4) dry; massive; soft, very friable, nonsticky, nonplastic;

few or common fine roots; common bedding planes; calcareous; moderately alkaline; abrupt smooth boundary.

C2—54 to 73 inches; reddish brown (5YR 5/4) very fine sandy loam, light reddish brown (5YR 6/4) dry; massive; soft, very friable, nonsticky, nonplastic; calcareous; moderately alkaline; clear smooth boundary.

C3—73 to 95 inches; dark reddish gray (5YR 4/2) silt loam, reddish gray (5YR 5/2) dry; massive; slightly hard, friable, sticky, plastic; thin strata of silty clay; calcareous; moderately alkaline.

The A horizon is reddish brown, light reddish brown, dark brown, dark reddish gray, or reddish gray.

The C horizon is reddish brown, light reddish brown, light brown, pink, dark reddish gray, or reddish gray. The upper part of the C horizon is very fine sandy loam or fine sandy loam. The lower part, below a depth of 70 inches, is silty clay or silty clay loam. Some pedons have thin strata of loamy fine sand, silt loam, silty clay loam, or silty clay. The average content of clay above a depth of 55 inches is less than 18 percent.

Padina Series

The Padina series consists of very deep, well drained, sandy soils on ancient stream terraces. These soils formed in sandy and loamy materials. Slopes range from 1 to 8 percent.

Typical pedon of Padina loamy fine sand, 1 to 8 percent slopes; from the intersection of Texas Highway 6 and Farm Road 2 east of Courtney, 1.3 miles south on Texas Highway 6 to West Road, 0.7 mile south and east on West Road, and 50 feet west of the road in a pasture:

Ap—0 to 6 inches; light yellowish brown (10YR 6/4) loamy fine sand, very pale brown (10YR 7/4) dry; weak fine subangular blocky structure; loose, friable, nonsticky, nonplastic; many fine roots; slightly acid; abrupt clear boundary.

E1—6 to 45 inches; light yellowish brown (10YR 6/4) loamy fine sand, very pale brown (10YR 7/4) dry; weak fine subangular blocky structure; loose, very friable, nonsticky, nonplastic; common fine roots; slightly acid; gradual wavy boundary.

E2—45 to 60 inches; yellowish brown (10YR 5/6) loamy fine sand, brownish yellow (10YR 6/6) dry; common medium distinct strong brown (7.5YR 5/6) mottles; weak fine subangular blocky structure; loose, very friable, nonsticky, nonplastic; strong brown (7.5YR 4/6) lamellae 0.5 inch thick and 6 inches apart; common fine roots; neutral; gradual wavy boundary.

E3—60 to 65 inches; yellowish brown (10YR 5/4) loamy fine sand, light yellowish brown (10YR 6/4) dry; weak fine subangular blocky structure; loose, very friable, nonsticky, nonplastic; few fine roots; many weakly cemented black concretions of ferrous manganese; slightly acid; clear wavy boundary.

Bt1—65 to 75 inches; yellowish brown (10YR 5/4) sandy clay loam, light yellowish brown (10YR 6/4) dry; common medium distinct light brown (10YR 6/4) and reddish yellow (10YR 6/8) mottles; weak fine subangular blocky structure; hard, firm, slightly sticky, slightly plastic; common patchy clay films on faces of peds; moderately acid; gradual smooth boundary.

Bt2—75 to 90 inches; mottled red (2.5YR 4/6), strong brown (7.5YR 5/6), and light brownish gray (10YR 6/2) sandy clay loam; weak fine subangular blocky structure; hard, firm, slightly sticky, slightly plastic; few patchy clay films on faces of peds; strongly acid.

The sandy surface layers range from 40 to 72 inches in thickness.

The A horizon is light yellowish brown or light brownish gray. Reaction is slightly acid or neutral.

The E horizon is light yellowish brown, yellowish brown, or light gray. It is fine sand or loamy fine sand. Strong brown mottles, lamellae, and black concretions are common in the lower part of most pedons. Reaction is slightly acid or neutral.

The Bt1 horizon is light gray or yellowish brown. It has mottles in shades of brown, yellow, gray, and red. Reaction ranges from very strongly acid to slightly acid.

The Bt2 horizon has mottles in shades of red, strong brown, and light brownish gray. It is fine sandy loam or sandy clay loam. Reaction ranges from very strongly acid to slightly acid.

Rader Series

The Rader series consists of very deep, moderately well drained, loamy soils on uplands and terraces. These soils formed in loamy material. Slopes range from 0 to 3 percent.

Typical pedon of Rader fine sandy loam, 0 to 1 percent slopes; from the intersection of Farm Road 379 and Farm Road 1227 southwest of Navasota, 1.4 miles south on Farm Road 1227, and 2,000 feet east on a private road in an area of rangeland:

A—0 to 4 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; slightly hard, very friable; many fine and medium roots; slightly acid; clear smooth boundary.

E—4 to 12 inches; grayish brown (10YR 5/2) fine sandy

loam, light brownish gray (10YR 6/2) dry; common medium distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; slightly hard, very friable, nonsticky, nonplastic; many fine and medium roots; slightly acid; gradual wavy boundary.

B/E—12 to 21 inches; light yellowish brown (10YR 6/4) sandy clay loam, very pale brown (10YR 7/4) dry; common medium distinct light gray (10YR 6/1) mottles; interfingers of E material between peds; weak medium subangular blocky structure; hard, firm, sticky, plastic; very strongly acid; gradual wavy boundary.

Bt1—21 to 46 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common medium distinct yellowish red (5YR 5/6) mottles; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; common clay films on faces of peds; very strongly acid; gradual wavy boundary.

Bt2—46 to 72 inches; light gray (10YR 7/1) clay, white (10YR 8/1) dry; common medium distinct yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure parting to weak medium subangular blocky; extremely hard, extremely firm, very sticky, very plastic; few fine roots; few fine black concretions; strongly acid.

The solum is more than 60 inches thick.

The combined thickness of the A and E horizons is 10 to 26 inches. The A horizon is dark grayish brown, grayish brown, yellowish brown, or brown. The E horizon is brown, grayish brown, light brownish gray, light yellowish brown, or pale brown. It has mottles of yellowish brown or pale brown. Reaction of the A and E horizons is moderately acid or slightly acid.

The B/E horizon is light yellowish brown, pale brown, or light brownish gray. It has mottles of gray, light gray, or light brownish gray. It is sandy clay loam or clay loam. The content of clay ranges from 25 to 35 percent. Reaction ranges from very strongly acid to slightly acid.

The Bt horizon is gray, light gray, grayish brown, or light brownish gray. It has mottles of yellowish red, yellowish brown, or strong brown. It is clay or clay loam. Reaction ranges from strongly acid to slightly acid.

Renish Series

The Renish series consists of shallow, well drained, loamy soils on uplands. These soils formed in strongly cemented calcareous sandstone bedrock. Slopes range from 8 to 20 percent.

Typical pedon of Renish loam in an area of Renish-Rock outcrop complex, 8 to 20 percent slopes; from the intersection of Texas Highway 6 and Texas Highway 90 in Navasota, 4.6 miles north and east on Texas Highway 90, and 50 feet east of a right-of-way fence in an area of rangeland:

A1—0 to 3 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common fine roots; few sandstone fragments; calcareous; moderately alkaline; clear smooth boundary.

A2—3 to 14 inches; very dark grayish brown (10YR 3/2) gravelly loam, grayish brown (10YR 5/2) dry; moderate medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; common sandstone fragments that increase with increasing depth; common fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

R—14 to 40 inches; coarsely fractured, hard, calcareous, moderately alkaline sandstone bedrock.

The solum ranges from 12 to 20 inches in thickness. The content of calcareous sandstone fragments in the A horizon ranges from 10 to 30 percent.

The A horizon is very dark grayish brown, very dark brown, very dark gray, or dark brown.

The R horizon consists of whitish or brownish indurated calcareous sandstone bedrock. Some pedons have thin beds of marl between the layers of sandstone bedrock.

Robco Series

The Robco series consists of very deep, moderately well drained, loamy soils on stream terraces. These soils formed in loamy and clayey sediments. Slopes range from 1 to 8 percent.

Typical pedon of Robco loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Texas Highway 105 in Navasota, 0.7 mile south on Texas Highway 6, about 0.5 mile east on a county road, and 50 feet south of the road in an area of woodland:

A—0 to 5 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose, nonsticky, nonplastic; common medium and fine roots; slightly acid; clear smooth boundary.

E—5 to 25 inches; yellowish brown (10YR 5/6) loamy fine sand, brownish yellow (10YR 6/6) dry; single grained; loose, nonsticky, nonplastic; common fine roots; moderately acid; abrupt smooth boundary.

Bt1—25 to 30 inches; yellowish brown (10YR 5/6) sandy clay loam, brownish yellow (10YR 6/6) dry; common medium distinct red (2.5YR 4/6) and few fine distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure;

hard, firm, sticky, plastic; strongly acid; gradual wavy boundary.
Bt2—30 to 50 inches; mottled yellowish brown (10YR 5/6), red (2.5YR 4/6), and grayish brown (10YR 5/2) clay loam; moderate medium subangular blocky structure; hard, firm, sticky, plastic; few fine roots; few thin clay films on faces of peds; strongly acid; gradual smooth boundary.
Bt3—50 to 65 inches; grayish brown (10YR 5/2) clay loam, light brownish gray (10YR 6/2) dry; weak medium subangular blocky structure; hard, firm, sticky, plastic; few fine roots; few thin clay films on faces of peds; strongly acid; gradual smooth boundary.
Bt4—65 to 75 inches; light brownish gray (10YR 6/2) clay loam, light gray (10YR 7/2) dry; weak medium subangular blocky structure; hard, firm, sticky, plastic; strongly acid.

The solum ranges from 75 to 80 inches or more in thickness.

The A horizon ranges from 5 to 8 inches in thickness. It is brown, pale brown, light brown, pinkish gray, or dark brown. Reaction is moderately acid or slightly acid.

The E horizon is brown, light brown, pinkish gray, pale brown, pink, or yellowish brown. Reaction is moderately acid or slightly acid. The boundary between the E and the Bt1 horizons is abrupt or clear. The combined thickness of the A and E horizons is 20 to 40 inches.

The Bt1 horizon is grayish brown, brown, and yellowish brown. It has mottles in shades of brown and red. It is clay loam or sandy clay loam. The content of clay ranges from 27 to 35 percent. Reaction ranges from strongly acid to slightly acid.

The Bt2 horizon is red or is mottled in shades of brown, gray, and red. It is clay loam or sandy clay loam. The content of clay ranges from 20 to 35 percent. Reaction ranges from strongly acid to slightly acid.

The Bt3 and Bt4 horizons are grayish brown or light brownish gray. They have mottles in shades of brown and red. They are clay or clay loam. The content of clay ranges from 30 to 40 percent. Reaction ranges from strongly acid to moderately acid.

Shalba Series

The Shalba series consists of shallow, moderately well drained, loamy soils on gently sloping uplands. These soils formed in tuffaceous sandstone bedrock. Slopes range from 1 to 5 percent.

Typical pedon of Shalba fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 90 and Texas Highway 244 north of Anderson, 1.8 miles north on Texas Highway 90, about 2.6 miles northwest on a county road, and 50 feet east of the road in an area of rangeland:

A—0 to 3 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; hard, friable, nonsticky, nonplastic; common fine roots and pores; moderately acid; abrupt smooth boundary.
Bt—3 to 14 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots and pores; moderately acid; abrupt smooth boundary.
Cr—14 to 40 inches; light brownish gray (10YR 6/2) tuffaceous sandstone bedrock, light gray (10YR 7/2) dry; slightly acid.

The thickness of the solum and the depth to weakly cemented tuffaceous sandstone bedrock range from 12 to 20 inches.

The A horizon is brown, grayish brown, very dark gray, dark grayish brown, or very dark grayish brown. Reaction is moderately acid or slightly acid.

The Bt horizon is grayish brown or dark grayish brown. The number of mottles in shades of yellow and brown ranges from none to common. Reaction is strongly acid or moderately acid.

The Cr horizon is light brownish gray or white. It is tuffaceous clay or tuffaceous sandstone bedrock interbedded with ash beds and siltstone bedrock.

Shiro Series

The Shiro series consists of moderately deep, moderately well drained, sandy soils on uplands. These soils formed in tuffaceous sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Shiro loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 90 and Texas Highway 30 in Roans Prairie, 2.1 miles east on Texas Highway 30, about 1.3 miles south on a county road, and 100 feet west of the road in an area of rangeland:

A—0 to 6 inches; pinkish gray (7.5YR 6/2) loamy fine sand, pinkish gray (7.5YR 7/2) dry; single grained; loose, nonsticky, nonplastic; many medium and fine roots; moderately acid; clear smooth boundary.
E—6 to 12 inches; pinkish gray (7.5YR 6/2) loamy fine sand, pinkish white (7.5YR 8/2) dry; single grained; hard, loose, nonsticky, nonplastic; many medium roots; moderately acid; abrupt smooth boundary.
Bt1—12 to 18 inches; yellowish red (5YR 5/6) clay,

reddish yellow (5YR 6/6) dry; common fine faint light brownish gray mottles; weak coarse prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, sticky, plastic; many fine roots; few thin clay films on faces of peds; very strongly acid; clear smooth boundary.

Bt2—18 to 24 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common medium distinct red (2.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate medium subangular blocky; extremely hard, extremely firm, sticky, plastic; few fine roots; few thin clay films on faces of peds; common fine white flakes of barite; very strongly acid; clear smooth boundary.

Bt3—24 to 31 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; moderate coarse subangular blocky structure; extremely hard, extremely firm, sticky, plastic; few fine roots; few thin clay films on faces of peds; common fine white flakes of barite; very strongly acid; abrupt smooth boundary.

Cr—31 to 40 inches; white (2.5Y 8/2), weakly cemented sandstone bedrock; common medium distinct reddish yellow (7.5YR 6/6) mottles; very strongly acid.

The solum ranges from 20 to 40 inches in thickness.

The combined thickness of the A and E horizons ranges from 10 to 18 inches. The A or Ap horizon is dark brown, dark grayish brown, brown, and pinkish gray. The E horizon is brown, pinkish gray, light brownish gray, or pale brown. Reaction of the A and E horizons ranges from strongly acid to slightly acid. Some pedons have yellowish brown mottles.

The Bt1 horizon is yellowish red, strong brown, or yellowish brown. It has yellowish brown, light brownish gray, strong brown, and red mottles. It is clay, sandy clay, or clay loam. Reaction is very strongly acid or strongly acid.

The Bt2 and Bt3 horizons are gray, light brownish gray, or light gray. They have brownish yellow, yellowish brown, or red mottles. Reaction is very strongly acid or strongly acid. Some pedons do not have a Bt3 horizon.

The Cr horizon is weakly to strongly cemented tuffaceous sandstone or siltstone bedrock interbedded with shale and clay. It is light gray, white, grayish brown, or light brownish gray.

Silawa Series

The Silawa series consists of very deep, well drained, sandy soils on old terraces. These soils formed in sandy and loamy sediments (fig. 22). Slopes range from 1 to 8 percent.

Typical pedon of Silawa loamy fine sand, 1 to 5 percent slopes; from the junction of Business Highway 6 and the Texas Highway 6 bypass south of Navasota, 0.7 mile south on Texas Highway 6, about 0.6 mile east on a county road, and 200 feet north in a pasture:

Ap—0 to 7 inches; brown (10YR 5/4) loamy fine sand, light brown (10YR 6/4) dry; weak fine subangular blocky structure; loose, nonsticky, nonplastic; many fine roots; strongly acid; abrupt smooth boundary.

A—7 to 15 inches; brown (7.5YR 5/4) loamy fine sand, light brown (7.5YR 6/4) dry; weak fine subangular blocky structure; loose, nonsticky, nonplastic; many fine roots; strongly acid; abrupt smooth boundary.

Bt1—15 to 28 inches; red (2.5YR 4/6) sandy clay loam, red (2.5YR 5/6) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; common fine roots; many thin clay films on faces of peds; strongly acid; gradual smooth boundary.

Bt2—28 to 40 inches; yellowish red (5YR 4/6) sandy clay loam, yellowish red (5YR 5/6) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; common fine roots; common thin clay films on faces of peds; strongly acid; gradual smooth boundary.

BC—40 to 48 inches; strong brown (7.5YR 5/6) fine sandy loam, reddish yellow (7.5YR 6/6) dry; weak medium subangular blocky structure; slightly hard, friable, nonsticky, nonplastic; strongly acid.

C—48 to 65 inches; reddish yellow (7.5YR 6/6) loamy sand, reddish yellow (7.5YR 7/6) dry; structureless; loose, nonsticky, nonplastic; strongly acid.

The solum ranges from 40 to 80 inches in thickness.

The A horizon is brown, dark brown, pale brown, pinkish gray, grayish brown, or brown. Some pedons have an E horizon. This horizon is light gray, very pale brown, light brownish gray, pale brown, pinkish gray, or light brown. Reaction of the A and E horizons ranges from strongly acid to slightly acid.

The Bt horizon is yellowish red or red. It is sandy clay loam or clay loam. Some pedons have a few siliceous pebbles. Reaction ranges from very strongly acid to slightly acid.

The BC horizon is reddish yellow, strong brown, or yellowish red fine sandy loam or sandy clay loam. Reaction is very strongly acid or moderately acid.

The C horizon, if it occurs, is stratified fine sandy loam, loamy sand, or loamy fine sand. Reaction ranges from strongly acid to slightly acid.

Silstid Series

The Silstid series consists of very deep, well drained, sandy soils on uplands. These soils formed in loamy

material. Slopes range from 1 to 8 percent.

Typical pedon of Silstid loamy fine sand, 1 to 5 percent slopes; from the intersection of Texas Highway 6 and Farm Road 2 near Courtney, 1.2 miles south on Texas Highway 6, about 0.6 mile southeast on a county road, and 200 feet south of the road in a pasture:

A—0 to 4 inches; pale brown (10YR 6/3) loamy fine sand, very pale brown (10YR 7/3) dry; single grained; loose, very friable, nonsticky, nonplastic; many fine and medium roots; neutral; clear smooth boundary.

E—4 to 35 inches; light brown (7.5YR 6/4) loamy fine sand, pink (7.5YR 7/4) dry; single grained; loose, very friable, nonsticky, nonplastic; many fine and medium roots; few siliceous pebbles; neutral; clear smooth boundary.

Bt1—35 to 47 inches; reddish yellow (7.5YR 6/6) sandy clay loam; common medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; hard, firm, nonsticky, nonplastic; common fine roots; few siliceous pebbles; slightly acid; gradual smooth boundary.

Bt2—47 to 54 inches; yellowish brown (10YR 5/4) sandy clay loam, light yellowish brown (10YR 6/4) dry; common medium prominent red (2.5YR 4/6) mottles; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; few fine roots; slightly acid; gradual smooth boundary.

Bt3—54 to 65 inches; yellowish red (5YR 4/6) sandy clay loam, reddish yellow (5YR 5/6) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; few fine roots; slightly acid; gradual smooth boundary.

Bt4—65 to 80 inches; yellowish red (5YR 5/8) sandy clay loam, reddish yellow (5YR 6/8) dry; moderate medium subangular blocky structure; hard, friable, nonsticky, nonplastic; strongly acid.

Some places have siliceous pebbles throughout.

The combined thickness of the A and E horizons is 30 to 40 inches. They are grayish brown, brown, pale brown, or light brown. Reaction ranges from moderately acid to neutral.

The Bt1 and Bt2 horizons are strong brown, reddish yellow, yellowish brown, or brownish yellow. They have prominent mottles of red, brownish yellow, or reddish yellow. The Bt3 and Bt4 horizons are reddish yellow or yellowish red. In some places the matrix is mottled. The Bt horizons range from strongly acid to slightly acid. They are sandy clay loam, loam, or fine sandy loam. The content of clay ranges from 18 to 30 percent.

Singleton Series

The Singleton series consists of moderately deep, moderately well drained, loamy soils on uplands. These soils formed in loamy and sandy tuffaceous siltstone and sandstone (fig. 23) bedrock. Slopes range from 0 to 5 percent.

Typical pedon of Singleton fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 2.6 miles west on Texas Highway 30, about 1.4 miles south on a county road, and 100 feet east of the road in an area of rangeland:

A—0 to 5 inches; light brownish gray (10YR 6/2) fine sandy loam, light gray (10YR 7/2) dry; weak fine subangular blocky structure; very hard, friable, nonsticky, nonplastic; many fine and medium roots; few siliceous pebbles; strongly acid; abrupt smooth boundary.

E—5 to 9 inches; pale brown (10YR 6/3) fine sandy loam, very pale brown (10YR 7/3) dry; weak fine subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine and medium roots, few coarse roots; few siliceous pebbles; strongly acid; abrupt smooth boundary.

Bt1—9 to 20 inches; dark brown (10YR 4/3) clay, dark grayish brown coatings on (10YR 4/2) peds; few fine distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium angular blocky; extremely hard, extremely firm, very sticky, very plastic; few fine roots; thick continuous dark grayish brown clay films on faces of peds; electrical conductivity is 0.3 mmhos/cm; very strongly acid; clear smooth boundary.

Bt2—20 to 32 inches; brown (10YR 5/3) clay, pale brown (10YR 6/3) dry; grayish brown (10YR 5/2) coatings on peds; few fine distinct brown (7.5YR 5/4) mottles; weak medium prismatic structure parting to moderate medium angular blocky; extremely hard, extremely firm, very sticky, very plastic; few fine roots; thick continuous grayish brown clay films on faces of peds; few fine white flakes of barite; electrical conductivity is 0.7 mmhos/cm; very strongly acid; gradual smooth boundary.

BC—32 to 38 inches; brown (10YR 5/3) clay loam, pale brown (10YR 6/3) dry; common medium distinct very pale brown (10YR 7/4) mottles; weak medium subangular blocky structure; very hard, very firm, sticky, plastic; few fine roots; few crystals of gypsum; few fine white flakes of barite; electrical conductivity is 2.0 mmhos/cm; moderately acid; clear smooth boundary.

Cr—38 to 60 inches; light gray (10YR 7/2), weakly cemented sandstone bedrock that has thin layers of sandy clay loam, white (10YR 8/2) dry; massive and horizontally bedded; very hard, very firm; few fine white flakes of barite; electrical conductivity is 1.4 mmhos/cm; moderately acid.

The solum ranges from 20 to 40 inches in thickness. The content of clay in the upper 20 inches of the Bt horizon is 35 to 45 percent. During dry periods small cracks are at the surface.

The combined thickness of the A and E horizons is 5 to 12 inches but is mainly less than 10 inches. The A horizon is light gray, light brownish gray, grayish brown, brown, or pale brown. The E horizon is light gray, light brownish gray, pale brown, or very pale brown. Reaction of the A and E horizons ranges from strongly acid to slightly acid.

The B horizon is grayish brown, light brownish gray, light gray, pinkish gray, brown, or dark grayish brown on the exterior of peds. The interior of peds is pale brown, brown, dark brown, or light brown. Few brownish and reddish mottles are common. The B horizon is clay or clay loam. The content of clay ranges from 35 to 50 percent. Reaction ranges from very strongly acid to moderately acid. The electrical conductivity ranges from 0.5 to 4.0 millimhos per centimeter. White crystals of barite are common. The number of crystals of gypsum ranges from none to common.

The BC horizon is similar in color to the B horizon. Reaction ranges from very strongly acid to slightly alkaline. Texture is clay loam or sandy clay loam. The content of clay is 25 to 40 percent.

The Cr horizon is weakly cemented tuffaceous sandstone or siltstone bedrock interbedded with clay loam or sandy clay loam. Reaction is strongly acid or moderately alkaline.

Splendora Series

The Splendora series consists of very deep, somewhat poorly drained, loamy soils on uplands. These soils formed in loamy unconsolidated sediments (fig. 24). Slopes range from 0 to 3 percent.

Typical pedon of Splendora fine sandy loam, 0 to 3 percent slopes; from the intersection of Farm Road 1774 and Texas Highway 105 in Plantersville, 6.0 miles south on Farm Road 1774, about 0.3 mile west and north on a subdivision road, and 50 feet west of the road in a subdivision:

A—0 to 3 inches; yellowish brown (10YR 5/4) fine sandy loam, light yellowish brown (10YR 6/4) dry; weak medium subangular blocky structure; soft, friable, nonsticky, nonplastic; many fine and medium roots; moderately acid; clear smooth boundary.

E—3 to 12 inches; light yellowish brown (10YR 6/4) fine sandy loam, very pale brown (10YR 7/4) dry; common medium prominent brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; soft, friable, nonsticky, nonplastic; many fine and medium roots; strongly acid; gradual smooth boundary.

Bt—12 to 30 inches; light yellowish brown (10YR 6/4) sandy clay loam, very pale brown (10YR 7/4) dry; many medium distinct light brownish gray (10YR 6/2) and common medium distinct dark yellowish brown (10YR 4/6) mottles; weak medium subangular blocky structure; hard, firm, nonsticky, nonplastic; common brittle bodies; light brownish gray vertically oriented areas that have interfingers of clean sand grains; very strongly acid; gradual smooth boundary.

Btx/E—30 to 40 inches; yellowish brown (10YR 5/6) sandy clay loam, brownish yellow (10YR 6/6) dry; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; hard, firm, nonsticky, nonplastic; few fine roots; about 25 percent, by volume, brittle masses; tongues of albic material (E), which make up about 20 percent of the horizon; moderately acid; gradual smooth boundary.

B't—40 to 60 inches; yellowish brown (10YR 5/6) clay loam, brownish yellow (10YR 6/6) dry; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; very hard, very firm, slightly sticky, slightly plastic; few nodules of ironstone 1 to 2 centimeters in size; moderately acid.

The solum is more than 60 inches thick. Reaction ranges from very strongly acid to neutral throughout.

The combined thickness of the A and E horizons is 10 to 20 inches. The A horizon is yellowish brown, grayish brown, brown, or pale brown. The E horizon is light yellowish brown, light gray, or grayish brown.

The Bt horizon is light yellowish brown, yellowish brown, very pale brown, or light brownish gray. It has mottles in shades of brown and gray. It is sandy clay loam or loam. The content of clay ranges from 18 to 30 percent.

The Btx/E horizon is yellowish brown, grayish brown, pale brown, or light brownish gray. It has mottles in shades of brown and gray. It is sandy clay loam or clay loam. The content of clay ranges from 25 to 40 percent. The content of albic material (E) ranges from 15 to 25 percent. The content of brittle masses ranges from 25 to 35 percent, by volume.

The B't horizon is yellowish brown, grayish brown, pale brown, or light brownish gray or is mottled in these colors. It is sandy clay loam or clay loam. The content of clay ranges from 25 to 40 percent.

The Splendora soil is outside the range defined for the series because it is less acid in the Btx/E and B't horizons and because the chroma in the A and E horizons is higher. These differences, however, do not affect the use and management of the soil.

Tabor Series

The Tabor series consists of very deep, moderately well drained, loamy soils on uplands. These soils formed in thick, unconsolidated clayey and loamy sediments (fig. 25). Slopes range from 1 to 5 percent.

Typical pedon of Tabor fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 1774 and Texas Highway 105 in Plantersville, 3.2 miles north on Farm Road 1774, about 1.1 miles east on a county road, and 100 feet south of the road:

Ap—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine and medium roots; strongly acid; abrupt smooth boundary.

E—6 to 14 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; weak fine subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine and medium roots; strongly acid; abrupt wavy boundary.

Bt1—14 to 22 inches; mottled brownish yellow (10YR 6/6) and light brownish gray (10YR 6/2) clay; many medium distinct reddish yellow (7.5YR 6/6) mottles; moderate medium subangular blocky structure; very hard, very firm, very sticky, very plastic; common fine roots; many clay films on faces of peds; strongly acid; clear smooth boundary.

Bt2—22 to 45 inches; light gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; many clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—45 to 60 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; common fine distinct light yellowish brown (10YR 6/4) mottles; weak medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; many clay films on faces of peds; neutral.

The solum ranges from 60 to 70 inches in thickness. During dry periods small cracks extend to the surface.

The combined thickness of the A and E horizons ranges from 10 to 20 inches. The A horizon is grayish brown, light brownish gray, or pale brown. The E horizon is grayish brown, light brownish gray, pale brown, light gray, or very pale brown. The thickness of the A and E horizons ranges from 10 to 20 inches. Reaction ranges from strongly acid to slightly acid.

The Bt1 and Bt2 horizons are yellowish brown, brownish yellow, or light gray. They have reddish yellow, strong brown, or brownish yellow mottles. Reaction ranges from very strongly acid to slightly acid.

The Bt3 horizon is dark grayish brown, dark gray, gray, or grayish brown. It has light brownish gray mottles. It is clay, clay loam, or sandy clay loam. Reaction ranges from strongly acid to slightly alkaline.

Tinn Series

The Tinn series consists of very deep, somewhat poorly drained, clayey soils along flood plains of local creeks and drainageways. These soils formed in calcareous, clayey alluvium. Slopes are 0 to 1 percent.

Typical pedon of Tinn clay, frequently flooded; from the intersection of Texas Highway 6 and Farm Road 2 east of Courtney, 1.3 miles south on Texas Highway 6, about 0.8 mile west on West Road, and 50 feet south of the road in a pasture:

Ap—0 to 6 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium granular structure; extremely hard, very firm, very sticky, very plastic; many fine roots; calcareous; moderately alkaline; abrupt smooth boundary.

Bss1—6 to 65 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium angular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; many intersecting slickensides within 32 inches of the surface; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Bss2—65 to 96 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; weak medium angular blocky structure parting to fine angular blocky; extremely hard, very firm, very sticky, very plastic; few intersecting slickensides; common fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Undisturbed areas have gilgai microrelief. The content of clay ranges from 40 to 60 percent. Some pedons have strata of sandy clay loam. During dry periods cracks 2 inches wide extend to a depth of 20 inches or more.

The Ap and A horizons are black or very dark gray. Intersecting slickensides are common between a depth of 32 to 65 inches.

Some pedons have a Bw or a C horizon. These horizons are dark brown or dark grayish brown.

Tonkavar Series

The Tonkavar series consists of very deep, well drained, sandy soils on uplands. These soils formed in weakly cemented sandstone bedrock. Slopes range from 1 to 8 percent.

Typical pedon of Tonkavar fine sand, 1 to 8 percent slopes; from the intersection of Texas Highway 30 and Texas Highway 90 in Roans Prairie, 2.8 miles west on Texas Highway 30, about 300 feet south on a private road, and 100 feet west of the road in an area of woodland:

A—0 to 5 inches; dark grayish brown (10YR 4/2) fine sand, light brownish gray (10YR 6/2) dry; weak coarse subangular blocky structure; loose, nonsticky, nonplastic; common fine and medium roots; few fine siliceous pebbles; slightly acid; clear smooth boundary.

E1—5 to 20 inches; light yellowish brown (10YR 6/4) sand, very pale brown (10YR 7/4) dry; weak coarse subangular blocky structure; loose, nonsticky, nonplastic; common fine and medium roots; few siliceous pebbles; slightly acid; clear smooth boundary.

E2—20 to 38 inches; pale brown (10YR 6/3) sand, very pale brown (10YR 7/3) dry; few fine prominent yellowish red (5YR 5/6) mottles; weak coarse subangular blocky structure; loose, nonsticky, nonplastic; common fine and medium roots; few siliceous pebbles; slightly acid; clear smooth boundary.

E3—38 to 53 inches; pale brown (10YR 6/3) loamy sand, very pale brown (10YR 7/3) dry; weak coarse subangular blocky structure; loose, nonsticky, nonplastic; common fine roots; few siliceous pebbles; less than 5 percent few thin strong brown (7.5YR 5/6) lamellae about 1 centimeter thick; slightly acid; abrupt smooth boundary.

Bt1—53 to 62 inches; yellowish red (5YR 5/6) sandy clay loam, reddish yellow (5YR 6/6) dry; few fine faint red mottles; moderate medium subangular blocky structure; firm, nonsticky, nonplastic; few discontinuous clay films; few fine roots; slightly acid; clear smooth boundary.

Bt2—62 to 69 inches; red (2.5YR 5/8) sandy clay loam, light red (2.5YR 6/8) dry; common medium distinct grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; friable, slightly sticky, slightly plastic; few roots; thin patchy clay films along root channels; layer of clay 1 centimeter thick at the Cr horizon boundary; strongly acid; abrupt wavy boundary.

Cr1—69 to 77 inches; light gray (10YR 7/2) weakly cemented sandstone bedrock; few medium prominent yellowish red (5YR 5/6) mottles; extremely firm: few roots along fractures; strongly acid; abrupt smooth boundary.

Cr2—77 to 85 inches; yellowish red (5YR 5/6) weakly cemented sandstone bedrock; common medium prominent very pale brown (10YR 7/3) mottles; extremely firm; few fine roots along fractures; very strongly acid.

The combined thickness of the A and E horizons is 40 to 72 inches. The A horizon is brown, pale brown, light brownish gray, very pale brown, or light gray. Reaction ranges from moderately acid to neutral. The E horizon is pale brown, light yellowish brown, or very pale brown. It is loamy fine sand, sand, fine sand, or loamy sand. Some pedons have lamellae of strong brown and reddish brown in the lower part of the E horizon. Reaction ranges from strongly acid to slightly acid.

The Bt horizon is strong brown, yellowish red, red, reddish brown, or light reddish brown. It has mottles of grayish brown or light brownish gray. It is sandy clay loam or fine sandy loam. Reaction is strongly acid or moderately acid.

The depth to the Cr horizon ranges from 60 to 80 inches. It is light gray, yellowish red, pale brown, light brown, or very pale brown. It has mottles in shades of red, yellow, brown, and gray. The sandstone bedrock is soft when moist and hard when dry. Reaction is very strongly acid or strongly acid.

Waller Series

The Waller series consists of very deep, poorly drained, loamy soils in depressions. These soils formed in loamy sediments. Slopes are 0 to 1 percent.

Typical pedon of Waller loam, 0 to 1 percent slopes; from the Waller County line south of Plantersville, 0.1 mile north on Farm Road, 1.7 miles west on a private road, and 300 feet south of the road:

A—0 to 6 inches; grayish brown (10YR 5/2) loam, light brownish gray (10YR 6/2) dry; common fine distinct brown (7.5YR 5/4) mottles; weak medium subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine roots; moderately acid; clear smooth boundary.

E—6 to 26 inches; light brownish gray (10YR 6/2) loam, light gray (10YR 7/2) dry; common medium distinct

yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; hard, friable, nonsticky, nonplastic; many fine roots; moderately acid; clear irregular boundary.

Btg/E—26 to 45 inches; grayish brown (10YR 5/2) clay loam, light brownish gray (10YR 6/2) dry; common medium distinct brown (7.5YR 5/4) mottles; moderate medium subangular blocky structure; very hard, very friable, nonsticky, nonplastic; few thin coatings of sand grains along surfaces of peds; about 20 percent, by volume, tongues and krotovina of E horizon material; moderately acid; gradual smooth boundary.

Btg—45 to 65 inches; light gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium distinct dark brown (10YR 4/3) mottles; moderate medium subangular blocky structure; very hard, very firm, slightly sticky, slightly plastic; patchy clay films on faces of peds; moderately acid.

The solum is more than 60 inches thick. Reaction ranges from very strongly acid to moderately acid above a depth of 60 inches but ranges from moderately acid to neutral below that depth.

The combined thickness of the A and E horizons is 18 to 35 inches. The A horizon is dark grayish brown or grayish brown. It has mottles in shades of brown or yellow. The E horizon is light gray or light brownish gray. It has mottles in shades of brown or yellow. The A and E horizons are loam or fine sandy loam.

The Btg/E horizon is loam, clay loam, or sandy clay loam.

The Btg horizon is gray or light gray. It has mottles in shades of brown. It is clay loam or sandy clay loam.

Wilson Series

The Wilson series consists of very deep, somewhat poorly drained, loamy soils on terraces. These soils formed in clayey alluvial sediments. Slopes range from 0 to 3 percent.

Typical pedon of Wilson clay loam, 0 to 1 percent slopes; from the intersection of Texas Highway 6 and Texas Highway 105 in Navasota, 0.3 mile east on Texas Highway 105, about 0.2 mile north on a county road, and 100 feet west of the road:

A—0 to 9 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; hard, firm, slightly sticky, slightly plastic; many fine and medium roots; slightly acid; clear wavy boundary.

Btg1—9 to 25 inches; black (10YR 2/1) clay, very dark gray (10YR 3/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky, very plastic; common fine roots; few pressure faces; slightly acid; gradual smooth boundary.

Btg2—25 to 45 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; weak medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; common distinct pressure faces; neutral; gradual smooth boundary.

Btg3—45 to 60 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; streaks of dark grayish brown (10YR 4/2); weak medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; few fine concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

C—60 to 72 inches; gray (10YR 5/1) and pale brown (10YR 6/3) clay; massive; extremely hard, extremely firm; few fine crystals of gypsum; moderately alkaline.

The solum ranges from 60 to 80 inches in thickness. During dry periods small cracks extend to the surface.

The A horizon is less than 10 inches thick. It is very dark gray, dark gray, or dark grayish brown. Reaction ranges from moderately acid to neutral. The boundary between the A and Bt horizon is clear to gradual.

The Btg1 horizon is black, dark gray, or very dark gray. It is clay or silty clay. The content of clay ranges from 40 to 60 percent. Reaction ranges from moderately acid to slightly alkaline.

The Btg2 and Btg3 horizons are gray, dark gray, or very dark gray. They are clay or silty clay. The content of clay ranges from 40 to 60 percent. In some pedons the Btg3 horizon has a few crystals of gypsum or masses of calcium carbonate. Reaction ranges from slightly acid to moderately alkaline.

The C horizon, if it occurs, is gray, grayish brown, pale brown, light brownish gray, or a combination of these colors. The number of gypsum crystals ranges from few to many. Reaction ranges from neutral to moderately alkaline.

Zack Series

The Zack series consists of moderately well drained, loamy soils on uplands. They are moderately deep to siltstone bedrock and interbedded shale. These soils formed in clayey and loamy sediments. Slopes range from 1 to 5 percent.

Typical pedon of Zack fine sandy loam, 1 to 5 percent slopes; from the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 8.7 miles north on Farm Road 244, about 1.1 miles west on a county road, and 200 feet south of the road in an area of rangeland:

A—0 to 6 inches; dark brown (10YR 3/3) fine sandy

loam, dark brown (10YR 4/3) dry; weak fine subangular blocky structure; hard, firm, nonsticky, nonplastic; many fine roots; moderately acid; abrupt wavy boundary.

Bt1—6 to 22 inches; dark brown (10YR 4/3) clay, brown (10YR 5/3) dry; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; common fine roots; clay films on surface of peds; few siliceous pebbles; moderately acid; clear wavy boundary.

Bt2—22 to 32 inches; brown (10YR 5/3) clay, pale brown (10YR 6/3) dry; common medium distinct grayish brown (10YR 5/2) mottles; moderate medium subangular blocky structure; extremely hard, very firm, very sticky, very plastic; few fine roots; clay films on faces of peds; few siliceous pebbles; slightly acid; clear smooth boundary.

C—32 to 48 inches; pale brown (10YR 6/3) siltstone bedrock, very pale brown (10YR 7/3) dry; massive; extremely hard, very firm, sticky, plastic; interbedded with weathered shale; neutral.

The depth to the underlying siltstone bedrock or shale is 25 to 40 inches. During dry periods the soil has cracks.

The combined thickness of the A and B horizons is 25 to 40 inches. The A horizon is less than 10 inches thick in most pedons. It is grayish brown, dark grayish brown, yellowish brown, brown, or dark brown. Reaction ranges from strongly acid to slightly acid.

The Bt1 horizon is brown, dark brown, strong brown, reddish brown, or red. It has mottles of grayish brown, dark grayish brown, yellowish brown, or dark yellowish brown. In some pedons the matrix is mottled. Reaction ranges from moderately acid to neutral.

The Bt2 or Bt2g horizon is brown, grayish brown, olive brown, dark grayish brown, or pale brown. It has mottles in shades of brown, yellow, or gray. Reaction ranges from moderately acid to moderately alkaline.

The C horizon is pale brown, very pale brown, brown, light gray, or gray. It is weakly consolidated or thinly bedded siltstone or mudstone bedrock. It is clay loam, silty clay loam, or sandy clay loam. The material is partly cemented in places. Reaction ranges from neutral to moderately alkaline. Some pedons have a few concretions of calcium carbonate.

Zulch Series

The Zulch series consists of moderately well drained, loamy soils that are moderately deep to siltstone bedrock and weathered shale. These soils formed in clayey and loamy siltstone bedrock and shale sediments. Slopes range from 0 to 5 percent.

Typical pedon of Zulch fine sandy loam, 0 to 1 percent slopes; from the intersection of Texas Highway 39 and Farm Road 244 in Iola, 0.2 miles east on a county road, and 100 feet north of the road in a pasture:

A—0 to 9 inches; dark grayish brown (10YR 4/2) fine sandy loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; extremely hard, firm, nonsticky, nonplastic; common fine and medium roots; slightly acid; abrupt wavy boundary.

Bt1—9 to 25 inches; very dark gray (10YR 3/1) clay; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—25 to 39 inches; dark grayish brown (10YR 4/2) clay; few medium distinct yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; extremely hard, extremely firm, very sticky, very plastic; few fine roots; few patchy clay films on faces of peds; slightly acid; clear smooth boundary.

C—39 to 60 inches; light brownish gray (10YR 6/2), weakly consolidated siltstone bedrock and weathered shale; moderately alkaline.

The depth to the underlying siltstone bedrock or shale is 30 to 40 inches. During dry periods the soil has cracks. Some pedons have salts or carbonates in the C horizon.

The combined thickness of the A and B horizons is 30 to 40 inches. The A horizon is less than 10 inches thick in most pedons but may be as much as 12 inches thick. It is gray, dark grayish brown, very dark grayish brown, or grayish brown. Reaction ranges from moderately acid to neutral.

The Bt horizon is very dark gray, dark gray, gray, very dark grayish brown, dark grayish brown, black, or very dark brown. Some pedons have mottles of yellowish brown, dark yellowish brown, brown, or yellowish red. The Bt horizon is clay or silty clay. Reaction ranges from moderately acid to slightly alkaline.

The C horizon is light brownish gray, grayish brown, pale brown, or light olive brown. It is siltstone bedrock, shale, or clay loam. Some places have yellowish and brownish mottles. Reaction ranges from neutral to moderately alkaline.

Formation of the Soils

Soil is a three-dimensional body on the earth's surface that supports plants. Soil forms through the action and interaction of five major factors. These factors are parent material, climate, living organisms, topography, and time. Human activities are also important in the formation of soils.

The interaction of the five main factors results in differences among the soils. Climate and plant and animal life are active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and through subsequent transportation by water and wind and slowly change it into a natural body that has genetically related horizons. The effects of climate and plant and animal life are conditioned by topography. Soils on flood plains, for example, are different from those on well drained uplands. The parent material affects the kind of soil profile that forms and, in some cases, determines it entirely. Finally, time is needed for changing the parent material into soil. Generally, a long time is needed for the development of distinct horizons.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the chemical and mineralogical composition of the soil. In Grimes County it consists of sediments deposited by water during the Holocene, Pleistocene, Miocene, and Eocene ages. The oldest geological formation that crops out in the county is the Yegua Formation of Eocene age. The Caddell, Wellborn, Manning, and Whitsett Formations are next in age. The Catahoula, Oakville, and Fleming Formations are of Miocene Age. The Willis Formation of Pleistocene age is the youngest. Parent materials of Pleistocene age are on stream terraces. Parent materials of Holocene age are along flood plains of the Brazos and Navasota Rivers and local creeks.

The soils in Grimes County are different mainly because the soils formed in different parent materials. Depcor and Silstid soils, for example, formed in loamy material, which resulted in indistinct horizons. Bleiblerville and Frelsburg soils developed in calcareous, clayey material, which prevented the formation of distinct horizons. The parent materials in the county are described in more detail under the heading "Geology."

Climate

The soils in Grimes County formed in a humid climate, which resulted in moderately rapid soil development. The climate is uniform throughout the county, but its effect is modified locally by runoff. Its effect is modified in some areas by the aspect of the slopes. Only minor differences among soils in the county probably resulted because of climate.

Living Organisms

Plants, micro-organisms, earthworms, crawfish, and other living organisms have contributed to the formation of the soils. Gains in content of organic matter and nitrogen in the soil, gains and losses in content of plant nutrients, and changes in structure and porosity are caused by plants and animals.

In Grimes County, plants, dominantly tall and mid grasses, have had more influence on soil formation than animals. The prairie climax vegetation has contributed significantly to the accumulation of organic matter and has resulted in a darker surface layer in the Brenham, Bleiblerville, Burleson, Cuero, Klump, and many other soils. The roots of grasses reach deeply into the soil to utilize minerals at a lower depth. Minerals and organic matter are distributed throughout the soil as plants die and decompose. The decomposed plant roots leave channels that increase the rate of water intake and the extent of aeration of the soil. Earthworms and other soil organisms feed on the decomposed roots. The borings of the earthworms also help channel water and air through the soil.

Organic matter has accumulated only in the upper few inches of the soil in areas of post oak savanna and pine forest. It is quickly destroyed if the soil is cultivated. Soils in these areas, such as Axtell, Boy, and Depcor soils, have a light colored surface layer and are acid in the upper part of the subsoil. Burrowing animals, such as ants, crawfish, and gophers, help to mix the surface soil, subsoil, and parent material.

Human activities, such as tillage, and livestock grazing influenced soil formation. Much of the acreage of the savannas and prairies has been cultivated. Cultivation can increase the rate of runoff and the amount of erosion and reduce the content of organic matter. Tillage and continuous grazing have compacted soils and reduced the degree of aeration and the rate of water infiltration and the permeability. All of these changes have affected the productivity of the soils and can have some affect on the future development of the soils. Surface mining activities can interrupt the processes of soil formation. The characteristics of some soils in the county have been drastically changed by surface mining activities. During the mining process, the native soil becomes spoil material. The Gibbonscreek soils in map units GbC and GbE are soils that have been reconstructed from spoil materials. The Conroe soils in map unit CpC have also been altered by human activities because the original gravelly surface layer and subsurface layer have been removed.

Topography

Topography, or relief, influences soil development through its effect on drainage, erosion, plant cover, and soil temperature. The topography of Grimes County ranges from nearly level along the flood plains to gently rolling to rolling along upland hillsides and breaks.

The degree of profile development often depends on the amount of moisture in the soil. Rader and Waller soils are on flats that receive extra water and are poorly drained and wet. These soils have gleyed characteristics, and horizonation is degraded. The more sloping Knolle and Silawa soils are better drained and more brightly colored and have more distinct horizons. Soils on foot slopes, such as Cuero soils, receive additional material and have a thick, dark surface layer. Soils on hillsides, such as Latium and Renish soils, have a thin surface layer because the surface layer is removed nearly as rapidly as the soil forms. Soils on flood plains receive additional material during flooding and have many layers.

Time

A great length of time is required for the formation of soils that have distinct horizons. Differences in the length of time that the parent material has been in place are reflected in the degree of development of soil horizons.

The soils in Grimes County range from young to old. The younger soils show little horizon development. The Norwood and Oklared soils on flood plains are examples of young soils. They are stratified and resemble the parent material, except for some darkening of the surface layer. The older soils have distinct horizons that do not resemble the parent material. Axtell and Annona soils are examples of older soils.

Processes of Horizon Differentiation

The formation of horizons in soils involves several processes, including accumulation of organic matter, leaching of carbonates and other bases, reduction and transfer of iron, and formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

The content of organic matter in the soils in Grimes County ranges from low to medium. Accumulation of organic matter in the upper part of a profile forms a distinct, dark surface layer. Bleiblerville, Brenham, and Cuero soils have accumulated sufficient organic matter to form a dark surface layer.

Carbonates have been leached out of many of the soils in the county. Much leaching has occurred in the Axtell and Crockett soils. The Brenham and Latium soils, however, have a high content of carbonates because little leaching has occured.

The reduction and transfer of iron, a process called gleying, is evident in the poorly drained and somewhat poorly drained soils. Gray colors in the lower layers of Lufkin and Waller soils indicate reduction and loss of iron. The presence of yellowish brown, strong brown, and reddish mottles and the formation of concretions in some horizons indicate segregation of iron. Depcor, Gomery, and Silstid soil have mottles in these colors, and Conroe soils have nodules of ironstone.

The translocation of clay minerals has contributed to horizon development in many of the soils in the county. These minerals are the product of weathering of primary minerals, such as micas and feldspars. The subsoil in many of the soils in the county has accumulations of clay or clay films in pores and on surfaces of peds. These soils were probably leached of carbonates and bases before the clay was translocated. An A horizon with accumulations of translocated clay is called an argillic horizon. Crockett, Huntsburg, and Tabor soils have an argillic horizon.

Geology

Dr. Saul Aronow, Department of Geology, Lamar University, Beaumont, Texas, prepared this section.

Grimes County lies in the West Gulf Coastal Plain geomorphic unit *(9)*. The formations in the unit dip toward the gulf at an angle less than 2 degrees. They are exposed at the surface in bands that parallel the gulf coast and are broken by normal faults that dip toward the gulf. In a few places in Grimes County

northeast of Singleton, northeastward trending groups of fault-bound grabens (down-dropped blocks bounded by normal faults) parallel the gulf coast *(3, 16, 18)*.

The oldest surface rocks in the county belong to the Yegua Formation, which is of Eocene age. The youngest sediments are the Holocene alluvial deposits along the Brazos and Navasota Rivers and their tributaries.

The western part of the county is drained by the Brazos and Navasota Rivers. Most of the eastern part drains into the San Jacinto River basin, and the northeastern part drains into the Trinity River.

The general soil map in this survey will be used to correlate the occurance of the soils in the county with the surface outcrops of the geologic formations. The northeast-southwest trend of the soil map units corresponds with the trend of outcrops of the major geologic units *(3, 4)*.

Yegua Formation

The Yegua Formation of Eocene age is the oldest geologic unit exposed in the county. It is the uppermost, or youngest, part of the Claiborne Group. Its area of outcrop generally underlies the Zulch-Zack-Boonville general soil map unit.

Locally, the Yegua Formation is mainly deltaic in origin *(10, 11)* and is the product of a marine regression, which is the seaward advance of the shoreline, over the previously deposited marine units of Tertiary age. The dominant components of the Yegua Formation are clays, claystones, shales, siltstones, and sandstones. In deltaic environments, the finer sediments are deposited in prodelta, delta-front, interdistributary, and crevasse-splay environments. The coarser sediments are deposited in distributary and delta-front environments. Lignite materials, if present, are located in abandoned distributary channels, in interdistributary swamps and marshes, and on the broad surfaces of subsiding, inactive deltas. Thin, reworked strata of pyroclastics (volcanic ash or tuff) are interbedded with the finer deposits. Commonly, the volcanic ash has weathered to smectites.

The Zulch, Zack, and Boonville soils are the principal soils in areas of the Yegua Formation. The parent materials of these soils range from claystones to shales to siltstones, which are the finer materials of a deltaic environment. The Shiro soil, which is a minor soil in this unit, has parent materials of deltaic and distributary sandstones.

All soils in areas of the Yegua Formation have A and E horizons of fine sandy loam or loamy fine sand that are 6 to 18 inches thick and overlie a clayey Bt horizon. In many places the A and E horizons have siliceous pebbles that are not present in the underlying Tertiary sediments. In some places a layer of gravel or stones is at the base of the E horizon. The presence of pebbles in the A and E horizons and the layer of stones suggest that the boundary between the E horizon and the underlying clayey Bt horizon is a lithologic discontinuity. The sandy materials in the upper part of the profile are probably mass-wasted and slope-washed colluvium derived from fluvial covers of late Tertiary or early Pleistocene age *(13)*.

Jackson Group

The next youngest sequence of formations in the county belongs to the Jackson Group of Eocene to Oligocene age *(3, 4)*. The outcrop area of the Jackson Group roughly corresponds with the northeastward trending part of the Axtell-Lufkin-Gredge general soil map unit and with the Singleton-Burlewash-Shiro and Gomery-Shiro-Elmina general soil map units on the "Geologic Atlas of Texas" *(3, 4)*.

The Jackson Group has been divided into four formations. From oldest to youngest, the formations are the Caddell, Wellborn, Manning, and Whitsett Formations. These formations are in a regressive or prograding sequence, and the seaward advance of the shoreline is toward the southeast *(7)*. The Caddell Formation consists of prodelta mud. The Wellborn Formation is a delta-front facies, and the Manning Formation is a delta-plain facies. The Whitsett Formation is an overlying fluvial facies. These formations have been the subject of several generations of surface geologic mapping and stratigraphic studies in Grimes County and counties to the northeast and southwest *(3, 4, 7, 14, 16, 17, 24)*.

During the planning of the Gibbons Creek lignite mine, the division of the Jackson Group into four formations and the interpretations of the environments of deposition were questioned *(6, 7)*. New proposals suggest that the Jackson Group be divided into two formations consisting of a lower prodelta, clayey, marine Caddell Formation and an upper Manning Formation and that the Wellborn and Whitsett Formations be eliminated *(6)*. The Manning Formation would consist of four superimposed sequences of delta-front and delta-plain sediments that could not be apportioned into three formations under the current rules of stratigraphic nomenclature. No fluvial plain sediments, as previously represented by the Whitsett Formation, would be identified. The thicker, more prominent sandstone beds were deposited as discontinuous delta-front sands. The lignite beds mined in the Gibbons Creek area south of Carlos were laid down in delta-plain environments. Minor sandstones among the delta plain sediments are considered distributary channel and crevasse-splay deposits.

The Caddell Formation consists of clay, sandstone, and siltstone that is glauconitic, calcareous, tuffaceous (bentonitic), lignitic, and locally fossiliferous. In some areas it has imprints of marine megafossils *(3, 4, 6)*. Most of the outcrops of the Caddell Formation are in the northeastward-southwestward trending part of the Axtell-Lufkin-Gredge general soil map unit. The northwestern margin of this map unit overlaps the adjacent Yegua Formation, and the southeastern margin overlaps the adjacent Manning Formation *(6)*.

The north-south trending part of the Axtell-Lufkin-Gredge general soil map unit that is parallel to the Navasota River is probably a very old, high, dissected terrace or terraces. The northeastward-southwestward trending part that overlies the Caddell Formation crosses the drainage divide between the basins of the Trinity and Navasota Rivers. If this area is of relict fluvial origin, it indicates a change in the drainage of the region. The whole area has been intricately eroded into isolated hills, some of which might be much lower terrace remnants.

Most of the soils that make up the Axtel-Lufkin-Gredge general soil map unit, including many of the minor soils, are commonly found on high, eroded terraces in Madison and Brazos Counties, which are adjacent to Grimes County. These high terraces are above the level of terraces adjacent to the flood plain of the Navasota River. They are indicated with a "Qhg" symbol on the "Geologic Atlas" and are described as high gravel deposits *(3)*. They have the same range in elevation and degree of dissection as the areas of the Axtell-Lufkin-Gredge general soil map unit in Grimes County. If the areas of the Axtell-Lufkin-Gredge general soil map unit had more gravel and were therefore as lithologically distinct as the "Qhg" geologic units in the adjacent counties, they might have been separated from the formations of Tertiary age.

The upper horizons of Axtell, Gredge, and Lufkin soils all contain siliceous pebbles that are not present in the underlying Caddell Formation. The boundary between the A horizon of fine sandy loam or the E horizon, if present, and the underlying clayey Bt horizon is abrupt. This suggests a lithologic discontinuity. The pebbles may have descended along desiccation cracks from layers of stones at the base of the A or E horizons. Alternatively, the upper horizons may be colluvially churned remnants of fluvial terrace deposits, which incorporated both clayey flood basin and gravelly point-bar deposits as well as the uppermost parts of the bedrock. The possible lithologic discontinuity at the base of the upper horizons may indicate two distinct episodes in the colluvial history of the now-dissected terrace surfaces.

The neutral to alkaline reactions of the lower horizons, the calcium carbonate nodules in the Axtell soil, and the geologic stratification in some C horizons suggest the presence of the Caddell Formation. At any rate, the Caddell Formation, as a parent material, has left no distinct or definite imprint on the soils.

The outcrop areas of the Manning Formation (as most recently defined) underlie all of the Singleton-Burlewash-Shiro and Gomery-Shiro-Elmina general soil map units and some adjacent parts of the Axtell-Lufkin-Gredge and Falba-Shiro-Greenvine general soil map units *(6)*. The bedrock in many of these soils is tuffaceous. The sandstone bedrock underlying some of the major soils, such as the Shiro and Gomery soils, is probably of delta-front or distributary origin. The mixed to clayey lithologies underlying other major and minor soils, such as the Singleton, Burlewash, Elmina, Falba, and Koether soils, are probably of prodelta, delta-front, interdistributary, and crevasse-splay origin.

The spoil material from the large open pit lignite mine south of Carlos, mapped as Gibbonscreek clay loam, is a mixture of several lithologies found in the Caddell and Manning Formations.

All of the soils overlying the Manning Formation, other than Gibbonscreek soils, have a sandy or loamy surface layer (A or A and E horizons) and an abrupt boundary over a Bt horizon of clay or sandy clay. Many of these soils have siliceous pebbles in the surface layer and in lower parts of the profile. The significance of these pebbles may be similar to the significance of pebbles in soils formed in areas of the Caddell Formation.

Catahoula Formation

The Catahoula Formation overlies the Jackson Group and is of late Oligocene to early Miocene age. Most outcrops of the Catahoula Formation are in areas of the Falba-Shiro-Greenvine general soil map unit.

The Catahoula Formation has the highest proportion of fine-grained pyroclastic materials of all the Tertiary age formations. The volcanic material may have originated in west Texas, New Mexico, and northern Mexico *(8)*. Most of the volcanic ash and its product of weathering, smectitic clay, has been fluvially and colluvially reworked since its initial descent. Silica, released into ground water by the weathering of the ash, has replaced or permeated woody vegetation and produced the petrified wood that is abundant in areas of the Catahoula Formation. The silica, in the form of opal, has cemented sand in some local areas of the Catahoula Formation and formed a hard, dense rock with the appearance of quartzite. The Whitsett Formation, the upper part of the Jackson Group, also is very tuffaceous and has some of the characteristics of the Catahoula Formation.

In Grimes County and adjacent areas, the Catahoula Formation is part of the Chita-Corrigan (paleo) fluvial system which was deposited by meandering streams flowing to the southeast *(8)*. The overall framework of the formation consists of crossbedded sandy channel, point bar, and crevasse splay deposits, which are between overbank flood basin and interchannel lacustrine deposits of mainly mud and silt. Some of the sand in the channels contains small pebbles, ferruginous nodules, and clasts of petrified wood. The finer grained facies, muds, and silts make up about 65 percent of the formation, by volume.

Two of the major soils in areas of the Catahoula Formation, the Falba and the Greenvine soils, have a C horizon that ranges in lithology from sandstone to siltstone to claystone or clay and encompasses all of the fluvial facies. The Shiro soil generally has a C horizon of sandstone, which can be attributed to channel or point bar facies. The Catahoula Formation is mainly noncalcareous *(3, 4, 20)*. Only the Greenvine soil has a calcareous C horizon.

Fleming Formation

The Fleming Formation overlies the Catahoula Formation unconformably. In Grimes County, the calcareous lithology of the Fleming Formation contrasts with the mainly noncalcareous lithology of the Catahoula Formation *(20)*.

The most continuous outcrops of the Fleming Formation are those overlain by the Frelsberg-Crockett-Brenham general soil map unit. Much of the Fleming Formation is covered unconformably by remnants of the Willis Formation. Depcor and Huntsburg soils, which are soils of minor extent in the Frelsberg-Crockett-Brenham unit, formed over these remnants of the Willis Formation.

The Fleming Formation is fluvial in origin. It consists mainly of overbank levee and flood basin deposits that are clayey and silty and, to a lesser extent, deposits in sandy crossbedded point bars and channels.

To the southwest, across the Brazos River in Washington County, the lower or older part of the Fleming Formation is in the Oakville Sandstone *(4)*. The Oakville Sandstone has greater amounts of point bar and channel sandstone and lesser amounts of overbank clays and silts than the Fleming Formation. Some disagree that the northeastern termination of the Oakville Sandstone is at the Brazos River *(15, 19, 20)* and suggest that it is either within Grimes County or northeast of the county. In the area where the Oakville Sandstone can be identified, the upward transition from the Oakville Sandstone to the more clayey Fleming Formation seems to mark a change in deposition by meandering streams or bedload-braided streams that yield deposits rich in sands and loams to deposition by suspended-load meandering streams that yield overbank deposits rich in silts and clays. In areas northeast of Grimes County where the Oakville Sandstone is not mapped, deposition by suspended-load streams occurred throughout the time of deposition in areas of the Fleming Formation.

The clayey facies of the Fleming Formation have locally abundant calcareous concretions of detrital origin rather than pedogenic origin. These concretions were probably derived from the erosion of caliche deposits at the same time as the accumulation of the Fleming Formation sediments *(5)*. The calcium carbonate was probably recycled from the older Tertiary age formations and was originally derived from central Texas limestone of Cretaceous age.

The clayey, calcareous, alkaline C horizons of the Frelsburg, Crockett, and Brenham soils reflect the flood basin facies of the Fleming Formation. In the Crockett soils, the upper acidic horizons that have brown and yellowish red mottles suggest that a thin residuum of the Willis Formation overlies the clay of the Fleming Formation.

Willis Formation

The Willis Formation unconformably overlies the Fleming Formation. Probably most of the outcrops of the Fleming Formation were originally covered by the Willis Formation. Depending upon the local content of sand and gravel and the geologic setting, the Willis Formation is considered fluvial to alluvial fan in origin.

In Grimes County, the Willis Formation is not particularly coarse grained. The dominant materials are sand, silt, and clay. The sand has only a small content of gravel. In some counties to the northeast and southwest, the Willis Formation is much more gravelly in many places. This indicates very coarse channel deposits of mixed-load meandering streams to bed-load braided streams.

The Depcor-Fetzer-Huntsburg general soils map unit, the Conroe-Depcor map unit, and part of the Robco-Chazos-Axtell map unit formed in areas of the Willis Formation. The entire solum of the Annona, Boy, Tonkavar, Depcor, Huntsburg, Conroe, Splendora, Landman, and Waller soils developed in the Willis Formation. In other soils, such as the Crockett, Fetzer, Wilson, Chazos, Axtell, Shiro, and Cuero soils, the upper part of the solum may have developed in the Willis Formation or a thin colluvial remnant of it and the lower part may have developed in the Fleming Formation or older formations.

On the geologic map, most areas of the Willis and Fleming Formations correspond with the Depcor-Fetzer-Huntsburg and Conroe-Depcor general soil map units. A

major difference between the soil map and the geologic map is that the northernmost area of the Depcor-Fetzer-Huntsburg unit is shown in an area of the Fleming Formation. It is sometimes difficult to determine whether the Willis Formation residuum or colluvial cover is sufficiently thick to be identified as an area of outcrop.

Areas of the Willis Formation are badly eroded deposits of alluvial plains that drained into a paleo-Gulf of Mexico that had buried deltaic margins. The alluvial plains were probably fed by discrete streams that had flood plains or braided channels inland of the continuous sedimentary units parallel to the Gulf of Mexico. These streams flowed through areas of outcrops of formations older than the Willis Formation. They may have deposited the laterally displaced and colluvially reworked siliceous pebbles found in the upper part of the sola of soils in areas of these older formations. Areas of the dissected Axtell-Lufkin-Gredge map unit in the northern part of the county may be remnants of the feeder system to the alluvial plains of the Willis Formation.

Pleistocene Terraces and Holocene Alluvium

The terraces that flank the Navasota and Brazos Rivers along the western margin of Grimes County are well to poorly defined. They are between the Holocene flood plain and the upland areas where formations as old as the Yegua Formation outcrop. Several of the larger terraces have been separated on the general soil map as part of the Robco-Chazos-Axtell general soil map unit. The largest terrace in the county, near Navasota, makes up the entire Mabank-Wilson-Burleson general soil map unit. Other smaller terraces that occur along the Navasota and Brazos Rivers are too small to show on the general soil map.

The soils that formed on these terraces include the Axtell, Burleson, Chazos, Gredge, Lufkin, Mabank, Robco, and Wilson soils. The Axtell, Burleson, Chazos, Gredge, Lufkin, Mabank, and Wilson soils have a solum that is mainly clayey, which suggests that the parts of the terraces underlain by these soils originated in flood basins. The lower part of the solum in the Mabank soil is calcareous, which suggests that only a thin cover of fluvial material overlies local calcareous bedrock. The lower part of the solum in the Robco soils is sandy clay loam that probably developed from deposits on levees, crevasse splays, or point bars. The surface layer of loamy fine sand is probably partly eolian in origin.

The terraces range in elevation from 10 to 50 feet above the adjacent flood plains. They are probably all Pleistocene in age, that is, less than 2 million years old, and may be related to glacially induced fluctuations in sea level *(12)*.

The Gladewater-Nahatche-Gowker and Brazoria-Norwood general soil map units consist of alluvial deposits of Holocene age along the Navasota and Brazos Rivers.

The reddish brown and dark reddish brown colors of the Brazoria-Norwood general soil map unit are probably derived from the redbeds of Permian and Triassic age through which the Brazos River flows in northwestern Texas. The darker colors of the Gladewater-Nahatche-Gowker general soil map unit reflect the more subdued colors of the sediments of Tertiary age in the drainage basin of the Navasota River.

The Norwood, Oklared, Nahatche, Navasan, and Hatliff soils probably formed in sediments on point bars, levees, and crevasse splays. The more clayey Brazoria, Kaman, Gladewater, and Gowker soils formed in deposits in flood basins.

The alluvial deposits are probably less than 5,000 years old. They probably reached their present elevation during the stabilization of the current sea level.

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Glossary

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep, rocky slopes.

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

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

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

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

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

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

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

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

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

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

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

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

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

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

Clay film. A thin coating of oriented clay on the surface

of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

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

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Cobblestone (or cobble). A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

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

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

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

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

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

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

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

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

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

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

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

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

Cemented.—Hard; little affected by moistening.

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

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

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

Deferred grazing. Postponing grazing or resting grazing land for a prescribed period.

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

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

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

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

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

free of the mottling related to wetness.

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

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

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

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

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

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

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

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

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic)—Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated)—Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil is not a source of gravel or sand for construction purposes.

Fast intake (in tables). The movement of water into the soil is rapid.

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

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

Fine textured soil. Sandy clay, silty clay, or clay.

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

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

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

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

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

Gilgai. Commonly, a succession of microbasins and

microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of clayey soils shrink and swell considerably with changes in moisture content.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, up to 3 inches (7.6 centimeters) in diameter.

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

Ground water (geology). Water filling all the unblocked pores of the material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

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

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

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

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

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or

roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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

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

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

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

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

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

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

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

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

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

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

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

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

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

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

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

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

Large stones (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

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

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

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

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

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

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and

coarse; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

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

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and thickness.

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

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

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

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

Plinthite. The sesquioxide-rich, humus-poor, highly weathered mixture of clay with quartz and other diluents. It commonly appears as red mottles, usually in platy, polygonal, or reticulate patterns. Plinthite changes irreversibly to an ironstone hardpan or to irregular aggregates on repeated wetting and drying, especially if it is exposed also to heat from the sun. In a moist soil, plinthite can be cut with a spade. It is a form of laterite.

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

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

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

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

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

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential climax vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil,

and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

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

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Moderately acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Slightly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 drawbar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). A shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees

in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.6 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, thickness of the line can be one fragment or more. It generally overlies material that weathered in place, and it is overlain by recent sediment of variable thickness.

Stones. Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

Stony. Refers to a soil containing stones in numbers that interfere with or prevent tillage.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed on the contour or at a slight angle to the contour across

sloping soils. The terrace intercepts surface runoff, so that water soaks into the soil or flows slowly to a prepared outlet.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill; part of a foot slope.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

Tuff. A compacted deposit that is 50 percent or more volcanic ash and dust.

Unstable fill (in tables). There is a risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial meltwater. In nonglaciated regions, alluvium deposited in stream valleys by heavily loaded streams.

Variegation. Refers to patterns of contrasting colors that are assumed to be inherited from the parent material rather than to be the result of poor drainage.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-81 at Brewham, Texas)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average daily	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	60.1	38.5	49.3	81	17	142	2.70	1.08	4.06	5	0.1
February	64.1	41.4	52.8	84	21	161	2.95	1.35	4.32	5	.3
March	71.9	48.1	60.0	89	28	329	2.07	.71	3.19	4	.0
April	79.5	57.4	68.5	91	39	555	3.99	1.82	5.85	5	.0
May	85.8	64.1	75.0	96	49	775	4.64	2.17	6.76	6	.0
June	92.4	70.2	81.3	101	59	939	3.79	.75	6.13	4	.0
July	96.3	72.6	84.5	104	66	1,070	1.90	.53	3.00	4	.0
August	96.7	72.2	84.5	105	64	1,070	2.61	.62	4.18	4	.0
September	90.7	67.6	79.2	101	53	876	4.65	1.64	7.14	6	.0
October	82.7	57.4	70.1	95	40	623	3.54	1.00	5.57	4	.0
November	71.2	47.5	59.4	88	28	297	3.95	1.74	5.84	6	.1
December	63.6	41.2	52.4	83	22	143	3.14	1.59	4.49	6	.0
Yearly:											
Average	79.6	56.5	68.1	---	---	---	---	---	---	---	---
Extreme	---	---	---	106	16	---	---	---	---	---	---
Total	---	---	---	---	---	6,980	39.93	30.20	49.07	59	.5

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-81 at Brewham, Texas)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Feb. 23	Mar. 10	Mar. 27
2 years in 10 later than--	Feb. 13	Feb. 28	Mar. 18
5 years in 10 later than--	Jan. 26	Feb. 10	Mar. 1
First freezing temperature in fall:			
1 year in 10 earlier than--	Dec. 8	Nov. 19	Nov. 5
2 years in 10 earlier than--	Dec. 17	Nov. 29	Nov. 14
5 years in 10 earlier than--	Jan. 5	Dec. 16	Nov. 30

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-81 at Brewham, Texas)

Probability	Daily minimum temperature during growing season		
	Higher than 24 °F	Higher than 28 °F	Higher than 32 °F
	Days	Days	Days
9 years in 10	305	272	237
8 years in 10	314	284	249
5 years in 10	337	307	274
2 years in 10	>365	331	299
1 year in 10	>365	347	311

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
AnC	Annona fine sandy loam, 1 to 5 percent slopes	16,300	3.2
AnC2	Annona fine sandy loam, 1 to 5 percent slopes, eroded	500	0.1
AnD	Annona fine sandy loam, 5 to 8 percent slopes	3,600	0.7
Ap	Arents	200	*
ArA	Arol fine sandy loam, 0 to 1 percent slopes	1,850	0.4
ArC	Arol fine sandy loam, 1 to 5 percent slopes	6,800	1.3
AxC	Axtell fine sandy loam, 1 to 5 percent slopes	13,300	2.6
AxC2	Axtell fine sandy loam, 1 to 5 percent slopes, eroded	1,800	0.4
AxD	Axtell fine sandy loam, 5 to 8 percent slopes	2,100	0.4
BcA	Bleiblerville clay, 0 to 1 percent slopes	510	0.1
BcB	Bleiblerville clay, 1 to 3 percent slopes	4,100	0.8
BfB	Boonville fine sandy loam, 1 to 3 percent slopes	4,050	0.8
BgD	Boy fine sand, 1 to 8 percent slopes	10,700	2.1
BoA	Brazoria clay, 0 to 1 percent slopes	3,900	0.8
BoB	Brazoria clay, 1 to 3 percent slopes	1,000	0.2
Bp	Brazoria clay, depressional	1,600	0.3
BrD	Brenham clay loam, 3 to 8 percent slopes	7,800	1.5
BsA	Burleson clay, 0 to 1 percent slopes	1,750	0.3
BuC	Burlewash fine sandy loam, 1 to 5 percent slopes	6,500	1.3
BuE	Burlewash fine sandy loam, 5 to 12 percent slopes	6,400	1.2
BxE	Burlewash-Gullied land complex, 5 to 15 percent slopes	1,000	0.2
CaC	Carbengle clay loam, 1 to 5 percent slopes	3,300	0.6
CaD	Carbengle clay loam, 5 to 8 percent slopes	2,100	0.4
ChC	Chazos loamy fine sand, 1 to 5 percent slopes	16,300	3.2
ChD	Chazos loamy fine sand, 5 to 8 percent slopes	2,800	0.5
CoC	Conroe loamy fine sand, 1 to 5 percent slopes	1,800	0.4
CpC	Conroe gravelly loamy fine sand, graded, 1 to 5 percent slopes	500	0.1
CrC	Crockett fine sandy loam, 1 to 5 percent slopes	4,900	1.0
CrC2	Crockett fine sandy loam, 1 to 5 percent slopes, eroded	700	0.1
CrD	Crockett fine sandy loam, 5 to 8 percent slopes	1,100	0.2
CuC	Cuero clay loam, 1 to 5 percent slopes	1,300	0.3
DeC	Depcor loamy fine sand, 1 to 5 percent slopes	18,100	3.5
DeD	Depcor loamy fine sand, 5 to 8 percent slopes	1,000	0.2
Du	Dumps, ash	200	*
EmC	Elmina loamy fine sand, 1 to 5 percent slopes	11,000	2.1
EmD	Elmina loamy fine sand, 5 to 8 percent slopes	1,200	0.2
FaC	Falba fine sandy loam, 1 to 5 percent slopes	18,400	3.6
FaC2	Falba fine sandy loam, 1 to 5 percent slopes, eroded	2,500	0.5
FeC	Fetzer loamy fine sand, 1 to 5 percent slopes	14,300	2.8
FlA	Flatonia clay loam, 0 to 1 percent slopes	300	0.1
FlB	Flatonia clay loam, 1 to 4 percent slopes	1,900	0.4
FrC	Frelsburg clay, 1 to 5 percent slopes	27,000	5.3
FrC2	Frelsburg clay, 1 to 5 percent slopes, eroded	350	0.1
GbC	Gibbonscreek clay loam, 1 to 5 percent slopes	1,700	0.3
GbE	Gibbonscreek clay loam, 5 to 20 percent slopes	300	0.1
Gd	Gladewater clay, frequently flooded	11,500	2.2
GmC	Gomery loamy fine sand, 1 to 5 percent slopes	12,000	2.3
Go	Gowker loam, frequently flooded	4,250	0.8
Gp	Gowker clay loam, frequently flooded	8,150	1.6
GrC	Gredge fine sandy loam, 1 to 5 percent slopes	3,750	0.7
GrE	Gredge fine sandy loam, 5 to 12 percent slopes	6,600	1.3
GvC	Greenvine clay, 1 to 5 percent slopes	6,500	1.3
GvD	Greenvine clay, 5 to 8 percent slopes	700	0.1
Ha	Hatliff fine sandy loam, frequently flooded	5,600	1.1
HuC	Huntsburg loamy fine sand, 1 to 5 percent slopes	17,200	3.3
HuD	Huntsburg loamy fine sand, 5 to 8 percent slopes	6,150	1.2
Ka	Kaman clay, frequently flooded	2,000	0.4
KlC	Klump sandy loam, 1 to 5 percent slopes	500	0.1
KlD	Klump sandy loam, 5 to 8 percent slopes	800	0.2
KnC	Knolle loamy sand, 1 to 5 percent slopes	250	*
KnD	Knolle loamy sand, 5 to 8 percent slopes	200	*
KrD	Koether-Rock outcrop complex, 1 to 8 percent slopes	1,050	0.2

See footnote at end of table.

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS--Continued

Map symbol	Soil name	Acres	Percent
LaC	Landman loamy fine sand, 1 to 5 percent slopes	900	0.2
LtD	Latium clay, 5 to 8 percent slopes	7,100	1.4
LtD3	Latium clay, 4 to 12 percent slopes, severely eroded	4,900	1.0
LuA	Lufkin fine sandy loam, 0 to 1 percent slopes	3,200	0.6
LuB	Lufkin fine sandy loam, 1 to 3 percent slopes	2,750	0.5
LxB	Lufkin-Rader complex, gently undulating	9,600	1.9
MaA	Mabank fine sandy loam, 0 to 1 percent slopes	4,500	0.9
MaB	Mabank fine sandy loam, 1 to 3 percent slopes	1,000	0.2
Na	Nahatche clay loam, frequently flooded	25,100	4.9
NdC	Navasan loamy sand, 1 to 5 percent slopes	1,100	0.2
NoA	Norwood silt loam, 0 to 1 percent slopes	3,900	0.8
NrA	Norwood silty clay loam, 0 to 1 percent slopes	110	*
OkA	Oklared very fine sandy loam, 0 to 1 percent slopes	500	0.1
On	Oklared-Norwood complex, frequently flooded	600	0.1
PaD	Padina loamy fine sand, 1 to 8 percent slopes	5,500	1.1
Pt	Pits	90	*
RaA	Rader fine sandy loam, 0 to 1 percent slopes	2,600	0.5
RaB	Rader fine sandy loam, 1 to 3 percent slopes	1,650	0.3
ReF	Renish-Rock outcrop complex, 8 to 20 percent slopes	1,300	0.3
RoC	Robco loamy fine sand, 1 to 5 percent slopes	9,000	1.8
RoD	Robco loamy fine sand, 5 to 8 percent slopes	500	0.1
SaC	Shalba fine sandy loam, 1 to 5 percent slopes	2,000	0.4
SbC	Shalba-Rock outcrop complex, 1 to 5 percent slopes	700	0.1
ShC	Shiro loamy fine sand, 1 to 5 percent slopes	28,000	5.5
ShD	Shiro loamy fine sand, 5 to 8 percent slopes	2,600	0.5
SlC	Silawa loamy fine sand, 1 to 5 percent slopes	900	0.2
SlD	Silawa loamy fine sand, 5 to 8 percent slopes	1,000	0.2
SmC	Silstid loamy fine sand, 1 to 5 percent slopes	2,600	0.5
SmD	Silstid loamy fine sand, 5 to 8 percent slopes	200	*
SnA	Singleton fine sandy loam, 0 to 1 percent slopes	300	0.1
SnC	Singleton fine sandy loam, 1 to 5 percent slopes	15,500	3.0
SpB	Splendora fine sandy loam, 0 to 3 percent slopes	400	0.1
TaC	Tabor fine sandy loam, 1 to 5 percent slopes	5,400	1.1
Tn	Tinn clay, frequently flooded	5,300	1.0
ToD	Tonkavar fine sand, 1 to 8 percent slopes	6,100	1.2
Wa	Waller loam, 0 to 1 percent slopes	120	*
WlA	Wilson clay loam, 0 to 1 percent slopes	1,600	0.3
WlB	Wilson clay loam, 1 to 3 percent slopes	800	0.2
ZaC	Zack fine sandy loam, 1 to 5 percent slopes	12,800	2.5
ZaC2	Zack fine sandy loam, 2 to 5 percent slopes, eroded	1,600	0.3
ZuA	Zulch fine sandy loam, 0 to 1 percent slopes	2,900	0.6
ZuC	Zulch fine sandy loam, 1 to 5 percent slopes	15,300	3.0
ZuC2	Zulch fine sandy loam, 1 to 5 percent slopes, eroded	1,096	0.2
	Water areas more than 40 acres in size	3,066	0.6
	Total	512,192	100.0

* Less than 0.1 percent.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Improved bermudagrass	Common bermudagrass	Bahiagrass	Corn	Oats
		AUM*	AUM*	AUM*	Bu	Bu
AnC, AnC2---------- Annona	IVe	5.0	---	5.5	30	30
AnD---------- Annona	VIe	5.0	---	5.0	---	25
Ap---------- Arents	VIe	2.0	---	2.0	---	---
ArA---------- Arol	IIIw	3.0	2.0	2.0	35	35
ArC---------- Arol	IVe	3.0	2.0	2.0	20	30
AxC---------- Axtell	IVe	5.0	4.0	4.0	30	30
AxC2---------- Axtell	IVe	4.0	3.0	3.0	30	---
AxD---------- Axtell	VIe	4.0	3.0	3.0	---	---
BcA---------- Bleiblerville	IIw	6.0	4.0	---	60	50
BcB---------- Bleiblerville	IIe	6.0	4.0	---	60	50
BfB---------- Boonville	IIIe	6.0	5.0	5.0	30	---
BgD---------- Boy	IIIs	7.0	5.0	---	45	35
BoA---------- Brazoria	IIw	6.0	5.0	---	100	60
BoB---------- Brazoria	IIe	6.0	5.0	---	80	60
Bp---------- Brazoria	IIIw	5.0	4.0	---	80	40
BrD---------- Brenham	IVe	5.0	4.0	3.0	50	50
BsA---------- Burleson	IIw	6.0	5.0	3.0	80	50
BuC---------- Burlewash	IVe	3.0	2.0	2.0	---	---
BuE---------- Burlewash	VIe	2.0	1.0	1.0	---	---

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Improved bermudagrass	Common bermudagrass	Bahiagrass	Corn	Oats
		AUM*	AUM*	AUM*	Bu	Bu
BxE Burlewash-Gullied land	VIIe	---	---	---	---	---
CaC Carbengle	IIIe	6.0	5.0	---	35	30
CaD Carbengle	IVe	5.0	4.0	---	---	30
ChC Chazos	IIIe	7.0	5.0	5.0	40	---
ChD Chazos	IVe	7.0	5.0	5.0	---	---
CoC Conroe	IIIs	7.0	5.0	5.0	55	---
CpC Conroe	VIe	5.0	4.0	4.0	---	---
CrC Crockett	IVe	5.5	4.0	4.0	35	35
CrC2 Crockett	IVe	4.0	3.0	3.0	---	20
CrD Crockett	VIe	5.0	3.0	3.0	---	35
CuC Cuero	IIIe	7.0	6.0	5.0	35	---
DeC Depcor	IIIe	7.0	5.0	4.0	40	40
DeD Depcor	IVe	7.0	5.0	4.0	---	---
Du** Dumps						
EmC Elmina	IIIe	6.0	4.0	4.0	30	25
EmD Elmina	IVe	6.0	4.0	4.0	---	---
FaC Falba	IVe	3.0	2.0	2.0	30	30
FaC2 Falba	IVe	2.0	1.0	1.0	30	25
FeC Fetzer	IIIe	6.0	5.0	---	---	---
FlA Flatonia	IIw	4.0	3.0	3.0	60	---

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Improved bermudagrass	Common bermudagrass	Bahiagrass	Corn	Oats
		AUM*	AUM*	AUM*	Bu	Bu
FlB Flatonia	IIe	4.0	3.0	3.0	60	---
FrC Frelsburg	IIIe	6.0	5.0	---	40	50
FrC2 Frelsburg	IVe	5.0	4.0	---	30	35
GbC Gibbonscreek	IVe	5.0	4.0	4.0	---	---
GbE Gibbonscreek	VIe	4.0	3.0	3.0	---	---
Gd Gladewater	Vw	3.0	2.0	1.0	---	---
GmC Gomery	IIIe	6.0	5.0	5.0	30	25
Go, Gp Gowker	Vw	7.0	6.0	6.0	---	60
GrC Gredge	IVe	5.0	4.0	4.0	25	---
GrE Gredge	VIe	3.0	2.0	2.0	---	---
GvC Greenvine	IIIe	4.0	3.0	---	40	40
GvD Greenvine	IVe	4.0	3.0	---	---	40
Ha Hatliff	Vw	7.0	6.0	6.0	---	---
HuC Huntsburg	IIIe	6.0	5.0	4.0	30	30
HuD Huntsburg	IVe	6.0	5.0	4.0	---	---
Ka Kaman	Vw	5.0	4.0	3.0	---	60
KlC Klump	IIIe	6.5	5.5	5.5	35	40
KlD Klump	IVe	6.5	5.0	5.0	20	40
KnC Knolle	IIIe	5.0	4.0	4.0	---	---
KnD Knolle	IVe	5.0	4.0	4.0	---	---

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Improved bermudagrass	Common bermudagrass	Bahiagrass	Corn	Oats
		AUM*	AUM*	AUM*	Bu	Bu
KrD---------- Koether-Rock outcrop	VIIs	---	---	---	---	---
LaC---------- Landman	IIIs	7.0	---	---	45	40
LtD---------- Latium	IVe	4.0	3.0	---	30	30
LtD3---------- Latium	VIe	3.0	2.0	---	---	25
LuA---------- Lufkin	IIIw	5.0	4.0	4.0	35	30
LuB---------- Lufkin	IIIe	5.0	4.0	4.0	35	30
LxB---------- Lufkin-Rader	IIIe	5.8	4.7	4.7	43	---
MaA---------- Mabank	IIIw	5.0	4.0	4.0	40	30
MaB---------- Mabank	IIIe	5.0	4.0	4.0	35	30
Na---------- Nahatche	Vw	8.0	7.0	7.0	---	60
NdC---------- Navasan	IIIs	7.0	4.0	---	---	---
NoA, NrA---------- Norwood	I	8.0	7.0	---	110	85
OkA---------- Oklared	I	8.0	7.0	---	100	60
On---------- Oklared-Norwood	Vw	8.0	7.0	---	---	---
PaD---------- Padina	IIIe	7.0	---	---	---	---
Pt**. Pits						
RaA---------- Rader	IIw	8.0	7.0	6.0	65	70
RaB---------- Rader	IIIe	8.0	7.0	6.0	60	70
ReF---------- Renish-Rock outcrop	VIe	---	---	---	---	---
RoC---------- Robco	IIIe	7.0	5.0	5.0	65	30

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Improved bermudagrass	Common bermudagrass	Bahiagrass	Corn	Oats
		AUM*	AUM*	AUM*	Bu	Bu
RoD---------- Robco	IVe	7.0	5.0	5.0	60	---
SaC---------- Shalba	IVs	2.0	2.0	2.0	---	---
SbC---------- Shalba-Rock outcrop	VIIs	---	---	---	---	---
ShC---------- Shiro	IIIe	5.0	4.0	4.0	50	40
ShD---------- Shiro	IVe	5.0	4.0	4.0	---	---
SlC---------- Silawa	IIIe	7.0	6.0	5.0	55	---
SlD---------- Silawa	IVe	7.0	6.0	5.0	---	---
SmC, SmD---------- Silstid	IIIe	7.0	5.0	5.0	---	---
SnA---------- Singleton	IIIw	3.0	2.0	2.0	---	---
SnC---------- Singleton	IVe	3.0	2.0	2.0	---	---
SpB---------- Splendora	IIIe	7.0	6.0	6.0	50	---
TaC---------- Tabor	IVe	7.0	6.0	6.0	40	50
Tn---------- Tinn	Vw	6.0	4.0	---	---	60
ToD---------- Tonkavar	IVs	6.0	---	---	45	---
Wa---------- Waller	IVw	4.0	3.0	3.0	---	---
WlA---------- Wilson	IIIw	5.0	4.0	4.0	50	35
WlB---------- Wilson	IIIe	5.0	4.0	4.0	50	35
ZaC---------- Zack	IVe	3.0	2.0	2.0	---	25
ZaC2---------- Zack	IVe	3.0	2.0	2.0	---	25
ZuA---------- Zulch	IIIw	3.0	2.0	2.0	20	25

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Improved bermudagrass	Common bermudagrass	Bahiagrass	Corn	Oats
		AUM*	AUM*	AUM*	Bu	Bu
ZuC---------- Zulch	IIIe	3.0	2.0	2.0	10	25
ZuC2---------- Zulch	IVe	2.0	1.0	1.0	10	---

* Animal unit month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
ArA, ArC---- Arol	Claypan Savannah----	5,500	4,500	2,500
AxC, AxC2, AxD---- Axtell	Claypan Savannah----	5,000	3,500	2,500
BcA, BcB---- Bleiblerville	Blackland----	7,500	6,000	4,500
BfB---- Boonville	Claypan Prairie----	6,000	5,000	4,000
BoA, BoB---- Brazoria	Clayey Bottomland----	8,000	6,000	4,000
Bp---- Brazoria	Clayey Bottomland----	9,000	7,000	5,000
BrD---- Brenham	Clay Loam----	6,500	4,500	3,000
BsA---- Burleson	Blackland----	7,000	5,500	4,000
BuC, BuE---- Burlewash	Claypan Savannah----	4,500	3,000	2,000
BxE*: Burlewash----	Claypan Savannah----	4,500	3,000	2,000
Gullied land.				
CaC, CaD---- Carbengle	Clay Loam----	5,500	4,000	2,500
ChC, ChD---- Chazos	Sandy Loam----	5,500	4,500	3,000
CrC, CrC2, CrD---- Crockett	Claypan Prairie----	6,000	5,000	3,000
CuC---- Cuero	Clay Loam----	6,500	5,000	3,000
FaC, FaC2---- Falba	Claypan Savannah----	5,500	4,000	2,500
FlA, FlB---- Flatonia	Clay Loam----	6,000	4,500	3,000
FrC---- Frelsburg	Blackland----	7,500	6,000	4,500
FrC2---- Frelsburg	Eroded Blackland----	7,500	6,000	4,500

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
Gd Gladewater	Clayey Bottomland	8,000	6,000	4,000
GrC, GrE Gredge	Claypan Savannah	5,000	3,500	2,500
GvC, GvD Greenvine	Blackland	7,000	5,000	3,000
KlC, KlD Klump	Sandy Loam	6,500	5,000	3,000
KnC, KnD Knolle	Sandy Loam	4,500	3,500	1,800
KrD*: Koether	Sandstone Hills	2,000	1,000	500
Rock outcrop.				
LtD Latium	Eroded Blackland	4,500	4,000	2,500
LtD3 Latium	Eroded Blackland	7,000	5,500	400
LuA, LuB Lufkin	Claypan Savannah	5,000	4,000	2,500
LxB*: Lufkin	Claypan Savannah	5,000	4,000	2,500
Rader	Sandy Loam	6,000	4,500	3,500
MaA, MaB Mabank	Claypan Prairie	6,000	5,000	3,000
Na Nahatche	Loamy Bottomland	5,500	4,500	3,000
NdC Navasan	Deep Sand	5,000	4,000	3,000
NoA, NrA Norwood	Loamy Bottomland	8,000	6,500	5,000
OkA Oklared	Loamy Bottomland	8,500	6,100	4,500
On*: Oklared	Loamy Bottomland	8,500	6,100	4,500
Norwood	Loamy Bottomland	8,000	6,500	5,000
PaD Padina	Deep Sand	4,500	3,500	2,250
RaA, RaB Rader	Sandy Loam	6,000	4,500	3,500

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential annual production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
ReF*: Renish	Chalky Ridge	3,000	2,000	1,000
Rock outcrop.				
RoC, RoD---- Robco	Sandy	3,600	3,000	2,600
SaC---- Shalba	Claypan Savannah	4,500	3,500	2,000
SbC*: Shalba	Claypan Savannah	4,500	3,500	2,000
Rock outcrop.				
ShC, ShD---- Shiro	Sandy Loam	5,000	4,200	2,500
SlC, SlD---- Silawa	Loamy Sand	6,000	5,000	3,000
SmC, SmD---- Silstid	Sandy	4,500	4,000	2,000
SnA, SnC---- Singleton	Claypan Savannah	5,000	4,000	2,500
TaC---- Tabor	Sandy Loam	6,500	5,500	3,500
Tn---- Tinn	Clayey Bottomland	7,000	6,000	4,000
WlA, WlB---- Wilson	Claypan Prairie	6,000	4,500	3,000
ZaC, ZaC2---- Zack	Claypan Prairie	5,000	3,500	2,000
ZuA, ZuC, ZuC2---- Zulch	Claypan Prairie	5,000	4,000	3,500

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

(Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available)

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
AnC, AnC2, AnD--Annona	8C	Slight	Moderate	Slight	Slight	Loblolly pine	80	230	Loblolly pine, slash pine.
						Shortleaf pine	70	173	
						Southern red oak	75	86	
BgD--Boy	9S	Slight	Slight	Moderate	Slight	Loblolly pine	87	300	Loblolly pine, slash pine.
						Shortleaf pine	75	222	
						Longleaf pine	80	---	
CoC--Conroe	8S	Slight	Moderate	Moderate	Slight	Loblolly pine	78	210	Loblolly pine, slash pine.
						Shortleaf pine	66	139	
CpC--Conroe	6C	Moderate	Moderate	Moderate	Slight	Loblolly pine	70	130	Loblolly pine.
						Shortleaf pine	60	87	
DeC--Depcor	8S	Slight	Moderate	Moderate	Slight	Loblolly pine	80	230	Loblolly pine, slash pine.
						Shortleaf pine	74	212	
						Southern red oak	---	---	
DeD--Depcor	9S	Slight	Moderate	Moderate	Slight	Loblolly pine	88	310	Loblolly pine, slash pine.
						Shortleaf pine	84	326	
						Southern red oak	---	---	
EmC, EmD--Elmina	8S	Slight	Moderate	Moderate	Slight	Loblolly pine	80	230	Loblolly pine, slash pine.
						Shortleaf pine	70	173	
FeC--Fetzer	8W	Slight	Moderate	Moderate	Slight	Loblolly pine	80	230	Loblolly pine, shortleaf pine.
						Shortleaf pine	70	173	
Gd--Gladewater	6W	Slight	Severe	Severe	Moderate	Water oak	85	262	Water oak.
						Willow oak	85	262	
GmC--Gomery	8S	Slight	Slight	Moderate	Slight	Loblolly pine	80	230	Loblolly pine, slash pine.
						Shortleaf pine	70	173	
						Southern red oak	---	---	
Go, Gp--Gowker	6W	Slight	Moderate	Moderate	Moderate	Water oak	90	207	Water oak, American sycamore, sweetgum.
						Southern red oak	---	---	
						American sycamore	---	---	
						White oak	---	---	
						Green ash	---	---	
Ha--Hatliff	10W	Slight	Moderate	Moderate	Moderate	Loblolly pine	95	380	Loblolly pine, slash pine, eastern cottonwood.
						Slash pine	---	---	
						Sweetgum	---	---	
						Water oak	---	---	
						Willow oak	---	---	
HuC, HuD--Huntsburg	10S	Moderate	Moderate	Moderate	Slight	Loblolly pine	94	290	Loblolly pine.
						Shortleaf pine	81	251	
Ka--Kaman	6W	Slight	Severe	Severe	Moderate	Water oak	92	227	

See footnote at end of table.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY--Continued

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity			Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	Volume*	
LaC---------- Landman	9S	Slight	Moderate	Moderate	Slight	Loblolly pine------- Shortleaf pine------ Southern red oak---- White oak----------	88 80 --- ---	310 271 --- ---	Loblolly pine, slash pine.
Na---------- Nahatche	6W	Slight	Severe	Moderate	Slight	Water oak---------- Willow oak---------- Eastern cottonwood--	92 91 ---	227 --- ---	Eastern cottonwood, water oak.
NoA, NrA-------- Norwood	9A	Slight	Slight	Slight	Slight	Eastern cottonwood-- Water oak----------	100 90	283 207	Eastern cottonwood, water oak.
OkA---------- Oklared	9A	Slight	Slight	Slight	Moderate	Eastern cottonwood-- Pecan---------- Hackberry----------	100 75 75	283 --- ---	Eastern cottonwood, American sycamore, pecan, black walnut, sweetgum.
On**: Oklared--------	9A	Slight	Slight	Slight	Moderate	Eastern cottonwood-- Pecan---------- Hackberry----------	100 75 75	283 --- ---	Eastern cottonwood, American sycamore, pecan, black walnut, sweetgum.
Norwood--------	9A	Slight	Slight	Slight	Slight	Eastern cottonwood-- Water oak----------	100 90	283 207	Eastern cottonwood, water oak.
ShC, ShD-------- Shiro	6C	Moderate	Moderate	Moderate	Slight	Loblolly pine------- Post oak---------- Blackjack oak-------	70 --- ---	130 --- ---	Loblolly pine.
SnA, SnC-------- Singleton	5W	Slight	Moderate	Severe	Slight	Loblolly pine-------	60	60	Loblolly pine.
SpB---------- Splendora	10W	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------ Water oak---------- Sweetgum----------	94 80 90 90	370 271 207 207	Loblolly pine, slash pine, southern red oak.
ToD---------- Tonkavar	8S	Slight	Moderate	Moderate	Moderate	Loblolly pine------- Shortleaf pine------	80 70	230 173	Loblolly pine, slash pine.
Wa---------- Waller	8W	Slight	Severe	Severe	Severe	Loblolly pine------- Water oak---------- Sweetgum---------- Shortleaf pine------ Longleaf pine-------	80 80 80 70 70	230 120 120 173 ---	Loblolly pine, slash pine.

* Volume is the yield in board feet (Doyle Rule) per acre per year over a 50-year period for fully stocked natural stands. The yield for cottonwood trees is based on a 30-year period.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION

(Only the soils suitable for production of commercial trees are listed)

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
AnC, AnC2, AnD-----	Favorable	2,500	Little bluestem	15
Annona	Normal	2,000	Brownseed paspalum	15
	Unfavorable	1,000	Panicum	15
			Indiangrass	10
			Longleaf uniola	10
			Purpletop	5
BgD-----	Favorable	2,000	Pinehill bluestem	20
Boy	Normal	1,500	Spreading panicum	15
	Unfavorable	1,000	Longleaf uniola	15
			Purpletop	10
			American beautyberry	10
			Indiangrass	5
			Greenbrier	5
CoC-----	Favorable	1,500	Pinehill bluestem	20
Conroe	Normal	1,250	Longleaf uniola	10
	Unfavorable	500	Purpletop	10
			Panicum	10
			American beautyberry	10
			Indiangrass	5
			Sedge	5
CpC-----	Favorable	1,000	Sedge	25
Conroe	Normal	650	Pinehill bluestem	20
	Unfavorable	300	Brownseed paspalum	15
			Panicum	10
			Longleaf uniola	10
DeC, DeD-----	Favorable	3,500	Pinehill bluestem	30
Depcor	Normal	2,500	Indiangrass	10
	Unfavorable	1,500	Longleaf uniola	10
			Panicum	10
			Sedge	10
			Switchgrass	5
			Purpletop	5
			Purple lovegrass	5
EmC, EmD-----	Favorable	1,500	Pinehill bluestem	20
Elmina	Normal	1,250	Longleaf uniola	10
	Unfavorable	500	Purpletop	10
			Panicum	10
			American beautyberry	10
			Indiangrass	5
			Sedge	5
FeC-----	Favorable	3,500	Pinehill bluestem	30
Fetzer	Normal	2,500	Indiangrass	10
	Unfavorable	1,500	Longleaf uniola	10
			Panicum	10
			Sedge	10
			Switchgrass	5
			Purpletop	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
Gd---------- Gladewater	Favorable	3,500	Sedge----------	20
	Normal	2,000	Paspalum----------	15
	Unfavorable	1,500	Virginia wildrye----------	10
			Panicum----------	10
			Beaked panicum----------	5
			Purpletop----------	5
			Pinehill bluestem----------	5
GmC---------- Gomery	Favorable	1,500	Pinehill bluestem----------	20
	Normal	1,250	Longleaf uniola----------	10
	Unfavorable	500	Purpletop----------	10
			Panicum----------	10
			American beautyberry----------	10
			Indiangrass----------	5
			Sedge----------	5
Go, Gp---------- Gowker	Favorable	3,500	Virginia wildrye----------	20
	Normal	2,500	Rustyseed paspalum----------	15
	Unfavorable	2,000	Beaked panicum----------	10
			Sedge----------	10
			Panicum----------	5
			Switchcane----------	5
Ha---------- Hatliff	Favorable	3,000	Spreading panicum----------	15
	Normal	2,000	Virginia wildrye----------	15
	Unfavorable	1,500	Rustyseed paspalum----------	15
			Longleaf uniola----------	10
			American beautyberry----------	5
			Peppervine----------	5
			Muscadine grape----------	5
HuC, HuD---------- Huntsburg	Favorable	3,500	Pinehill bluestem----------	30
	Normal	2,500	Indiangrass----------	10
	Unfavorable	1,500	Longleaf uniola----------	10
			Panicum----------	10
			Sedge----------	10
			Switchgrass----------	5
			Purpletop----------	5
			Purple lovegrass----------	5
Ka---------- Kaman	Favorable	4,500	Switchcane----------	40
	Normal	4,000	Virginia wildrye----------	10
	Unfavorable	3,000	Spreading panicum----------	10
LaC---------- Landman	Favorable	2,000	Pinehill bluestem----------	20
	Normal	1,500	Panicum----------	15
	Unfavorable	1,000	Longleaf uniola----------	15
			Purpletop----------	10
			American beautyberry----------	10
			Indiangrass----------	5
			Sedge----------	5
Na---------- Nahatche	Favorable	3,000	Hairy wildrye----------	20
	Normal	2,000	Spreading panicum----------	15
	Unfavorable	1,500	Rustyseed paspalum----------	15
			Panicum----------	10
			Bentawn plumegrass----------	5
			Switchcane----------	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
NoA, NrA	Favorable	8,000	Virginia wildrye	15
Norwood	Normal	6,500	Beaked panicum	10
	Unfavorable	5,000	Indiangrass	10
			Little bluestem	10
			Switchgrass	10
			Sedge	10
			Big bluestem	5
			Rustyseed paspalum	5
OkA	Favorable	4,500	Little bluestem	15
Oklared	Normal	3,600	Canada wildrye	10
	Unfavorable	3,000	Broadleaf uniola	10
			Giant cane	10
			Switchgrass	5
			Big bluestem	5
			Beaked panicum	5
			Sedge	5
On*:				
Oklared	Favorable	4,500	Little bluestem	15
	Normal	3,600	Canada wildrye	10
	Unfavorable	3,000	Broadleaf uniola	10
			Giant cane	10
			Switchgrass	5
			Big bluestem	5
			Beaked panicum	5
			Sedge	5
Norwood	Favorable	8,000	Virginia wildrye	15
	Normal	6,500	Beaked panicum	10
	Unfavorable	5,000	Indiangrass	10
			Little bluestem	10
			Switchgrass	10
			Sedge	10
			Big bluestem	5
			Rustyseed paspalum	5
ShC, ShD	Favorable	5,000	Little bluestem	40
Shiro	Normal	4,200	Purpletop	5
	Unfavorable	2,500	Longleaf uniola	5
			Switchgrass	5
			Beaked panicum	5
			Sand lovegrass	5
			Brownseed paspalum	5
			Indiangrass	5
			Panicum	5
			Post oak	5
			Blackjack oak	5
SnA, SnC	Favorable	5,000	Little bluestem	40
Singleton	Normal	4,000	Purpletop	5
	Unfavorable	2,500	Longleaf uniola	5
			Switchgrass	5
			Brownseed paspalum	5
			Indiangrass	5
			Post oak	5
			Blackjack oak	5

See footnote at end of table.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION--Continued

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
SpB---------- Splendora	Favorable	2,300	Pinehill bluestem	35
	Normal	1,800	Beaked panicum	10
	Unfavorable	1,400	Longleaf uniola	10
			Sedge	10
			Yaupon	10
			American beautyberry	5
ToD---------- Tonkavar	Favorable	1,400	Pinehill bluestem	15
	Normal	1,200	Longleaf uniola	15
	Unfavorable	800	Indiangrass	10
			Purpletop	10
			Brownseed paspalum	5
			Panicum	5
Wa---------- Waller	Favorable	1,950	Pinehill bluestem	30
	Normal	1,650	Beaked panicum	10
	Unfavorable	1,250	Sedge	10
			Virginia wildrye	5
			Brownseed paspalum	5
			Carolina jessamine	5
			Greenbrier	5
			Southern bayberry	5
			Longleaf uniola	5
			Panicum	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
AnC, AnC2 Annona	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly.	Slight	Slight.
AnD Annona	Severe: percs slowly.	Severe: percs slowly.	Severe: percs slowly, slope.	Severe: erodes easily.	Moderate: slope.
Ap* Arents	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope.	Slight	Slight.
ArA Arol	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, depth to rock.
ArC Arol	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: wetness, depth to rock.
AxC, AxC2 Axtell	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Moderate: droughty.
AxD Axtell	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty.
BcA Bleiblerville	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
BcB Bleiblerville	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
BfB Boonville	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
BgD Boy	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
BoA, BoB Brazoria	Severe: flooding, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Bp Brazoria	Severe: flooding, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
BrD Brenham	Slight	Slight	Moderate: slope.	Slight	Slight.
BsA Burleson	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
BuC Burlewash	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock, percs slowly.	Severe: erodes easily.	Moderate: depth to rock.
BuE Burlewash	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, depth to rock.
BxE*: Burlewash	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: slope, depth to rock.
Gullied land	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: erodes easily.	Moderate: slope.
CaC Carbengle	Slight	Slight	Moderate: slope, depth to rock, small stones.	Slight	Moderate: depth to rock.
CaD Carbengle	Slight	Slight	Severe: slope.	Slight	Moderate: depth to rock.
ChC Chazos	Slight	Slight	Moderate: slope, small stones.	Slight	Moderate: droughty.
ChD Chazos	Slight	Slight	Severe: slope.	Slight	Moderate: droughty.
CoC Conroe	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
CpC Conroe	Severe: small stones.	Severe: small stones.	Severe: small stones.	Slight	Severe: small stones.
CrC, CrC2 Crockett	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Moderate: droughty.
CrD Crockett	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Severe: erodes easily.	Moderate: droughty.
CuC Cuero	Slight	Slight	Moderate: slope.	Slight	Slight.
DeC Depcor	Moderate: wetness, percs slowly.	Moderate: wetness, too sandy, percs slowly.	Moderate: slope, wetness, too sandy.	Moderate: too sandy.	Moderate: droughty.
DeD Depcor	Moderate: wetness, percs slowly.	Moderate: wetness, too sandy, percs slowly.	Severe: slope.	Moderate: too sandy.	Moderate: droughty.
Du*. Dumps					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
EmC---------- Elmina	Severe: percs slowly.	Severe: percs slowly.	Severe: percs lowly.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
EmD---------- Elmina	Severe: percs slowly.	Severe: percs slowly.	Severe: slope, percs slowly.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
FaC, FaC2---------- Falba	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
FeC---------- Fetzer	Moderate: wetness, percs slowly, too sandy.	Moderate: wetness, too sandy, percs slowly.	Moderate: slope, too sandy, wetness.	Moderate: wetness, too sandy.	Moderate: wetness.
FlA---------- Flatonia	Slight----------	Slight----------	Moderate: small stones.	Slight----------	Moderate: droughty.
FlB---------- Flatonia	Slight----------	Slight----------	Moderate: slope, small stones.	Slight----------	Moderate: droughty.
FrC, FrC2---------- Frelsburg	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey, percs slowly.	Moderate: too clayey.	Severe: too clayey.
GbC---------- Gibbonscreek	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
GbE---------- Gibbonscreek	Moderate: slope, percs slowly.	Moderate: slope, percs slowly.	Severe: slope.	Slight----------	Moderate: slope.
Gd---------- Gladewater	Severe: flooding, wetness, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey, wetness, flooding.	Severe: too clayey.	Severe: flooding, too clayey.
GmC---------- Gomery	Moderate: percs slowly, too sandy.	Moderate: percs slowly, too sandy.	Moderate: slope, percs slowly, too sandy.	Moderate: too sandy.	Moderate: droughty.
Go, Gp---------- Gowker	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
GrC---------- Gredge	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Slight----------	Slight.
GrE---------- Gredge	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight----------	Slight.
GvC---------- Greenvine	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Moderate: slope, too clayey.	Moderate: too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
GvD Greenvine	Moderate: percs slowly, too clayey.	Moderate: too clayey, percs slowly.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
Ha Hatliff	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
HuC Huntsburg	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.
HuD Huntsburg	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: slope, wetness.	Severe: wetness.	Severe: wetness.
Ka Kaman	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, flooding, percs slowly.	Severe: too clayey.	Severe: flooding, too clayey.
KlC Klump	Slight	Slight	Moderate: slope.	Slight	Slight.
KlD Klump	Slight	Slight	Severe: slope.	Slight	Slight.
KnC Knolle	Slight	Slight	Moderate: slope.	Slight	Slight.
KnD Knolle	Slight	Slight	Severe: slope.	Slight	Slight.
KrD*: Koether	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: large stones, too sandy.	Severe: large stones, droughty.
Rock outcrop.					
LaC Landman	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
LtD Latium	Moderate: percs slowly.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
LtD3 Latium	Moderate: slope, percs slowly.	Moderate: slope, too clayey.	Severe: slope.	Moderate: too clayey.	Severe: too clayey.
LuA, LuB Lufkin	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
LxB*: Lufkin	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
LxB*:					
Rader	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
MaA, MaB	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Mabank					
Na	Severe: flooding, wetness.	Severe: wetness.	Severe: wetness, flooding.	Severe: wetness.	Severe: wetness, flooding.
Nahatche					
NdC	Severe: flooding.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Navasan					
NoA, NrA	Severe: flooding.	Slight	Slight	Slight	Slight.
Norwood					
OkA	Severe: flooding.	Slight	Slight	Slight	Slight.
Oklared					
On*:					
Oklared	Severe: flooding.	Moderate: flooding.	Severe: flooding.	Moderate: flooding.	Severe: flooding.
Norwood	Severe: flooding.	Moderate: flooding.	Moderate: slope.	Moderate: flooding.	Severe: flooding.
PaD	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.	Moderate: droughty.
Padina					
Pt*					
Pits					
RaA	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Slight	Slight.
Rader					
RaB	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: slope, wetness, percs slowly.	Slight	Slight.
Rader					
ReF*:					
Renish	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Slight	Severe: depth to rock.
Rock outcrop.					
RoC	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Moderate: slope, small stones, too sandy.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
Robco					

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
RoD Robco	Moderate: wetness, too sandy.	Moderate: wetness, too sandy.	Severe: slope.	Moderate: wetness, too sandy.	Moderate: wetness, droughty.
SaC Shalba	Severe: wetness, depth to rock.	Severe: depth to rock.	Severe: wetness, depth to rock.	Moderate: wetness.	Severe: depth to rock.
SbC*: Shalba	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: wetness.	Severe: depth to rock.
Rock outcrop.					
ShC Shiro	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly, depth to rock.	Slight	Moderate: depth to rock.
ShD Shiro	Moderate: percs slowly.	Moderate: percs slowly.	Severe: slope.	Slight	Moderate: depth to rock.
SlC Silawa	Slight	Slight	Moderate: slope.	Slight	Slight.
SlD Silawa	Slight	Slight	Severe: slope.	Slight	Slight.
SmC Silstid	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, small stones.	Moderate: too sandy.	Moderate: droughty.
SmD Silstid	Moderate: too sandy.	Moderate: too sandy.	Severe: slope.	Moderate: too sandy.	Moderate: droughty.
SnA Singleton	Moderate: wetness, percs slowly.	Moderate: wetness, percs slowly.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, depth to rock.
SnC Singleton	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, depth to rock.	Slight	Moderate: depth to rock.
SpB Splendora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
TaC Tabor	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, small stones, percs slowly.	Slight	Moderate: droughty.
Tn Tinn	Severe: flooding, percs slowly, too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey, flooding, percs slowly.	Severe: too clayey.	Severe: flooding, too clayey.
ToD Tonkavar	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.

See footnote at end of table.

TABLE 9.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
Wa---------- Waller	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WlA, WlB---------- Wilson	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
ZaC, ZaC2---------- Zack	Moderate: percs slowly.	Moderate: percs slowly.	Moderate: slope, percs slowly.	Severe: erodes easily.	Slight.
ZuA, ZuC, ZuC2-------- Zulch	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated)

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
AnC, AnC2, AnD----- Annona	Fair	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Ap* Arents												
ArA---------- Arol	Fair	Good	Fair	Fair	---	Fair	Fair	Fair	Fair	Fair	Fair	Fair.
ArC---------- Arol	Fair	Good	Fair	Fair	---	Fair	Poor	Poor	Fair	Fair	Poor	Fair.
AxC, AxC2---------- Axtell	Fair	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
AxD---------- Axtell	Poor	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	Good	Very poor.	Good.
BcA, BcB---------- Bleiblerville	Good	Good	Fair	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
BfB---------- Boonville	Fair	Good	Good	---	---	Good	Fair	Fair	Good	---	Fair	Good.
BgD---------- Boy	Fair	Good	Good	Fair	Fair	---	Poor	Poor	Good	Fair	Poor	---
BoA, BoB---------- Brazoria	Fair	Fair	Fair	Good	---	Fair	Poor	Fair	Fair	Good	Poor	Fair.
Bp---------- Brazoria	Poor	Fair	Fair	Good	---	Fair	Fair	Good	Fair	Good	Fair	Fair.
BrD---------- Brenham	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
BsA---------- Burleson	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
BuC---------- Burlewash	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
BuE---------- Burlewash	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
BxE*: Burlewash---------	Poor	Fair	Good	---	---	Good	Very poor.	Very poor.	Fair	---	Very poor.	Good.
Gullied land------	Poor	Fair	Poor	---	---	Poor	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
CaC, CaD---------- Carbengle	Fair	Good	Good	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
ChC, ChD---------- Chazos	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
CoC, CpC---------- Conroe	Poor	Fair	Good	Fair	Fair	---	Very poor.	Very poor.	Fair	Good	Very poor.	---
CrC, CrC2---------- Crockett	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
CrD---------- Crockett	Poor	Fair	Good	Good	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
CuC---------- Cuero	Good	Good	Good	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
DeC, DeD---------- Depcor	Poor	Fair	Good	Good	Good	---	Very poor.	Very poor.	Fair	Good	Very poor.	---
Du*. Dumps												
EmC, EmD---------- Elmina	Poor	Fair	Good	Fair	Fair	---	Poor	Poor	Fair	Fair	Poor	---
FaC, FaC2---------- Falba	Fair	Good	Fair	Fair	---	Fair	Poor	Poor	Fair	Fair	Poor	Fair.
FeC---------- Fetzer	Fair	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
FlA, FlB---------- Flatonia	Good	Good	Good	---	---	Fair	Very poor.	Very poor.	Good	---	Very poor.	Fair.
FrC, FrC2---------- Frelsburg	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
GbC---------- Gibbonscreek	Fair	Good	Good	---	---	Fair	Poor	Poor	Good	---	Poor	Fair.
GbE---------- Gibbonscreek	Poor	Fair	Good	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Gd---------- Gladewater	Poor	Fair	Fair	Fair	---	---	Poor	Good	Fair	Fair	Fair	---
GmC---------- Gomery	Fair	Fair	Good	Fair	Fair	---	Poor	Poor	Fair	Fair	Poor	---
Go, Gp---------- Gowker	Poor	Fair	Fair	Good	---	---	Poor	Poor	Fair	Good	Poor	---
GrC, GrE---------- Gredge	Fair	Good	Good	Good	---	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
GvC, GvD---------- Greenvine	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Ha---------- Hatliff	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
HuC, HuD---------- Huntsburg	Poor	Fair	Good	Good	Good	---	Poor	Very poor.	Fair	Good	Very poor.	---
Ka---------- Kaman	Poor	Fair	Poor	Fair	Poor	---	Poor	Good	Poor	Fair	Fair	---
KlC, KlD---------- Klump	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
KnC, KnD---------- Knolle	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
KrD*:												
Koether----------	Very poor.	Very poor.	Very poor.	---	---	Poor	Very poor.	Very poor.	Very poor.	---	Very poor.	Very poor.
Rock outcrop.												
LaC---------- Landman	Poor	Fair	Good	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
LtD, LtD3---------- Latium	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	---
LuA, LuB---------- Lufkin	Fair	Good	Fair	Good	Good	---	Fair	Fair	Fair	Good	Fair	---
LxB*:												
Lufkin----------	Fair	Good	Fair	Good	Good	---	Fair	Fair	Fair	Good	Fair	---
Rader----------	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
MaA, MaB---------- Mabank	Fair	Good	Good	Good	---	Fair	Fair	Fair	Good	---	Fair	Fair.
Na---------- Nahatche	Fair	Fair	Fair	Good	Fair	---	Poor	Fair	Fair	Good	Poor	---
NdC---------- Navasan	Poor	Fair	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
NoA, NrA---------- Norwood	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
OkA---------- Oklared	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
On*:												
Oklared----------	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Norwood----------	Good	Good	Fair	---	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
PaD---------- Padina	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Pt*. Pits												

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
RaA, RaB---------- Rader	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
ReF*:												
Renish----------	Poor	Poor	Fair	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Fair.
Rock outcrop.												
RoC, RoD---------- Robco	Fair	Fair	Good	---	---	Good	Poor	Very poor.	Fair	---	Very poor.	Good.
SaC---------- Shalba	Poor	Poor	Poor	---	---	Fair	Poor	Very poor.	Poor	---	Very poor.	Poor.
SbC*:												
Shalba----------	Poor	Poor	Poor	---	---	Fair	Poor	Very poor.	Poor	---	Very poor.	Poor.
Rock outcrop.												
ShC, ShD---------- Shiro	Fair	Good	Good	Fair	Fair	---	Poor	Very poor.	Good	Fair	Poor	---
SlC, SlD---------- Silawa	Fair	Good	Good	---	---	Good	Poor	Very poor.	Good	---	Very poor.	Good.
SmC, SmD---------- Silstid	Poor	Poor	Fair	Poor	Poor	Good	Poor	Very poor.	Poor	Poor	Very poor.	Fair.
SnA---------- Singleton	Fair	Good	Fair	Fair	---	Good	Fair	Fair	Fair	Fair	Fair	Fair.
SnC---------- Singleton	Fair	Good	Fair	Fair	---	Good	Poor	Poor	Fair	Fair	Poor	Fair.
SpB---------- Splendora	Fair	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
TaC---------- Tabor	Fair	Good	Good	---	---	Good	Very poor.	Very poor.	Good	---	Very poor.	Good.
Tn---------- Tinn	Poor	Fair	Fair	Good	--	---	Poor	Fair	Fair	Fair	Poor	---
ToD---------- Tonkavar	Poor	Fair	Good	Good	G(	---	Poor	Very poor.	Fair	Good	Very poor.	---
Wa---------- Waller	Poor	Fair	Fair	Good	Fa..	---	Good	Good	Fair	Good	Good	---
WlA, WlB---------- Wilson	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
ZaC, ZaC2---------- Zack	Fair	Good	Good	Good	---	Good	Poor	Very poor.	Good	Good	Very poor.	Good.
ZuA---------- Zulch	Fair	Good	Good	Good	---	Fair	Fair	Fair	Good	---	Fair	Fair.

See footnote at end of table.

TABLE 10.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
ZuC, ZuC2----------Zulch	Fair	Good	Good	Good	---	Fair	Poor	Poor	Good	---	Poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
AnC, AnC2 Annona	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
AnD Annona	Severe: wetness.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: slope.
Ap* Arents	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Slight.
ArA, ArC Arol	Severe: wetness.	Severe: shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: wetness, depth to rock.
AxC, AxC2, AxD Axtell	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: droughty.
BcA, BcB Bleiblerville	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
BfB Boonville	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
BgD Boy	Severe: cutbanks cave.	Slight	Moderate: wetness.	Moderate: slope.	Slight	Moderate: droughty.
BoA, BoB Brazoria	Severe: cutbanks cave.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Bp Brazoria	Severe: cutbanks cave, ponding.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: flooding, ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding, too clayey.
BrD Brenham	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
BsA Burleson	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
BuC Burlewash	Moderate: depth to rock, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: depth to rock.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
BuE---------- Burlewash	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope, depth to rock.
BxE*: Burlewash--------	Moderate: depth to rock, too clayey, slope.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Moderate: slope, depth to rock.
Gullied land-----	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.
CaC---------- Carbengle	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Slight---------	Moderate: low strength.	Moderate: depth to rock.
CaD---------- Carbengle	Moderate: depth to rock.	Slight---------	Moderate: depth to rock.	Moderate: slope.	Moderate: low strength.	Moderate: depth to rock.
ChC---------- Chazos	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: droughty.
ChD---------- Chazos	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Moderate: droughty.
CoC---------- Conroe	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
CpC---------- Conroe	Severe: wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Severe: low strength.	Severe: small stones.
CrC, CrC2, CrD---- Crockett	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: droughty.
CuC---------- Cuero	Slight---------	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
DeC---------- Depcor	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: droughty.
DeD---------- Depcor	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: droughty.
Du*. Dumps						
EmC---------- Elmina	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
EmD---------- Elmina	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: wetness, droughty.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
FaC, FaC2 Falba	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
FeC Fetzer	Severe: cutbanks cave.	Moderate: wetness, shrink-swell.	Severe: wetness.	Moderate: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness.
FlA, FlB Flatonia	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Slight.
FrC, FrC2 Frelsburg	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
GbC Gibbonscreek	Slight	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Severe: low strength, unstable fill.	Slight.
GbE Gibbonscreek	Moderate: slope.	Severe: unstable fill.	Severe: unstable fill.	Severe: slope, unstable fill.	Severe: low strength, unstable fill.	Moderate: slope.
Gd Gladewater	Severe: cutbanks cave, wetness.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding, too clayey.
GmC Gomery	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight	Moderate: droughty.
Go, Gp Gowker	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
GrC Gredge	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Slight.
GrE Gredge	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.	Slight.
GvC, GvD Greenvine	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
Ha Hatliff	Severe: cutbanks cave, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: wetness, flooding.	Severe: wetness, flooding.
HuC, HuD Huntsburg	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Ka Kaman	Severe: cutbanks cave, wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding, too clayey.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
KlC---------- Klump	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
KlD---------- Klump	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
KnC---------- Knolle	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
KnD---------- Knolle	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
KrD*: Koether----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: large stones, droughty.
Rock outcrop.						
LaC---------- Landman	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Slight---------	Slight---------	Moderate: droughty.
LtD---------- Latium	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Severe: too clayey.
LtD3---------- Latium	Severe: cutbanks cave.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, slope.	Severe: shrink-swell, low strength.	Severe: too clayey.
LuA, LuB---------- Lufkin	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
LxB*: Lufkin----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
Rader----------	Severe: wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness.	Slight.
MaA, MaB---------- Mabank	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Na---------- Nahatche	Severe: wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: low strength, wetness, flooding.	Severe: wetness, flooding.
NdC---------- Navasan	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Moderate: droughty.
NoA, NrA---------- Norwood	Slight---------	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength.	Slight.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
OkA---------- Oklared	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
On*:						
Oklared----------	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Norwood----------	Moderate: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: low strength, flooding.	Severe: flooding.
PaD---------- Padina	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
Pt*. Pits						
RaA, RaB---------- Rader	Severe: wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness.	Slight.
ReF*:						
Renish----------	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock, low strength.	Severe: depth to rock.
Rock outcrop.						
RoC---------- Robco	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness.	Moderate: wetness.	Moderate: wetness, droughty.
RoD---------- Robco	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness, shrink-swell.	Moderate: wetness, slope.	Moderate: wetness.	Moderate: wetness, droughty.
SaC---------- Shalba	Severe: depth to rock, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, depth to rock, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: depth to rock.
SbC*:						
Shalba----------	Severe: depth to rock, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, depth to rock, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength.	Severe: depth to rock.
Rock outcrop.						
ShC, ShD---------- Shiro	Moderate: depth to rock, too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.	Moderate: depth to rock.
SlC---------- Silawa	Slight---------	Slight---------	Slight---------	Slight---------	Slight---------	Slight.
SlD---------- Silawa	Slight---------	Slight---------	Slight---------	Moderate: slope.	Slight---------	Slight.
SmC---------- Silstid	Severe: cutbanks cave.	Slight---------	Slight---------	Slight---------	Slight---------	Moderate: droughty.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
SmD---------- Silstid	Severe: cutbanks cave.	Slight---------	Slight---------	Moderate: slope.	Slight---------	Moderate: droughty.
SnA, SnC---------- Singleton	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.	Moderate: depth to rock.
SpB---------- Splendora	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
TaC---------- Tabor	Moderate: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: low strength, shrink-swell.	Moderate: droughty.
Tn---------- Tinn	Severe: wetness.	Severe: flooding, shrink-swell.	Severe: flooding, wetness, shrink-swell.	Severe: flooding, shrink-swell.	Severe: shrink-swell, low strength, flooding.	Severe: flooding, too clayey.
ToD---------- Tonkavar	Severe: cutbanks cave.	Slight---------	Moderate: wetness.	Moderate: slope.	Slight---------	Severe: droughty.
Wa---------- Waller	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
WlA, WlB---------- Wilson	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: shrink-swell, low strength, wetness.	Severe: wetness.
ZaC, ZaC2--------- Zack	Moderate: too clayey.	Moderate: shrink-swell.	Slight---------	Moderate: shrink-swell.	Severe: low strength.	Slight.
ZuA, ZuC, ZuC2---- Zulch	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
AnC, AnC2 Annona	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
AnD Annona	Severe: percs slowly, wetness.	Severe: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Ap* Arents	Moderate: percs slowly.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Good.
ArA, ArC Arol	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock.	Severe: depth to rock, wetness, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
AxC, AxC2, AxD Axtell	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BcA Bleiblerville	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BcB Bleiblerville	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BfB Boonville	Severe: wetness, percs slowly.	Moderate: seepage, slope.	Severe: wetness.	Severe: wetness.	Poor: hard to pack, wetness.
BgD Boy	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: too sandy.
BoA Brazoria	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
BoB Brazoria	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: flooding.	Poor: too clayey, hard to pack.
Bp Brazoria	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
BrD Brenham	Moderate: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
BsA Burleson	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
BuC Burlewash	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
BuE Burlewash	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
BxE*: Burlewash	Severe: depth to rock, percs slowly.	Severe: depth to rock, slope.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
Gullied land	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Fair: slope.
CaC, CaD Carbengle	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
ChC, ChD Chazos	Severe: percs slowly.	Severe: seepage.	Moderate: too clayey.	Slight	Poor: hard to pack.
CoC Conroe	Severe: wetness, percs slowly.	Severe: seepage, wetness.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, hard to pack.
CpC Conroe	Severe: wetness, percs slowly.	Severe: wetness.	Moderate: wetness, too clayey.	Moderate: wetness.	Fair: too clayey, hard to pack.
CrC, CrC2, CrD Crockett	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
CuC Cuero	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
DeC, DeD Depcor	Severe: wetness, percs slowly.	Moderate: slope.	Moderate: wetness, too clayey.	Severe: seepage.	Fair: too clayey, wetness.
Du*. Dumps					
EmC, EmD Elmina	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: depth to rock, wetness.	Severe: seepage.	Fair: depth to rock, too sandy, wetness.
FaC, FaC2 Falba	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock.	Severe: depth to rock, wetness, too clayey.	Severe: depth to rock, wetness.	Poor: depth to rock, too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
FeC Fetzer	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Moderate: wetness.	Poor: too clayey.
FlA Flatonia	Severe: wetness, percs slowly.	Moderate: depth to rock.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, hard to pack.
FlB Flatonia	Severe: wetness, percs slowly.	Moderate: depth to rock, slope.	Severe: depth to rock, too clayey.	Moderate: depth to rock.	Poor: too clayey, hard to pack.
FrC, FrC2 Frelsburg	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
GbC Gibbonscreek	Severe: percs slowly.	Severe: unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Fair: too clayey.
GbE Gibbonscreek	Severe: percs slowly.	Severe: slope, unstable fill.	Severe: unstable fill.	Severe: unstable fill.	Fair: too clayey, slope.
Gd Gladewater	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack, wetness.
GmC Gomery	Severe: wetness, percs slowly, poor filter.	Severe: seepage, wetness.	Severe: depth to rock.	Severe: seepage.	Poor: thin layer.
Go, Gp Gowker	Severe: flooding, wetness, percs slowly.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness, thin layer.
GrC, GrE Gredge	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: hard to pack.
GvC, GvD Greenvine	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
Ha Hatliff	Severe: flooding, wetness.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, wetness.
HuC, HuD Huntsburg	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Ka Kaman	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
KlC, KlD Klump	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey.
KnC, KnD Knolle	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight	Fair: too clayey.
KrD*: Koether	Severe: depth to rock.	Severe: seepage, depth to rock.	Severe: depth to rock, seepage.	Severe: depth to rock.	Poor: depth to rock, seepage, large stones.
Rock outcrop.					
LaC Landman	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Fair: too sandy.
LtD Latium	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey, hard to pack.
LtD3 Latium	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey, hard to pack.
LuA Lufkin	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
LuB Lufkin	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
LxB*: Lufkin	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Rader	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
MaA, MaB Mabank	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Na Nahatche	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Severe: flooding, wetness.	Poor: wetness.
NdC Navasan	Severe: percs slowly, poor filter.	Severe: seepage.	Moderate: flooding, too sandy.	Severe: seepage.	Fair: too sandy.
NoA, NrA Norwood	Moderate: flooding, percs slowly.	Moderate: seepage.	Moderate: flooding, too clayey.	Moderate: flooding.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
OkA Oklared	Severe: wetness.	Severe: seepage, flooding.	Severe: seepage, wetness.	Severe: seepage.	Good.
On*: Oklared	Severe: flooding, wetness.	Severe: seepage, flooding.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage.	Good.
Norwood	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Fair: too clayey.
PaD Padina	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Pt*. Pits					
RaA Rader	Severe: wetness, percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
RaB Rader	Severe: wetness, percs slowly.	Moderate: slope.	Severe: too clayey.	Moderate: wetness.	Poor: too clayey, hard to pack.
ReF*: Renish	Severe: depth to rock.	Severe: slope, depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Poor: depth to rock.
Rock outcrop.					
RoC, RoD Robco	Severe: wetness, percs slowly, poor filter.	Severe: seepage.	Severe: wetness.	Severe: seepage.	Poor: thin layer.
SaC Shalba	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness, too clayey.	Severe: depth to rock, wetness.	Poor: depth to rock, too clayey, hard to pack.
SbC*: Shalba	Severe: depth to rock, wetness.	Severe: depth to rock, wetness.	Severe: depth to rock, wetness, too clayey.	Severe: depth to rock, wetness.	Poor: depth to rock, too clayey, hard to pack.
Rock outcrop.					
ShC, ShD Shiro	Severe: depth to rock, wetness, percs slowly.	Severe: depth to rock, wetness.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
SlC, SlD Silawa	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Fair: thin layer.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
SmC, SmD---------- Silstid	Severe: poor filter.	Severe: seepage.	Moderate: too sandy.	Severe: seepage.	Poor: seepage.
SnA, SnC---------- Singleton	Severe: depth to rock, percs slowly.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Severe: depth to rock.	Poor: depth to rock, too clayey, hard to pack.
SpB---------- Splendora	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: wetness.	Severe: wetness.	Poor: wetness.
TaC---------- Tabor	Severe: percs slowly.	Moderate: seepage, slope.	Severe: too clayey.	Slight----------	Poor: too clayey, hard to pack.
Tn---------- Tinn	Severe: flooding, wetness, percs slowly.	Severe: flooding.	Severe: flooding, wetness, too clayey.	Severe: flooding, wetness.	Poor: too clayey, hard to pack.
ToD---------- Tonkavar	Severe: poor filter.	Severe: seepage.	Severe: too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Wa---------- Waller	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
WlA---------- Wilson	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
WlB---------- Wilson	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
ZaC, ZaC2---------- Zack	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight----------	Fair: too clayey.
ZuA---------- Zulch	Severe: wetness, percs slowly.	Slight----------	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
ZuC, ZuC2---------- Zulch	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
AnC, AnC2, AnD Annona	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ap* Arents	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
ArA, ArC Arol	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
AxC, AxC2, AxD Axtell	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BcA, BcB Bleiblerville	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BfB Boonville	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
BgD Boy	Good	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
BoA, BoB Brazoria	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Bp Brazoria	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
BrD Brenham	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BsA Burleson	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BuC, BuE Burlewash	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
BxE*: Burlewash	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
BxE*: Gullied land	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: slope.
CaC, CaD---------- Carbengle	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, too clayey, small stones.
ChC, ChD---------- Chazos	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
CoC---------- Conroe	Fair: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
CpC---------- Conroe	Poor: low strength.	Improbable: excess fines.	Probable	Poor: too clayey, small stones.
CrC, CrC2, CrD-------- Crockett	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
CuC---------- Cuero	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
DeC, DeD---------- Depcor	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
Du*. Dumps				
EmC, EmD---------- Elmina	Fair: area reclaim, thin layer, wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
FaC, FaC2---------- Falba	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
FeC---------- Fetzer	Fair: wetness.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, thin layer.
FlA, FlB---------- Flatonia	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
FrC, FrC2---------- Frelsburg	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GbC---------- Gibbonscreek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
GbE---------- Gibbonscreek	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, small stones, slope.
Gd---------- Gladewater	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
GmC---------- Gomery	Fair: area reclaim, low strength, thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
Go, Gp---------- Gowker	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
GrC, GrE---------- Gredge	Fair: shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
GvC, GvD---------- Greenvine	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Ha---------- Hatliff	Poor: wetness.	Probable----------	Improbable: too sandy.	Poor: wetness, too sandy.
HuC, HuD---------- Huntsburg	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Ka---------- Kaman	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KlC, KlD---------- Klump	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
KnC, KnD---------- Knolle	Good----------	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
KrD*: Koether----------	Poor: depth to rock.	Improbable: thin layer.	Improbable: too sandy.	Poor: depth to rock, large stones.
Rock outcrop.				
LaC---------- Landman	Good----------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
LtD, LtD3---------- Latium	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
LuA, LuB---------- Lufkin	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
LxB*:				
Lufkin	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Rader	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
MaA, MaB Mabank	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Na Nahatche	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
NdC Navasan	Good	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
NoA Norwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
NrA Norwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
OkA Oklared	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
On*:				
Oklared	Good	Improbable: excess fines.	Improbable: excess fines.	Good.
Norwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
PaD Padina	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Pt*. Pits				
RaA, RaB Rader	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: thin layer.
ReF*:				
Renish	Poor: depth to rock, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, small stones.
Rock outcrop.				
RoC, RoD Robco	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy, small stones.
SaC Shalba	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SbC*:				
Shalba	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: depth to rock, too clayey.
Rock outcrop.				
ShC, ShD Shiro	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
SlC, SlD Silawa	Good	Probable	Improbable: excess fines.	Fair: too clayey, small stones, area reclaim.
SmC, SmD Silstid	Good	Improbable: thin layer.	Improbable: too sandy.	Fair: too sandy, small stones.
SnA, SnC Singleton	Poor: depth to rock, shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
SpB Splendora	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
TaC Tabor	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
Tn Tinn	Poor: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
ToD Tonkavar	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Wa Waller	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
WlA, WlB Wilson	Poor: shrink-swell, low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
ZaC, ZaC2 Zack	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: thin layer.
ZuA, ZuC, ZuC2 Zulch	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
AnC, AnC2--------- Annona	Slight---------	Moderate: hard to pack.	Severe: slow refill.	Percs slowly, slope.	Wetness, percs slowly, slope.	Percs slowly, wetness, erodes easily.	Percs slowly, erodes easily.
AnD--------------- Annona	Slight---------	Moderate: hard to pack.	Severe: slow refill.	Percs slowly, slope.	Wetness, percs slowly, slope.	Slope, wetness, erodes easily.	Slope, erodes easily, percs slowly.
Ap*--------------- Arents	Moderate: slope.	Slight---------	Severe: no water.	Deep to water	Slope----------	Favorable------	Favorable.
ArA, ArC---------- Arol	Moderate: depth to rock.	Severe: hard to pack.	Severe: no water.	Percs slowly, depth to rock.	Wetness, soil blowing, percs slowly.	Depth to rock, erodes easily, wetness.	Erodes easily, depth to rock, percs slowly.
AxC, AxC2, AxD---- Axtell	Slight---------	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Erodes easily, percs slowly.	Erodes easily, droughty.
BcA, BcB---------- Bleiblerville	Slight---------	Severe: hard to pack.	Severe: no water.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.
BfB--------------- Boonville	Slight---------	Severe: wetness.	Severe: no water.	Percs slowly---	Wetness, soil blowing, percs slowly.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, percs slowly.
BgD--------------- Boy	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Too sandy------	Droughty.
BoA, BoB---------- Brazoria	Slight---------	Severe: hard to pack.	Severe: no water.	Percs slowly---	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.
Bp---------------- Brazoria	Slight---------	Severe: hard to pack, ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.	Wetness, percs slowly.
BrD--------------- Brenham	Moderate: seepage, slope.	Moderate: thin layer, hard to pack.	Severe: no water.	Deep to water	Slope----------	Favorable------	Favorable.
BsA--------------- Burleson	Slight---------	Severe: hard to pack.	Severe: no water.	Deep to water	Slow intake, percs slowly.	Percs slowly---	Percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
BuC---------- Burlewash	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Depth to rock, erodes easily.	Erodes easily, depth to rock.
BuE---------- Burlewash	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
BxE*: Burlewash--------	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Deep to water	Slope, soil blowing.	Slope, depth to rock, erodes easily.	Slope, erodes easily, depth to rock.
Gullied land-----	Severe: slope.	Slight---------	Severe: no water.	Deep to water	Slope----------	Slope----------	Slope.
CaC, CaD---------- Carbengle	Moderate: seepage, depth to rock, slope.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Depth to rock, slope.	Depth to rock	Depth to rock.
ChC, ChD---------- Chazos	Slight---------	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing, percs slowly.	Droughty, percs slowly.
CoC---------- Conroe	Slight---------	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, droughty, fast intake.	Wetness, percs slowly.	Droughty, rooting depth.
CpC---------- Conroe	Slight---------	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, fast intake.	Wetness, percs slowly.	Rooting depth.
CrC, CrC2, CrD---- Crockett	Slight---------	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, percs slowly.	Erodes easily, percs slowly.	Erodes easily, droughty.
CuC---------- Cuero	Severe: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Slope----------	Favorable------	Favorable.
DeC, DeD---------- Depcor	Slight---------	Moderate: piping, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness, percs slowly.	Wetness, percs slowly.	Droughty, percs slowly.
Du*. Dumps							

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
EmC, EmD Elmina	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Percs slowly, slope, cutbanks cave.	Slope, droughty.	Wetness, soil blowing.	Droughty, percs slowly.
FaC, FaC2 Falba	Moderate: depth to rock.	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, depth to rock, slope.	Slope, wetness.	Depth to rock, wetness, soil blowing.	Wetness, depth to rock, percs slowly.
FeC Fetzer	Slight	Moderate: wetness.	Severe: no water.	Percs slowly, slope.	Fast intake, percs slowly, slope.	Wetness, percs slowly.	Percs slowly.
FlA, FlB Flatonia	Slight	Severe: hard to pack.	Severe: no water.	Deep to water	Droughty, percs slowly.	Percs slowly	Droughty, percs slowly.
FrC, FrC2 Frelsburg	Slight	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, slow intake, percs slowly.	Percs slowly	Percs slowly.
GbC Gibbonscreek	Slight	Moderate: piping.	Severe: no water.	Deep to water	Slope	Erodes easily	Erodes easily.
GbE Gibbonscreek	Slight	Moderate: piping.	Severe: no water.	Deep to water	Slope	Slope, erodes easily.	Slope, erodes easily.
Gd Gladewater	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Wetness, percs slowly.
GmC Gomery	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Favorable	Droughty.
Go, Gp Gowker	Moderate: seepage.	Severe: wetness.	Severe: no water.	Percs slowly, flooding.	Wetness, percs slowly, flooding.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
GrC, GrE Gredge	Slight	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Erodes easily, soil blowing, percs slowly.	Erodes easily, percs slowly.
GvC, GvD Greenvine	Moderate: depth to rock.	Severe: hard to pack.	Severe: no water.	Percs slowly, depth to rock, slope.	Slope, slow intake.	Depth to rock, percs slowly.	Depth to rock, percs slowly.
Ha Hatliff	Severe: seepage.	Severe: seepage, piping, wetness.	Severe: cutbanks cave.	Flooding, cutbanks cave.	Wetness, droughty.	Wetness, too sandy, soil blowing.	Wetness, droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
HuC, HuD---------- Huntsburg	Slight---------	Severe: wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Wetness, percs slowly.	Wetness, percs slowly.
Ka---------- Kaman	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Percs slowly.
KlC, KlD---------- Klump	Severe: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing---	Favorable.
KnC, KnD---------- Knolle	Severe: seepage.	Moderate: thin layer, piping.	Severe: no water.	Deep to water	Fast intake, slope, soil blowing.	Soil blowing---	Favorable.
KrD*: Koether----------	Severe: depth to rock, seepage.	Severe: seepage, piping, large stones.	Severe: no water.	Deep to water	Slope, large stones, droughty.	Large stones, depth to rock.	Large stones, droughty.
Rock outcrop.							
LaC---------- Landman	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, slope.	Favorable------	Droughty.
LtD---------- Latium	Slight---------	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, slow intake, percs slowly.	Percs slowly---	Percs slowly.
LtD3---------- Latium	Slight---------	Severe: hard to pack.	Severe: no water.	Deep to water	Slope, slow intake, percs slowly.	Slope, percs slowly.	Slope, percs slowly.
LuA, LuB---------- Lufkin	Slight---------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, soil blowing, percs slowly.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, percs slowly.
LxB*: Lufkin----------	Slight---------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, soil blowing, percs slowly.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, percs slowly.
Rader----------	Slight---------	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness--------	Wetness, soil blowing, percs slowly.	Percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
MaA, MaB---------- Mabank	Slight---------	Severe: wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Na---------- Nahatche	Moderate: seepage.	Severe: wetness.	Moderate: slow refill.	Flooding-------	Wetness, flooding.	Wetness--------	Wetness.
NdC---------- Navasan	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
NoA---------- Norwood	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
NrA---------- Norwood	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Favorable------	Erodes easily	Erodes easily.
OkA---------- Oklared	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Favorable------	Favorable------	Favorable.
On*: Oklared----------	Severe: seepage.	Severe: piping.	Severe: cutbanks cave.	Deep to water	Flooding-------	Favorable------	Favorable.
Norwood----------	Moderate: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Erodes easily	Erodes easily	Erodes easily.
PaD---------- Padina	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.
Pt*. Pits							
RaA, RaB---------- Rader	Slight---------	Moderate: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness--------	Wetness, soil blowing, percs slowly.	Percs slowly.
ReF*: Renish----------	Severe: depth to rock.	Moderate: piping.	Severe: no water.	Deep to water	Slope, depth to rock.	Slope, depth to rock.	Slope, depth to rock.
Rock outcrop.							
RoC, RoD---------- Robco	Severe: seepage.	Moderate: wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Erodes easily, wetness, percs slowly.	Erodes easily, droughty, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions	Grassed waterways
SaC---------- Shalba	Severe: depth to rock.	Severe: hard to pack.	Severe: no water.	Percs slowly, depth to rock, slope.	Slope, wetness, soil blowing.	Depth to rock, erodes easily, wetness.	Wetness, erodes easily, depth to rock.
SbC*: Shalba----------	Severe: depth to rock.	Severe: hard to pack.	Severe: no water.	Percs slowly, depth to rock, slope.	Slope, wetness, soil blowing.	Depth to rock, erodes easily, wetness.	Wetness, erodes easily, depth to rock.
Rock outcrop.							
ShC, ShD---------- Shiro	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Percs slowly, depth to rock, slope.	Slope, fast intake.	Depth to rock, soil blowing.	Depth to rock, percs slowly.
SlC, SlD---------- Silawa	Severe: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Fast intake, soil blowing, slope.	Soil blowing---	Favorable.
SmC, SmD---------- Silstid	Moderate: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Soil blowing---	Droughty.
SnA---------- Singleton	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Percs slowly, depth to rock.	Wetness, soil blowing.	Depth to rock, erodes easily.	Erodes easily, depth to rock, percs slowly.
SnC---------- Singleton	Moderate: depth to rock.	Severe: thin layer.	Severe: no water.	Percs slowly, depth to rock, slope.	Slope, wetness, soil blowing.	Depth to rock, erodes easily, wetness.	Erodes easily, depth to rock, percs slowly.
SpB---------- Splendora	Slight---------	Severe: wetness.	Severe: no water.	Percs slowly---	Percs slowly, rooting depth.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, rooting depth.
TaC---------- Tabor	Slight---------	Moderate: hard to pack.	Severe: no water.	Deep to water	Slope, droughty, soil blowing.	Erodes easily, soil blowing, percs slowly.	Erodes easily, droughty, percs slowly.
Tn---------- Tinn	Slight---------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, flooding.	Wetness, slow intake, percs slowly.	Wetness, percs slowly.	Percs slowly.
ToD---------- Tonkavar	Severe: seepage.	Severe: seepage.	Severe: no water.	Deep to water	Slope, droughty, fast intake.	Too sandy, soil blowing.	Droughty.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Wa---------- Waller	Moderate: seepage.	Severe: piping, wetness.	Severe: slow refill.	Percs slowly---	Wetness, percs slowly, erodes easily.	Erodes easily, wetness.	Wetness, erodes easily, percs slowly.
W1A, W1B---------- Wilson	Slight---------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Erodes easily, wetness, percs slowly.	Wetness, erodes easily, percs slowly.
ZaC, ZaC2--------- Zack	Slight---------	Moderate: piping.	Severe: no water.	Deep to water	Slope, soil blowing, percs slowly.	Erodes easily, soil blowing.	Erodes easily, percs slowly.
ZuA---------- Zulch	Slight---------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness--------	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, percs slowly.
ZuC, ZuC2--------- Zulch	Slight---------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Slope, wetness.	Erodes easily, wetness, soil blowing.	Wetness, erodes easily, percs slowly.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
AnC---------- Annona	0-7	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0	95-100	95-100	75-95	45-55	<30	NP-7
	7-27	Clay, clay loam	CH	A-7	0	95-100	95-100	90-100	75-95	51-70	30-45
	27-65	Clay, clay loam	CH, CL	A-7	0	95-100	95-100	90-100	75-95	41-65	25-45
AnC2---------- Annona	0-4	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0	95-100	95-100	75-95	45-55	<30	NP-7
	4-30	Clay, clay loam	CH	A-7	0	95-100	95-100	90-100	75-95	51-70	30-45
	30-60	Clay, clay loam	CH, CL	A-7	0	95-100	95-100	90-100	75-95	41-65	25-45
AnD---------- Annona	0-5	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0	95-100	95-100	75-95	45-55	<30	NP-7
	5-28	Clay, clay loam	CH	A-7	0	95-100	95-100	90-100	75-95	51-70	30-45
	28-60	Clay, clay loam	CH, CL	A-7	0	95-100	95-100	90-100	75-95	41-65	25-45
Ap*---------- Arents	0-80	Variable---------	---	---	---	---	---	---	---	---	---
ArA---------- Arol	0-6	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	98-100	95-100	70-85	40-55	<20	NP-7
	6-30	Clay, clay loam	CH	A-7	0	98-100	95-100	90-100	70-95	51-70	34-48
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ArC---------- Arol	0-6	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	98-100	95-100	70-85	40-55	<20	NP-7
	6-34	Clay, clay loam	CH	A-7	0	98-100	95-100	90-100	70-95	51-70	34-48
	34-45	Weathered bedrock	---	---	---	---	---	---	---	---	---
AxC---------- Axtell	0-9	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2-4, A-4	0	90-100	80-100	75-100	28-75	<31	NP-7
	9-25	Clay, clay loam	CL, CH	A-7-6	0-2	95-100	95-100	85-100	70-98	41-65	25-42
	25-50	Clay, sandy clay	CL, CH	A-7-6	0-2	95-100	95-100	85-100	70-98	41-65	25-42
	50-65	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7-6	0-2	95-100	95-100	75-100	50-95	35-63	20-45
AxC2---------- Axtell	0-4	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2-4, A-4	0	90-100	80-100	75-100	28-75	<31	NP-7
	4-21	Clay, clay loam	CL, CH	A-7-6	0-2	95-100	95-100	85-100	70-98	41-65	25-42
	21-52	Clay, sandy clay	CL, CH	A-7-6	0-2	95-100	95-100	85-100	70-98	41-65	25-42
	52-65	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7-6	0-2	95-100	95-100	75-100	50-95	35-63	20-45
AxD---------- Axtell	0-8	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-2-4, A-4	0	90-100	80-100	75-100	28-75	<31	NP-7
	8-30	Clay, clay loam	CL, CH	A-7-6	0-2	95-100	95-100	85-100	70-98	41-65	25-42
	30-42	Clay, sandy clay	CL, CH	A-7-6	0-2	95-100	95-100	85-100	70-98	41-65	25-42
	42-72	Sandy clay loam, clay loam, clay.	CL, CH	A-6, A-7-6	0-2	95-100	95-100	75-100	50-95	35-63	20-45
BcA---------- Bleiblerville	0-15	Clay----------	CH	A-7-6	0	95-100	95-100	90-100	80-100	55-85	35-60
	15-65	Clay, silty clay	CH	A-7-6	0	95-100	95-100	90-100	80-100	55-85	35-60

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
BcB---------- Bleiblerville	0-6	Clay----------	CH	A-7-6	0	95-100	95-100	90-100	80-100	55-85	35-60
	6-55	Clay, silty clay	CH	A-7-6	0	95-100	95-100	90-100	80-100	55-85	35-60
	55-65	Clay, silty clay	CH	A-7-6	0	95-100	95-100	90-100	80-100	55-85	35-60
BfB---------- Boonville	0-13	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4	0-1	95-100	85-98	70-95	40-65	<20	NP-7
	13-46	Clay, clay loam	CH, CL	A-7	0	95-100	90-100	85-100	70-90	45-65	25-40
	46-60	Sandy clay loam, clay loam, clay.	CL, SC	A-7, A-6	0-1	80-100	80-98	65-95	45-95	35-50	15-30
BgD---------- Boy	0-49	Fine sand--------	SM, SC-SM	A-2-4	0	100	100	85-100	14-35	<25	NP-7
	49-70	Sandy loam, fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SC-SM	A-4, A-6	0	100	90-100	80-100	36-55	23-40	6-20
BoA---------- Brazoria	0-15	Clay----------	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
	15-98	Clay, silty clay	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
BoB---------- Brazoria	0-18	Clay----------	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
	18-90	Clay, silty clay	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
Bp---------- Brazoria	0-20	Clay----------	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
	20-65	Clay, silty clay	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
BrD---------- Brenham	0-12	Clay loam--------	CL	A-7-6, A-6	0	100	95-100	85-100	60-100	35-49	17-27
	12-55	Silty clay loam, clay loam, clay.	CL, CH	A-7-6, A-6	0	95-100	95-100	85-100	75-100	39-55	20-33
	55-80	Clay, silty clay	CL, CH	A-7-6	0	95-100	95-100	85-100	80-100	41-65	22-42
BsA---------- Burleson	0-42	Clay----------	CH, CL	A-7-6	0-2	90-100	90-100	90-99	67-97	45-57	28-39
	42-81	Clay, silty clay	CH	A-7-6	0-1	90-100	90-100	90-99	80-99	51-72	34-48
	81-95	Clay, silty clay	CH	A-7-6	0-2	90-100	80-100	75-99	67-98	60-84	40-60
BuC---------- Burlewash	0-7	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0	90-100	90-100	70-95	40-60	<20	NP-7
	7-20	Clay, sandy clay	CL, CH	A-7	0	95-100	95-100	90-100	51-90	41-55	20-30
	20-35	Clay loam, sandy clay loam, clay.	CL	A-6, A-7	0	95-100	95-100	75-95	51-75	35-45	18-25
	35-55	Weathered bedrock	---	---	---	---	---	---	---	---	---
BuE---------- Burlewash	0-6	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0	90-100	90-100	70-95	40-60	<20	NP-7
	6-21	Clay, sandy clay	CL, CH	A-7	0	95-100	95-100	90-100	51-90	41-55	20-30
	21-25	Clay loam, sandy clay loam, clay.	CL	A-6, A-7	0	95-100	95-100	75-95	51-75	35-45	18-25
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
BxE*: Burlewash-------	0-5	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0	90-100	90-100	70-95	40-60	<20	NP-7
	5-22	Clay, sandy clay	CL, CH	A-7	0	95-100	95-100	90-100	51-90	41-55	20-30
	22-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Gullied land----	0-80	Variable---------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
CaC--- Carbengle	0-12	Clay loam---	CL	A-6, A-4	0-5	90-100	85-100	70-98	51-80	25-40	8-20
	12-30	Loam, sandy clay loam, clay loam.	CL	A-6, A-4	0-8	85-100	85-100	70-98	51-85	25-40	8-20
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
CaD--- Carbengle	0-12	Clay loam---	CL	A-6, A-4	0-5	90-100	85-100	70-98	51-80	25-40	8-20
	12-22	Loam, sandy clay loam, clay loam.	CL	A-6, A-4	0-8	85-100	85-100	70-98	51-85	25-40	8-20
	22-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
ChC--- Chazos	0-15	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	80-100	75-100	60-98	20-50	<25	NP-4
	15-27	Sandy clay, clay	CL, CH	A-7-6	0	90-100	75-100	75-100	55-85	43-58	21-35
	27-65	Clay loam, sandy clay loam.	CL, CH, SC	A-7-6	0	90-100	75-100	65-95	35-75	43-58	21-35
	65-90	Clay loam, silty clay loam, clay.	CL, CH	A-7-6, A-6	0	90-100	75-100	70-95	50-85	35-55	15-35
ChD--- Chazos	0-12	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	80-100	75-100	60-98	20-50	<25	NP-4
	12-22	Sandy clay, clay	CL, CH	A-7-6	0	90-100	75-100	75-100	55-85	43-58	21-35
	22-42	Clay loam, sandy clay loam.	CL, CH, SC	A-7-6	0	90-100	75-100	65-95	35-75	43-58	21-35
	42-65	Clay loam, silty clay loam, clay.	CL, CH	A-7-6, A-6	0	90-100	75-100	70-95	50-85	35-55	15-35
CoC--- Conroe	0-24	Loamy fine sand	SM, SC-SM	A-2-4, A-4, A-1-b	0	80-100	80-98	45-80	15-40	<25	NP-4
	24-40	Sandy clay loam, sandy clay, clay loam.	SC, CL, GC	A-2-6, A-2-7, A-6, A-7	0	65-95	60-95	50-90	25-60	30-47	15-31
	40-74	Sandy clay, clay	CL, SC, CH	A-7-6, A-2-7	0	80-100	75-100	60-95	32-60	40-55	20-35
CpC--- Conroe	0-2	Gravelly loamy fine sand.	GM, SC-SM, SM, GP-GM	A-1, A-4, A-2-4	0	35-85	35-80	20-70	10-40	<25	NP-4
	2-17	Sandy clay, clay	CL, SC, CH	A-7-6	0	80-100	75-100	60-95	35-60	40-55	20-35
	17-60	Sandy clay loam, sandy clay.	CL, SC, CH	A-7-6, A-6	0	80-100	75-100	60-95	35-60	35-55	18-35
CrC--- Crockett	0-9	Fine sandy loam	SM, ML, CL, SC	A-4, A-6	0-2	98-100	94-100	89-100	40-96	15-35	3-15
	9-27	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	89-100	75-100	75-100	60-98	35-59	23-42
	27-55	Clay loam, sandy clay loam, clay.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	50-90	30-60	15-40
	55-65	Stratified loam to very shaly clay.	CH, CL	A-7	0-5	90-100	90-100	90-100	70-99	45-71	27-52
CrC2--- Crockett	0-4	Fine sandy loam	SM, ML, CL, SC	A-4, A-6	0-2	98-100	94-100	89-100	40-96	15-35	3-15
	4-16	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	89-100	75-100	75-100	60-98	35-59	23-42
	16-48	Clay loam, sandy clay loam, clay.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	50-90	30-60	15-40
	48-60	Stratified loam to very shaly clay.	CH, CL	A-7	0-5	90-100	90-100	90-100	70-99	45-71	27-52

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
CrD--- Crockett	0-6	Fine sandy loam	SM, ML, CL, SC	A-4, A-6	0-2	98-100	94-100	89-100	40-96	15-35	3-15
	6-23	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	89-100	75-100	75-100	60-98	35-59	23-42
	23-42	Clay loam, sandy clay loam, clay.	CL, CH	A-6, A-7	0-5	90-100	85-100	75-100	50-90	30-60	15-40
	42-60	Stratified loam to very shaly clay.	CH, CL	A-7	0-5	90-100	90-100	90-100	70-99	45-71	27-52
CuC--- Cuero	0-6	Clay loam---	CL, SC	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	70-97	30-70	25-35	8-15
	6-40	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	80-100	40-80	30-45	11-22
	40-65	Sandy clay loam, clay loam.	CL, SC	A-6	0	85-100	85-100	80-90	36-55	30-40	11-20
	65-72	Variable---	---	---	---	---	---	---	---	---	---
DeC--- Depcor	0-28	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	90-100	90-100	50-100	15-45	<25	NP-4
	28-60	Sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2-4, A-7	0	90-100	90-100	80-100	28-75	25-47	8-25
DeD--- Depcor	0-36	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	90-100	90-100	50-100	15-45	<25	NP-4
	36-65	Sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2-4, A-7	0	90-100	90-100	80-100	28-75	25-47	8-25
Du*. Dumps											
EmC--- Elmina	0-5	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	60-95	15-40	<25	NP-4
	5-22	Loamy fine sand, fine sand.	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	60-95	15-40	<25	NP-4
	22-55	Clay, sandy clay	CH	A-7-6	0	95-100	95-100	85-100	51-95	51-65	27-40
	55-72	Weathered bedrock	---	---	---	---	---	---	---	---	---
EmD--- Elmina	0-5	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	60-95	15-40	<25	NP-4
	5-24	Loamy fine sand, fine sand.	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	60-95	15-40	<25	NP-4
	24-47	Clay, sandy clay	CH	A-7-6	0	95-100	95-100	85-100	51-95	51-65	27-40
	47-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
FaC--- Falba	0-6	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	98-100	95-100	70-98	40-60	<30	NP-10
	6-35	Clay loam, clay	CH	A-7	0	98-100	95-100	90-100	75-95	51-70	34-48
	35-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
FaC2--- Falba	0-3	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	98-100	95-100	70-98	40-60	<30	NP-10
	3-25	Clay loam, clay	CH	A-7	0	98-100	95-100	90-100	75-95	51-70	34-48
	25-50	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
FeC---------- Fetzer	0-25	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	50-98	15-45	<25	NP-7
	25-34	Clay loam, sandy clay loam.	SC, CL	A-6, A-7-6	0	95-100	95-100	80-98	36-80	30-45	11-25
	34-75	Clay loam, sandy clay, clay.	CL, CH	A-7-6, A-6	0	95-100	95-100	85-100	51-95	35-55	15-30
FlA---------- Flatonia	0-6	Clay loam--------	CL, CH	A-6, A-7-6	0	80-100	80-100	75-100	40-70	39-56	21-34
	6-45	Clay, sandy clay, silty clay.	CH, CL	A-7-6	0	95-100	90-100	90-100	50-80	46-64	28-41
	45-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
FlB---------- Flatonia	0-6	Clay loam--------	CL, CH	A-6, A-7-6	0	80-100	80-100	75-100	40-70	39-56	21-34
	6-45	Clay, sandy clay, silty clay.	CH, CL	A-7-6	0	95-100	90-100	90-100	50-80	46-64	28-41
	45-55	Weathered bedrock	---	---	---	---	---	---	---	---	---
FrC---------- Frelsburg	0-10	Clay----------	CH	A-7-6	0	95-100	95-100	90-100	85-100	55-90	35-65
	10-70	Clay, silty clay	CH	A-7-6	0	95-100	95-100	90-100	85-100	55-90	35-65
FrC2---------- Frelsburg	0-6	Clay----------	CH	A-7-6	0	95-100	95-100	90-100	85-100	55-90	35-65
	6-60	Clay, silty clay	CH	A-7-6	0	95-100	95-100	90-100	85-100	55-90	35-65
GbC, GbE--------- Gibbonscreek	0-7	Clay loam--------	CL, CH	A-7, A-7-6, A-6	0-2	90-100	90-100	90-100	70-95	35-55	11-30
	7-80	Clay loam, sandy clay loam, silty clay loam.	CL, SC, CH	A-6, A-7-6	0-2	90-100	90-100	80-100	45-95	30-66	13-40
Gd---------- Gladewater	0-8	Clay----------	CH, CL	A-7	0	100	100	90-100	80-95	48-75	25-50
	8-60	Clay----------	CH	A-7	0	100	100	95-100	90-100	51-75	30-50
GmC---------- Gomery	0-30	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	60-95	15-40	<25	NP-4
	30-59	Sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	65-100	35-75	30-44	11-25
	59-65	Weathered bedrock	---	---	---	---	---	---	---	---	---
Go---------- Gowker	0-22	Loam----------	CL	A-4, A-6	0	95-100	95-100	85-95	60-75	22-30	7-14
	22-60	Clay, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	80-100	40-90	30-48	11-21
Gp---------- Gowker	0-24	Clay loam--------	CL, SC	A-6	0	95-100	95-100	85-100	40-80	30-40	11-18
	24-28	Clay, clay loam, sandy clay.	CL	A-6, A-7	0	95-100	95-100	85-100	70-95	38-48	15-21
	28-60	Clay, sandy clay loam, clay loam.	CL, SC	A-6, A-7	0	95-100	95-100	80-100	40-90	30-48	11-21

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
GrC, GrE--- Gredge	0-7	Fine sandy loam	SM, ML, SC-SM, CL-ML	A-4	0-1	90-100	90-100	75-85	35-55	<31	NP-7
	7-21	Sandy clay, clay	CH, CL	A-7-6	0-1	90-100	85-100	75-100	51-98	45-65	28-42
	21-40	Clay loam, sandy clay loam.	CL, CH	A-7-6	0-1	90-100	90-100	80-100	51-85	41-60	25-40
	40-57	Clay loam, sandy clay loam.	CL, SC	A-6, A-7-6	0-1	90-100	90-100	80-100	36-80	35-50	15-30
	57-68	Clay loam, sandy clay loam, fine sandy loam.	SC, CL	A-4, A-6	0-3	90-100	90-100	65-100	36-75	22-40	7-20
GvC--- Greenvine	0-5	Clay---	CH	A-7-6	0	100	95-100	90-100	75-98	55-75	32-50
	5-30	Clay, silty clay	CH	A-7-6	0	100	95-100	90-100	75-98	55-92	32-62
	30-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
GvD--- Greenvine	0-12	Clay---	CH	A-7-6	0	100	95-100	90-100	75-98	55-75	32-50
	12-25	Clay, silty clay	CH	A-7-6	0	100	95-100	90-100	75-98	55-92	32-62
	25-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
Ha--- Hatliff	0-6	Fine sandy loam	SM, CL, ML, SC	A-4	0	100	95-100	65-95	36-55	<30	NP-10
	6-72	Stratified loam to sand.	SP-SM, SM, SC, SC-SM	A-2-4, A-4, A-3	0	100	95-100	50-90	5-45	<30	NP-9
HuC--- Huntsburg	0-11	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	90-100	85-100	50-95	15-45	<25	NP-4
	11-16	Sandy clay, clay	CL, CH, SC	A-7	0	90-100	90-100	70-100	36-90	44-55	22-30
	16-65	Clay loam, sandy clay, clay.	CL, CH, SC	A-7	0	90-100	90-100	70-100	36-90	48-62	25-36
HuD--- Huntsburg	0-10	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	90-100	85-100	50-95	15-45	<25	NP-4
	10-25	Sandy clay, clay	CL, CH, SC	A-7	0	90-100	90-100	70-100	36-90	44-55	22-30
	25-65	Clay loam, sandy clay, clay.	CL, CH, SC	A-7	0	90-100	90-100	70-100	36-90	48-62	25-36
Ka--- Kaman	0-15	Clay---	CH, CL	A-7	0	98-100	98-100	90-100	75-90	46-66	24-42
	15-60	Clay, silty clay	CH, CL	A-7	0	98-100	98-100	90-100	75-90	46-66	24-42
KlC--- Klump	0-15	Sandy loam---	SM, SC-SM	A-2, A-4	0	100	100	60-85	30-50	<30	NP-7
	15-45	Sandy loam, sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2	0	100	100	80-100	30-65	23-38	7-15
	45-60	Sandy clay loam, fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2	0	100	100	75-100	15-30	20-27	3-9
KlD--- Klump	0-10	Sandy loam---	SM, SC-SM	A-2, A-4	0	100	100	60-85	30-50	<30	NP-7
	10-45	Sandy loam, sandy clay loam, clay loam.	SC, CL	A-4, A-6, A-2	0	100	100	80-100	30-65	23-38	7-15
	45-65	Sandy clay loam, fine sandy loam, sandy loam.	SM, SC-SM, SC	A-2	0	100	100	75-100	15-30	20-27	3-9

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
KnC---------- Knolle	0-8	Loamy sand-------	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	98-100	80-100	5-25	<25	NP-5
	8-15	Sandy loam, loamy coarse sand, loamy sand.	SC-SM, SM	A-2-4, A-4	0	100	98-100	80-100	25-45	<27	NP-7
	15-55	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-6, A-4, A-7-6	0	100	98-100	85-100	36-65	20-45	7-23
	55-70	Sandy loam, sandy clay loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	100	98-100	85-100	30-45	20-27	3-9
KnD---------- Knolle	0-8	Loamy sand-------	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	98-100	80-100	5-25	<25	NP-5
	8-13	Sandy loam, loamy coarse sand, loamy sand.	SC-SM, SM	A-2-4, A-4	0	100	98-100	80-100	25-45	<27	NP-7
	13-50	Sandy clay loam, clay loam, sandy clay.	SC, CL	A-6, A-4, A-7-6	0	100	98-100	85-100	36-65	20-45	7-23
	50-70	Sandy loam, sandy clay loam, loamy sand.	SM, SC-SM, SC	A-2, A-4	0	100	98-100	85-100	30-45	20-27	3-9
KrD*:											
Koether---------	0-12	Stony loamy sand	SM, SP-SM	A-2	25-45	80-98	75-95	50-65	10-30	<20	NP-4
	12-30	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
LaC---------- Landman	0-65	Loamy fine sand	SM, SC-SM	A-2-4	0	95-100	95-100	85-100	14-35	<25	NP-7
	65-75	Sandy clay loam, fine sandy loam, clay loam.	CL, SC, CL-ML, SC-SM	A-4, A-6, A-2-6	0	95-100	90-100	80-100	32-55	23-40	6-20
LtD---------- Latium	0-4	Clay----------	CH	A-7-6	0	95-100	90-100	85-100	80-100	55-85	35-60
	4-60	Clay, silty clay	CH	A-7-6	0	95-100	90-100	85-100	80-100	55-85	35-60
LtD3---------- Latium	0-4	Clay----------	CH	A-7-6	0	95-100	90-100	85-100	80-100	55-85	35-60
	4-70	Clay, silty clay	CH	A-7-6	0	95-100	90-100	85-100	80-100	55-85	35-60
LuA---------- Lufkin	0-7	Fine sandy loam	SM, CL, ML, SC	A-4	0-5	90-100	80-100	80-100	40-85	<30	NP-10
	7-45	Clay, clay loam, silty clay loam.	CH, CL	A-7-6	0	90-100	90-100	90-100	65-95	45-67	30-45
	45-60	Loam, clay loam, sandy clay loam.	CH, CL, SC	A-7	0	85-100	85-100	80-100	48-90	40-86	25-55
LuB---------- Lufkin	0-8	Fine sandy loam	SM, CL, ML, SC	A-4	0-5	90-100	80-100	80-100	40-85	<30	NP-10
	8-45	Clay, clay loam, silty clay loam.	CH, CL	A-7-6	0	90-100	90-100	90-100	65-95	45-67	30-45
	45-60	Loam, clay loam, sandy clay loam.	CH, CL, SC	A-7	0	85-100	85-100	80-100	48-90	40-86	25-55

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
LxB*:											
Lufkin	0-10	Fine sandy loam	SM, CL, ML, SC	A-4	0-5	90-100	80-100	80-100	40-85	<30	NP-10
	10-45	Clay, clay loam, silty clay loam.	CH, CL	A-7-6	0	90-100	90-100	90-100	65-95	45-67	30-45
	45-60	Loam, clay loam, sandy clay loam.	CH, CL, SC	A-7	0	85-100	85-100	80-100	48-90	40-86	25-55
Rader	0-25	Fine sandy loam	ML, CL, SC, SM	A-2, A-4	0	98-100	95-100	90-100	34-72	18-28	3-10
	25-35	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	90-100	36-75	26-40	11-22
	35-60	Clay loam, sandy clay, clay.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	51-90	36-60	18-38
MaA Mabank	0-9	Fine sandy loam	CL, CL-ML, SC-SM, SC	A-4, A-6	0	95-100	95-100	80-98	40-70	19-32	4-15
	9-65	Clay, clay loam	CH, CL	A-7, A-6	0	95-100	95-100	95-100	60-85	38-55	22-37
	65-70	Clay, clay loam	CH, CL	A-7, A-6	0	95-100	95-100	95-100	60-85	38-55	22-37
MaB Mabank	0-8	Fine sandy loam	CL, CL-ML, SC-SM, SC	A-4, A-6	0	95-100	95-100	80-98	40-70	19-32	4-15
	8-65	Clay, clay loam	CH, CL	A-7, A-6	0	95-100	95-100	95-100	60-85	38-55	22-37
Na Nahatche	0-6	Clay loam	CL	A-6, A-7, A-4	0	100	100	90-100	54-92	25-47	8-25
	6-60	Stratified loam to silty clay loam.	CL	A-6, A-7	0	100	100	90-100	60-90	30-45	11-25
NdC Navasan	0-6	Loamy sand	SM, SC-SM	A-2-4	0	95-100	95-100	50-75	15-35	<25	NP-5
	6-65	Loamy fine sand, loamy sand.	SM, SC-SM	A-2-4	0	95-100	95-100	50-75	15-35	<25	NP-5
	65-75	Sandy loam, fine sandy loam.	SM, SC, ML, CL	A-4	0-1	90-100	90-100	60-85	35-60	20-30	3-10
	75-95	Fine sand, sandy clay loam, clay loam.	SC, CL	A-4, A-6	0-1	90-100	90-100	65-95	35-75	22-36	8-20
NoA Norwood	0-18	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	51-90	20-35	4-15
	18-45	Silt loam, silty clay loam, loam.	CL	A-6, A-7, A-4	0	100	100	90-100	60-98	25-46	7-26
	45-80	Silt loam, very fine sandy loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	2-25
NrA Norwood	0-16	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	85-98	30-55	15-35
	16-52	Silt loam, silty clay loam, loam.	CL	A-6, A-7, A-4	0	100	100	90-100	60-98	25-46	7-26
	52-63	Silt loam, very fine sandy loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	2-25
OkA Oklared	0-16	Very fine sandy loam.	CL, ML, CL-ML	A-4	0	100	100	94-100	51-85	<30	NP-10
	16-73	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<30	NP-10

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments 3-10 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
On*:											
Oklared	0-4	Very fine sandy loam.	CL, ML, CL-ML	A-4	0	100	100	94-100	51-85	<30	NP-10
	4-60	Fine sandy loam, very fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<30	NP-10
Norwood	0-8	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	95-100	51-90	20-35	4-15
	8-35	Silt loam, silty clay loam, loam.	CL	A-6, A-7, A-4	0	100	100	90-100	60-98	25-46	7-26
	35-60	Silt loam, very fine sandy loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	2-25
PaD	0-6	Loamy fine sand	SM, SC-SM	A-2-4	0	100	95-100	85-100	15-35	<25	NP-5
Padina	6-65	Fine sand, loamy fine sand.	SM, SP-SM, SC-SM	A-2-4, A-3	0	100	95-100	85-100	8-28	<25	NP-5
	65-75	Sandy clay loam, fine sandy loam.	SC, CL	A-2, A-4, A-6, A-7	0	90-100	90-100	90-100	25-65	22-42	8-22
Pt*.											
Pits											
RaA	0-12	Fine sandy loam	ML, CL, SC, SM	A-2, A-4	0	98-100	95-100	90-100	34-72	18-28	3-10
Rader	12-21	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	90-100	36-75	26-40	11-22
	21-72	Clay loam, sandy clay, clay.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	51-90	36-60	18-38
RaB	0-16	Fine sandy loam	ML, CL, SC, SM	A-2, A-4	0	98-100	95-100	90-100	34-72	18-28	3-10
Rader	16-23	Loam, sandy clay loam, clay loam.	SC, CL	A-6	0	95-100	95-100	90-100	36-75	26-40	11-22
	23-66	Clay loam, sandy clay, clay.	CL, CH	A-6, A-7	0	95-100	95-100	90-100	51-90	36-60	18-38
ReF*:											
Renish	0-14	Loam	CL	A-6, A-4	0-10	85-100	80-100	80-100	65-90	30-40	9-18
	14-15	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Rock outcrop.											
RoC	0-5	Loamy fine sand	SM, SP-SM	A-2-4, A-3	0	80-100	80-100	65-95	8-35	<25	NP-3
Robco	5-25	Loamy fine sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	80-100	80-100	65-95	8-35	<25	NP-3
	25-50	Sandy clay loam, loam, clay loam.	SC, CL	A-6, A-4	0	98-100	98-100	80-100	36-75	26-40	8-22
	50-75	Clay loam, sandy clay loam.	CL	A-6, A-7	0	98-100	98-100	80-100	50-80	36-50	16-28
RoD	0-6	Loamy fine sand	SM, SP-SM	A-2-4, A-3	0	80-100	80-100	65-95	8-35	<25	NP-3
Robco	6-21	Loamy fine sand, fine sand.	SM, SP-SM	A-2-4, A-3	0	80-100	80-100	65-95	8-35	<25	NP-3
	21-41	Sandy clay loam, loam, clay loam.	SC, CL	A-6, A-4	0	98-100	98-100	80-100	36-75	26-40	8-22
	41-74	Sandy clay loam, clay loam, clay.	CL, SC	A-6, A-7	0	98-100	98-100	80-100	40-95	32-50	13-28

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SaC---------- Shalba	0-3	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	95-100	95-100	70-98	40-60	<20	NP-7
	3-14	Clay----------	CH	A-7	0	95-100	95-100	90-100	75-95	51-70	34-48
	14-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
SbC*: Shalba----------	0-3	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	95-100	95-100	70-98	40-60	<20	NP-7
	3-18	Clay----------	CH	A-7	0	95-100	95-100	90-100	75-95	51-70	34-48
	18-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
Rock outcrop.											
ShC---------- Shiro	0-12	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	60-95	15-40	<25	NP-7
	12-24	Clay, sandy clay, clay loam.	CL, CH	A-7-6	0	95-100	95-100	85-100	51-95	45-65	23-38
	24-31	Clay, sandy clay, clay loam.	CL, CH, SC	A-7-6	0	95-100	95-100	75-100	40-70	45-65	25-38
	31-40	Weathered bedrock	---	---	---	---	---	---	---	---	---
ShD---------- Shiro	0-10	Loamy fine sand	SM, SC-SM	A-2-4, A-4	0	95-100	95-100	60-95	15-40	<25	NP-7
	10-35	Clay, sandy clay, clay loam.	CL, CH	A-7-6	0	95-100	95-100	85-100	51-95	45-65	23-38
	35-45	Weathered bedrock	---	---	---	---	---	---	---	---	---
SlC---------- Silawa	0-15	Loamy fine sand	SM, SC-SM	A-2-4	0	95-100	95-100	70-100	15-35	<25	NP-4
	15-40	Sandy clay loam, fine sandy loam, clay loam.	CL, SC	A-4, A-6	0	85-100	85-100	80-100	35-65	25-40	8-18
	40-48	Fine sandy loam, gravelly fine sandy loam, sandy clay loam.	CL, CL-ML, SC, SC-SM	A-4, A-6, A-2-4, A-2-6	0-2	70-100	70-100	38-100	18-60	21-34	4-14
	48-65	Loamy fine sand, gravelly loamy sand, fine sandy loam.	SM, SC-SM, SP-SM, GM	A-2-4, A-4, A-1-b	0-2	51-100	51-100	38-100	12-40	<26	NP-7
SlD---------- Silawa	0-12	Loamy fine sand	SM, SC-SM	A-2-4	0	95-100	95-100	70-100	15-35	<25	NP-4
	12-55	Sandy clay loam, fine sandy loam, clay loam.	CL, SC	A-4, A-6	0	85-100	85-100	80-100	35-65	25-40	8-18
	55-80	Loamy fine sand, gravelly loamy sand, fine sandy loam.	SM, SC-SM, SP-SM, GM	A-2-4, A-4, A-1-b	0-2	51-100	51-100	38-100	12-40	<26	NP-7
SmC---------- Silstid	0-4	Loamy fine sand	SM, SP-SM	A-2-4, A-3	0-1	90-100	85-100	80-100	9-25	<25	NP-3
	4-35	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0-1	90-100	85-100	80-100	9-25	<25	NP-3
	35-54	Sandy clay loam, loam, fine sandy loam.	SC, CL, SC-SM, CL-ML	A-4, A-6, A-2-4, A-2-6	0-1	90-100	85-100	75-100	30-55	20-43	4-26
	54-80	Sandy clay loam, loam, fine sandy loam.	SC, CL, SC-SM, CL-ML	A-4, A-6, A-2-4, A-2-6	0-1	90-100	80-100	70-100	22-55	20-43	4-25

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
SmD--Silstid	0-10	Loamy fine sand	SM, SP-SM	A-2-4, A-3	0-1	90-100	85-100	80-100	9-25	<25	NP-3
	10-32	Fine sand, loamy fine sand.	SM, SP-SM	A-2, A-3	0-1	90-100	85-100	80-100	9-25	<25	NP-3
	32-52	Sandy clay loam, loam, fine sandy loam.	SC, CL, SC-SM, CL-ML	A-4, A-6, A-2-4, A-2-6	0-1	90-100	85-100	75-100	30-55	20-43	4-26
	52-60	Sandy clay loam, loam, fine sandy loam.	SC, CL, SC-SM, CL-ML	A-4, A-6, A-2-4, A-2-6	0-1	90-100	80-100	70-100	22-55	20-43	4-25
SnA--Singleton	0-6	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	95-100	90-100	70-95	40-60	<25	NP-7
	6-21	Clay	CH	A-7-6	0	95-100	90-100	90-100	75-95	51-70	34-48
	21-35	Clay, clay loam, sandy clay.	CH, CL	A-7-6	0	95-100	90-100	85-100	51-95	45-60	23-36
	35-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SnC--Singleton	0-9	Fine sandy loam	SC-SM, SM, CL-ML, ML	A-4	0	95-100	90-100	70-95	40-60	<25	NP-7
	9-20	Clay	CH	A-7-6	0	95-100	90-100	90-100	75-95	51-70	34-48
	20-32	Clay, clay loam, sandy clay.	CH, CL	A-7-6	0	95-100	90-100	85-100	51-95	45-60	23-36
	32-38	Clay loam, sandy clay loam.	SC, CL	A-6, A-7-6	0	95-100	90-100	80-100	40-80	35-49	15-25
	38-60	Weathered bedrock	---	---	---	---	---	---	---	---	---
SpB--Splendora	0-12	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0	95-100	95-100	95-100	40-60	<20	NP-7
	12-30	Loam, fine sandy loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	51-80	20-30	7-16
	30-40	Sandy clay loam, loam, fine sandy loam.	CL, CL-ML	A-4, A-6	0	80-100	80-100	70-100	51-80	20-30	7-16
	40-60	Sandy clay loam, loam, fine sandy loam.	CL	A-6	0	80-100	80-100	70-100	51-80	25-35	12-20
TaC--Tabor	0-14	Fine sandy loam	ML, SM, CL-ML, SC-SM	A-4, A-2-4	0	85-100	75-100	70-100	30-55	<25	NP-7
	14-45	Clay	CH, CL	A-7	0	95-100	90-100	85-100	55-90	45-65	25-40
	45-72	Sandy clay loam, clay loam, clay.	CH, CL, SC	A-7, A-6	0	95-100	90-100	75-100	40-90	35-60	15-35
Tn--Tinn	0-6	Clay	CH, CL	A-7	0	95-100	95-100	85-100	80-100	45-75	25-54
	6-96	Clay, silty clay	CH	A-7	0	95-100	90-100	80-100	80-100	55-75	35-54
ToD--Tonkavar	0-4	Fine sand	SM, SC-SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<25	NP-5
	4-72	Sand, loamy fine sand, loamy sand.	SM, SC-SM, SP-SM	A-2-4, A-3	0	95-100	95-100	50-75	5-30	<25	NP-5
	72-78	Sandy clay loam, clay loam, fine sandy loam.	SC, CL	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	50-90	15-55	20-39	8-20
	78-90	Weathered bedrock	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO	3-10 inches	4	10	40	200		
	In				Pct					Pct	
Wa Waller	0-6	Loam	ML, CL-ML	A-4	0	100	98-100	95-100	51-75	<25	NP-6
	6-26	Loam, silt loam, very fine sandy loam.	CL, CL-ML, ML	A-4, A-6	0	100	98-100	95-100	60-90	15-30	2-11
	26-65	Loam, sandy clay loam, clay loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	60-90	20-40	4-20
WlA Wilson	0-9	Clay loam	CL	A-6, A-7-6	0	95-100	85-100	80-100	60-96	38-49	20-30
	9-25	Silty clay, clay, clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	25-60	Silty clay, clay, silty clay loam.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
WlB Wilson	0-8	Clay loam	CL	A-6, A-7-6	0	95-100	85-100	80-100	60-96	38-49	20-30
	8-27	Silty clay, clay, clay loam.	CL, CH	A-7-6	0	90-100	80-100	80-100	65-96	43-56	26-37
	27-61	Silty clay, clay, silty clay loam.	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-96	38-65	24-48
ZaC Zack	0-6	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0-1	90-100	90-100	70-95	40-65	20-30	NP-7
	6-22	Clay	CH	A-7-6	0-1	90-100	90-100	90-100	75-95	50-70	30-45
	22-32	Clay, clay loam	CH, CL	A-7-6	0-1	90-100	90-100	90-100	70-95	42-60	25-38
	32-48	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0-1	90-100	90-100	80-100	51-90	26-40	8-20
ZaC2 Zack	0-4	Fine sandy loam	SM, SC-SM, ML, CL-ML	A-4	0-1	90-100	90-100	70-95	40-65	20-30	NP-7
	4-29	Clay	CH	A-7-6	0-1	90-100	90-100	90-100	75-95	50-70	30-45
	29-60	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0-1	90-100	90-100	80-100	51-90	26-40	8-20
ZuA Zulch	0-9	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	70-100	40-60	<30	NP-7
	9-41	Clay loam, clay, silty clay.	CH, CL	A-7-6	0	95-100	95-100	90-100	75-95	41-60	20-35
	41-60	Clay, clay loam	CH, CL	A-6, A-7-6	0	95-100	95-100	90-100	65-90	35-76	18-57
ZuC Zulch	0-6	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	70-100	40-60	<30	NP-7
	6-35	Clay loam, clay, silty clay.	CH, CL	A-7-6	0	95-100	95-100	90-100	75-95	41-60	20-35
	35-60	Clay, clay loam	CH, CL	A-6, A-7-6	0	95-100	95-100	90-100	65-90	35-76	18-57
ZuC2 Zulch	0-4	Fine sandy loam	SM, ML	A-4	0	95-100	95-100	70-100	40-60	<30	NP-7
	4-36	Clay loam, clay, silty clay.	CH, CL	A-7-6	0	95-100	95-100	90-100	75-95	41-60	20-35
	36-60	Clay, clay loam	CH, CL	A-6, A-7-6	0	95-100	95-100	90-100	65-90	35-76	18-57

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
AnC	0-7	5-18	1.20-1.40	0.6-2.0	0.13-0.18	4.5-6.5	Low	0.43	5	<1
Annona	7-27	40-60	1.30-1.50	<0.06	0.12-0.18	4.5-6.5	High	0.32		
	27-65	35-60	1.30-1.50	<0.06	0.12-0.18	5.1-8.4	High	0.28		
AnC2	0-4	5-18	1.20-1.40	0.6-2.0	0.13-0.18	4.5-6.5	Low	0.43	5	<1
Annona	4-30	40-60	1.30-1.50	<0.06	0.12-0.18	4.5-6.5	High	0.32		
	30-60	35-60	1.30-1.50	<0.06	0.12-0.18	5.1-8.4	High	0.28		
AnD	0-5	5-18	1.20-1.40	0.6-2.0	0.13-0.18	4.5-6.5	Low	0.43	5	<1
Annona	5-28	40-60	1.30-1.50	<0.06	0.12-0.18	4.5-6.5	High	0.32		
	28-60	35-60	1.30-1.50	<0.06	0.12-0.18	5.1-8.4	High	0.28		
Ap*	0-80	---	---	0.01-20	---	---				---
Arents										
ArA	0-6	15-20	1.40-1.60	0.6-2.0	0.11-0.17	5.1-6.0	Low	0.43	2	<1
Arol	6-30	35-50	1.25-1.45	<0.06	0.10-0.16	5.1-7.8	High	0.32		
	30-60	---	---	0.01-0.6	---	---				
ArC	0-6	15-20	1.40-1.60	0.6-2.0	0.11-0.17	5.1-6.0	Low	0.43	2	<1
Arol	6-34	35-50	1.25-1.45	<0.06	0.10-0.16	5.1-7.8	High	0.32		
	34-45	---	---	0.01-0.6	---	---				
AxC	0-9	7-18	1.40-1.60	0.6-2.0	0.11-0.15	5.1-6.5	Low	0.43	5	.5-1
Axtell	9-25	35-55	1.35-1.60	<0.06	0.07-0.16	4.5-5.5	High	0.37		
	25-50	27-50	1.50-1.70	<0.06	0.07-0.16	5.6-8.4	High	0.37		
	50-65	25-50	1.50-1.70	0.2-0.6	0.07-0.12	5.6-8.4	High	0.37		
AxC2	0-4	7-18	1.40-1.60	0.6-2.0	0.11-0.15	5.1-6.5	Low	0.43	5	.5-1
Axtell	4-21	35-55	1.35-1.60	<0.06	0.07-0.16	4.5-5.5	High	0.37		
	21-52	27-50	1.50-1.70	<0.06	0.07-0.16	5.6-8.4	High	0.37		
	52-65	25-50	1.50-1.70	0.2-0.6	0.07-0.12	5.6-8.4	High	0.37		
AxD	0-8	7-18	1.40-1.60	0.6-2.0	0.11-0.15	5.1-6.5	Low	0.43	5	.5-1
Axtell	8-30	35-55	1.35-1.60	<0.06	0.07-0.16	4.5-5.5	High	0.37		
	30-42	27-50	1.50-1.70	<0.06	0.07-0.16	5.6-8.4	High	0.37		
	42-72	25-50	1.50-1.70	0.2-0.6	0.07-0.12	5.6-8.4	High	0.37		
BcA	0-15	45-60	1.15-1.35	<0.06	0.15-0.18	6.6-8.4	Very high	0.32	5	1-4
Bleiblerville	15-65	45-60	1.15-1.35	<0.06	0.15-0.18	7.4-8.4	Very high	0.32		
BcB	0-6	45-60	1.15-1.35	<0.06	0.15-0.18	6.6-8.4	Very high	0.32	5	1-4
Bleiblerville	6-55	45-60	1.15-1.35	<0.06	0.15-0.18	7.4-8.4	Very high	0.32		
	55-65	45-70	1.15-1.35	<0.06	0.15-0.18	7.4-8.4	Very high	0.32		
BfB	0-13	5-15	1.25-1.59	0.6-2.0	0.11-0.15	5.1-7.3	Low	0.43	5	<1
Boonville	13-46	35-55	1.25-1.45	<0.06	0.12-0.17	5.1-8.4	High	0.32		
	46-60	25-55	1.35-1.70	0.06-0.2	0.10-0.15	5.6-8.4	Moderate	0.37		
BgD	0-49	2-10	1.40-1.60	6.0-20	0.05-0.10	4.5-6.5	Low	0.17	5	<2
Boy	49-70	20-35	1.55-1.75	0.2-0.6	0.10-0.15	4.5-6.0	Low	0.24		
BoA	0-15	60-80	1.25-1.50	<0.06	0.08-0.18	7.4-8.4	High	0.32	5	2-6
Brazoria	15-98	60-80	1.25-1.50	<0.06	0.08-0.18	7.4-8.4	High	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
BoB----------	0-18	60-80	1.25-1.50	<0.06	0.08-0.18	7.4-8.4	High----------	0.32	5	2-6
Brazoria	18-90	60-80	1.25-1.50	<0.06	0.08-0.18	7.4-8.4	High----------	0.32		
Bp----------	0-20	60-80	1.30-1.50	<0.06	0.14-0.19	7.4-8.4	High----------	0.32	5	2-6
Brazoria	20-65	60-80	1.35-1.55	<0.06	0.14-0.19	7.4-8.4	High----------	0.32		
BrD----------	0-12	25-35	1.30-1.40	0.6-2.0	0.15-0.20	7.9-8.4	Moderate-----	0.32	5	1-3
Brenham	12-55	36-44	1.30-1.40	0.6-2.0	0.12-0.18	7.9-8.4	Moderate-----	0.32		
	55-80	40-55	1.20-1.35	0.6-2.0	0.12-0.16	7.9-8.4	Moderate-----	0.32		
BsA----------	0-42	40-60	1.35-1.50	<0.06	0.12-0.18	5.6-8.4	High----------	0.32	5	1-3
Burleson	42-81	40-60	1.40-1.55	<0.06	0.12-0.18	6.1-8.4	High----------	0.32		
	81-95	40-60	1.40-1.55	<0.06	0.12-0.18	7.4-8.4	High----------	0.32		
BuC----------	0-7	5-15	1.30-1.45	0.6-2.0	0.11-0.15	4.5-6.0	Low-----------	0.43	2	<1
Burlewash	7-20	40-55	1.30-1.45	<0.06	0.12-0.18	3.6-5.5	High----------	0.28		
	20-35	30-45	1.30-1.45	0.2-0.6	0.12-0.18	4.5-5.5	High----------	0.32		
	35-55	---	---	---	---	---	----------	----		
BuE----------	0-6	5-15	1.30-1.45	0.6-2.0	0.11-0.15	4.5-6.0	Low-----------	0.43	2	<1
Burlewash	6-21	40-55	1.30-1.45	<0.06	0.12-0.18	3.6-5.5	High----------	0.28		
	21-25	30-45	1.30-1.45	0.2-0.6	0.12-0.18	4.5-5.5	High----------	0.32		
	25-60	---	---	---	---	---	----------	----		
BxE*:										
Burlewash-------	0-5	5-15	1.30-1.45	0.6-2.0	0.11-0.15	4.5-6.0	Low-----------	0.43	2	<1
	5-22	40-55	1.30-1.45	<0.06	0.12-0.18	3.6-5.5	High----------	0.28		
	22-60	---	---	---	---	---	----------	----		
Gullied land----	0-80	---	---	0.01-20	---	---	----------	----	---	---
CaC----------	0-12	20-35	1.40-1.55	0.6-2.0	0.15-0.20	7.9-8.4	Low-----------	0.32	3	1-3
Carbengle	12-30	20-35	1.40-1.55	0.6-2.0	0.15-0.20	7.9-8.4	Low-----------	0.32		
	30-60	---	---	0.06-2.0	---	---	----------	----		
CaD----------	0-12	20-35	1.40-1.55	0.6-2.0	0.15-0.20	7.9-8.4	Low-----------	0.32	3	1-3
Carbengle	12-22	20-35	1.40-1.55	0.6-2.0	0.15-0.20	7.9-8.4	Low-----------	0.32		
	22-60	---	---	0.06-2.0	---	---	----------	----		
ChC----------	0-15	2-12	1.40-1.60	2.0-6.0	0.06-0.10	5.6-7.3	Low-----------	0.20	5	<1
Chazos	15-27	35-50	1.35-1.50	0.06-0.2	0.12-0.16	5.6-6.5	Moderate-----	0.32		
	27-65	20-40	1.35-1.55	0.06-0.2	0.11-0.17	5.6-7.3	Moderate-----	0.32		
	65-90	27-45	1.40-1.60	0.06-0.2	0.12-0.18	6.1-8.4	Moderate-----	0.32		
ChD----------	0-12	2-12	1.40-1.60	2.0-6.0	0.06-0.10	5.6-7.3	Low-----------	0.20	5	<1
Chazos	12-22	35-50	1.35-1.50	0.06-0.2	0.12-0.16	5.6-6.5	Moderate-----	0.32		
	22-42	20-40	1.35-1.55	0.06-0.2	0.11-0.17	5.6-7.3	Moderate-----	0.32		
	42-65	27-45	1.40-1.60	0.06-0.2	0.12-0.18	6.1-8.4	Moderate-----	0.32		
CoC----------	0-24	2-10	1.30-1.50	2.0-6.0	0.07-0.11	4.5-6.5	Very low-----	0.24	5	<2
Conroe	24-40	30-45	1.50-1.65	0.06-0.2	0.10-0.20	4.5-5.5	Moderate-----	0.20		
	40-74	35-50	1.55-1.75	0.06-0.2	0.10-0.16	4.5-5.5	Moderate-----	0.17		
CpC----------	0-2	2-10	1.40-1.60	2.0-6.0	0.04-0.10	4.5-6.5	Very low-----	0.15	5	<1
Conroe	2-17	35-50	1.55-1.75	0.06-0.2	0.10-0.16	4.5-5.5	Moderate-----	0.17		
	17-60	30-45	1.55-1.80	0.06-0.2	0.10-0.16	4.5-5.5	Moderate-----	0.17		
CrC----------	0-9	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.8	Low-----------	0.43	5	.5-2
Crockett	9-27	40-55	1.35-1.60	<0.06	0.08-0.14	5.6-7.3	High----------	0.32		
	27-55	20-50	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	Moderate-----	0.32		
	55-65	30-60	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	High----------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
CrC2---	0-4	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.8	Low---	0.43	5	.5-2
Crockett	4-16	40-55	1.35-1.60	<0.06	0.08-0.14	5.6-7.3	High---	0.32		
	16-48	20-50	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	Moderate---	0.32		
	48-60	30-60	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	High---	0.32		
CrD---	0-6	5-20	1.50-1.60	0.6-2.0	0.11-0.20	5.6-7.8	Low---	0.43	5	.5-2
Crockett	6-23	40-55	1.35-1.60	<0.06	0.08-0.14	5.6-7.3	High---	0.32		
	23-42	20-50	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	Moderate---	0.32		
	42-60	30-60	1.50-1.70	<0.06	0.11-0.15	6.1-8.4	High---	0.32		
CuC---	0-6	27-30	1.40-1.65	0.6-2.0	0.11-0.19	6.1-7.8	Low---	0.24	4	1-3
Cuero	6-40	20-35	1.45-1.70	0.6-2.0	0.15-0.22	6.1-8.4	Moderate---	0.28		
	40-65	20-35	1.45-1.70	0.6-2.0	0.15-0.19	7.9-8.4	Moderate---	0.32		
	65-72	---	---	0.2-20.0	---	---	---	---		
DeC---	0-28	3-12	1.30-1.50	6.0-20	0.06-0.11	4.5-6.5	Very low---	0.17	5	<1
Depcor	28-60	22-35	1.50-1.65	0.06-0.2	0.10-0.15	4.5-6.5	Low---	0.24		
DeD---	0-36	3-12	1.30-1.50	6.0-20	0.06-0.11	4.5-6.5	Very low---	0.17	5	<1
Depcor	36-65	22-35	1.50-1.65	0.06-0.2	0.10-0.15	4.5-6.5	Low---	0.24		
Du*.										
Dumps										
EmC---	0-5	4-14	1.40-1.60	6.0-20.0	0.06-0.10	4.5-6.5	Very low---	0.20	3	.5-1
Elmina	5-22	3-12	1.40-1.60	6.0-20.0	0.05-0.10	4.5-6.5	Very low---	0.20		
	22-55	35-55	1.35-1.60	<0.06	0.10-0.15	3.6-6.0	High---	0.32		
	55-72	---	---	0.01-0.6	---	---	---	---		
EmD---	0-5	4-14	1.40-1.60	6.0-20.0	0.06-0.10	4.5-6.5	Very low---	0.20	3	.5-1
Elmina	5-24	3-12	1.40-1.60	6.0-20.0	0.05-0.10	4.5-6.5	Very low---	0.20		
	24-47	35-55	1.35-1.60	<0.06	0.10-0.15	3.6-6.0	High---	0.32		
	47-60	---	---	0.01-0.6	---	---	---	---		
FaC---	0-6	10-20	1.45-1.60	0.6-2.0	0.11-0.15	4.5-5.5	Low---	0.32	2	.5-2
Falba	6-35	35-50	1.25-1.45	<0.06	0.14-0.18	4.5-5.5	High---	0.28		
	35-40	---	---	0.2-2.0	---	---	---	---		
FaC2---	0-3	10-20	1.45-1.60	0.6-2.0	0.11-0.15	4.5-5.5	Low---	0.32	2	.5-2
Falba	3-25	35-50	1.25-1.45	<0.06	0.14-0.18	4.5-5.5	High---	0.28		
	25-50	---	---	0.2-2.0	---	---	---	---		
FeC---	0-25	3-12	1.40-1.60	6.0-20	0.06-0.11	4.5-6.5	Low---	0.24	5	<1
Fetzer	25-34	25-35	1.35-1.60	0.06-0.2	0.12-0.18	4.5-6.0	Low---	0.28		
	34-75	30-50	1.35-1.60	0.06-0.2	0.12-0.18	4.5-7.8	Moderate---	0.37		
FlA---	0-6	28-35	1.40-1.65	0.2-0.6	0.12-0.19	6.1-8.4	Moderate---	0.32	4	1-4
Flatonia	6-45	40-50	1.40-1.70	0.06-0.2	0.08-0.14	6.1-8.4	High---	0.32		
	45-60	---	---	0.01-0.6	---	---	---	---		
FlB---	0-6	14-35	1.40-1.65	0.2-0.6	0.12-0.19	6.1-8.4	Moderate---	0.32	4	1-4
Flatonia	6-45	40-50	1.40-1.70	0.06-0.2	0.08-0.14	6.1-8.4	High---	0.32		
	45-55	---	---	0.01-0.6	---	---	---	---		
FrC---	0-10	45-60	1.25-1.45	<0.06	0.15-0.20	7.4-8.4	Very high---	0.32	5	1-4
Frelsburg	10-70	45-60	1.30-1.50	<0.06	0.14-0.19	7.9-8.4	Very high---	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
FrC2----------	0-6	45-60	1.25-1.45	<0.06	0.15-0.20	7.4-8.4	Very high----	0.32	5	1-4
Frelsburg	6-60	45-60	1.30-1.50	<0.06	0.14-0.19	7.9-8.4	Very high----	0.32		
GbC, GbE----------	0-7	27-40	1.20-1.40	0.2-0.6	0.15-0.20	5.6-8.4	Moderate-----	0.37	5	<1
Gibbonscreek	7-80	18-35	1.30-1.50	0.2-0.6	0.12-0.17	5.6-8.4	Moderate-----	0.37		
Gd----------	0-8	40-60	1.20-1.40	0.06-0.2	0.15-0.20	5.6-7.3	High----------	0.32	5	1-3
Gladewater	8-60	40-60	1.20-1.40	<0.06	0.15-0.18	4.5-6.5	High----------	0.32		
GmC----------	0-30	3-12	1.40-1.60	6.0-20	0.07-0.11	4.5-6.5	Very low-----	0.17	4	.5-2
Gomery	30-59	25-35	1.40-1.65	0.2-0.6	0.12-0.17	4.5-6.0	Low----------	0.24		
	59-65	---	---	0.01-0.6	---	---	----------	----		
Go----------	0-22	20-27	1.20-1.50	0.6-2.0	0.15-0.20	5.6-6.5	Low----------	0.32	5	1-3
Gowker	22-60	28-45	1.30-1.60	0.2-0.6	0.12-0.20	5.6-8.4	Moderate-----	0.37		
Gp----------	0-24	28-35	1.20-1.50	0.6-2.0	0.12-0.20	5.6-6.5	Moderate-----	0.32	5	1-3
Gowker	24-28	28-45	1.30-1.60	0.06-0.2	0.12-0.20	5.6-7.3	Moderate-----	0.37		
	28-60	28-45	1.30-1.60	0.2-0.6	0.12-0.20	5.6-8.4	Moderate-----	0.37		
GrC, GrE----------	0-7	7-15	1.30-1.55	0.6-2.0	0.11-0.15	4.5-6.5	Low----------	0.43	5	<1
Gredge	7-21	40-55	1.30-1.50	<0.06	0.13-0.18	4.5-6.5	High----------	0.37		
	21-40	25-40	1.35-1.55	0.06-0.2	0.13-0.18	5.1-7.8	Moderate-----	0.37		
	40-57	20-35	1.40-1.60	0.2-0.6	0.13-0.18	5.6-8.4	Moderate-----	0.37		
	57-68	15-35	1.30-1.60	0.2-0.6	0.07-0.18	5.6-8.4	Moderate-----	0.37		
GvC----------	0-5	40-60	1.10-1.30	<0.06	0.12-0.18	5.1-8.4	Very high----	0.32	3	1-4
Greenvine	5-30	40-60	1.20-1.40	<0.06	0.12-0.18	5.1-8.4	Very high----	0.32		
	30-60	---	---	0.01-0.6	---	---	----------	----		
GvD----------	0-12	40-60	1.10-1.30	<0.06	0.12-0.18	5.1-8.4	Very high----	0.32	3	1-4
Greenvine	12-25	40-60	1.20-1.40	<0.06	0.12-0.18	5.1-8.4	Very high----	0.32		
	25-60	---	---	0.01-0.6	---	---	----------	----		
Ha----------	0-6	8-20	1.20-1.50	2.0-6.0	0.11-0.15	5.1-7.3	Low----------	0.28	5	<1
Hatliff	6-72	8-18	1.20-1.50	2.0-6.0	0.05-0.11	5.1-7.3	Low----------	0.24		
HuC----------	0-11	5-12	1.30-1.50	6.0-20	0.06-0.11	5.6-6.5	Very low-----	0.28	5	<2
Huntsburg	11-16	35-55	1.40-1.60	0.06-0.2	0.10-0.15	4.5-5.5	Moderate-----	0.32		
	16-65	35-55	1.40-1.60	<0.06	0.10-0.18	4.5-5.5	High----------	0.32		
HuD----------	0-10	5-12	1.30-1.50	6.0-20	0.06-0.11	5.6-6.5	Very low-----	0.28	5	<2
Huntsburg	10-25	35-55	1.40-1.60	0.06-0.2	0.10-0.15	4.5-5.5	Moderate-----	0.32		
	25-65	35-55	1.40-1.60	<0.06	0.10-0.18	4.5-5.5	High----------	0.32		
Ka----------	0-15	40-60	1.30-1.50	<0.06	0.15-0.20	5.6-7.8	High----------	0.32	5	1-3
Kaman	15-60	40-60	1.40-1.65	<0.06	0.14-0.18	5.6-8.4	High----------	0.32		
KlC----------	0-15	5-15	1.30-1.60	2.0-6.0	0.10-0.14	5.6-7.8	Low----------	0.24	5	1-2
Klump	15-45	20-35	1.40-1.65	0.6-2.0	0.10-0.17	5.1-7.3	Low----------	0.32		
	45-60	10-25	1.40-1.65	2.0-6.0	0.10-0.15	5.6-8.4	Low----------	0.32		
KlD----------	0-10	5-15	1.30-1.60	2.0-6.0	0.10-0.14	5.6-7.8	Low----------	0.24	5	1-2
Klump	10-45	20-35	1.40-1.65	0.6-2.0	0.10-0.17	5.1-7.3	Low----------	0.32		
	45-65	10-25	1.40-1.65	2.0-6.0	0.10-0.15	5.6-8.4	Low----------	0.32		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
KnC	0-8	3-12	1.30-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.20	5	.5-1
Knolle	8-15	10-20	1.30-1.60	2.0-6.0	0.10-0.14	5.1-7.3	Low	0.24		
	15-55	20-40	1.35-1.65	0.6-2.0	0.12-0.17	5.1-7.3	Low	0.32		
	55-70	10-25	1.35-1.65	2.0-6.0	0.07-0.14	5.1-6.5	Low	0.32		
KnD	0-8	3-12	1.30-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.20	5	.5-1
Knolle	8-13	10-20	1.30-1.60	2.0-6.0	0.10-0.14	5.1-7.3	Low	0.24		
	13-50	20-40	1.35-1.65	0.6-2.0	0.12-0.17	5.1-7.3	Low	0.32		
	50-70	10-25	1.35-1.65	2.0-6.0	0.07-0.14	5.1-6.5	Low	0.32		
KrD*:										
Koether	0-12	5-10	1.30-1.65	6.0-20	0.03-0.08	4.5-6.0	Low	0.05	1	<1
	12-30	---	---	0.01-0.6	---	---				
Rock outcrop.										
LaC	0-65	2-8	1.50-1.65	6.0-20	0.05-0.10	5.1-6.5	Very low	0.17	5	<2
Landman	65-75	18-35	1.55-1.75	0.2-0.6	0.10-0.15	4.5-6.5	Low	0.24		
LtD	0-4	45-60	1.25-1.45	<0.06	0.15-0.18	7.4-8.4	Very high	0.32	4	.5-2
Latium	4-60	45-60	1.25-1.45	<0.06	0.15-0.18	7.4-8.4	Very high	0.32		
LtD3	0-4	45-60	1.25-1.45	<0.06	0.15-0.18	7.4-8.4	Very high	0.32	4	.5-2
Latium	4-70	45-60	1.25-1.45	<0.06	0.15-0.18	7.4-8.4	Very high	0.32		
LuA	0-7	5-18	1.35-1.65	0.6-2.0	0.11-0.18	5.1-6.5	Low	0.43	5	.5-2
Lufkin	7-45	35-45	1.40-1.60	<0.06	0.12-0.18	4.5-7.8	Very high	0.32		
	45-60	20-40	1.40-1.68	<0.06	0.10-0.14	6.1-8.4	High	0.37		
LuB	0-8	5-18	1.35-1.65	0.6-2.0	0.11-0.18	5.1-6.5	Low	0.43	5	.5-2
Lufkin	8-45	35-45	1.40-1.60	<0.06	0.12-0.18	4.5-7.8	Very high	0.32		
	45-60	20-40	1.40-1.68	<0.06	0.10-0.14	6.1-8.4	High	0.37		
LxB*:										
Lufkin	0-10	5-18	1.35-1.65	0.6-2.0	0.11-0.18	5.1-6.5	Low	0.43	5	.5-2
	10-45	35-45	1.40-1.60	<0.06	0.12-0.18	4.5-7.8	Very high	0.32		
	45-60	20-40	1.40-1.68	<0.06	0.10-0.14	6.1-8.4	High	0.37		
Rader	0-25	4-10	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.5	Low	0.32	5	.5-2
	25-35	18-30	1.40-1.60	0.2-0.6	0.12-0.18	4.5-5.5	Moderate	0.32		
	35-60	35-50	1.45-1.70	<0.06	0.12-0.18	4.5-6.5	High	0.32		
MaA	0-9	10-20	1.50-1.65	0.6-2.0	0.11-0.15	5.6-7.3	Low	0.43	5	1-2
Mabank	9-65	35-50	1.45-1.65	<0.6	0.12-0.18	5.6-8.4	High	0.32		
	65-70	35-50	1.45-1.65	<0.6	0.12-0.18	5.6-8.4	High	0.32		
MaB	0-8	10-20	1.50-1.65	0.6-2.0	0.11-0.15	5.6-7.3	Low	0.43	5	1-2
Mabank	8-65	35-50	1.45-1.65	<0.6	0.12-0.18	5.6-8.4	High	0.32		
Na	0-6	28-35	1.10-1.30	0.6-2.0	0.15-0.20	5.1-7.8	Moderate	0.28	5	1-3
Nahatche	6-60	18-35	1.30-1.60	0.6-2.0	0.10-0.15	5.1-7.8	Moderate	0.28		
NdC	0-6	2-10	1.40-1.60	6.0-20	0.07-0.11	5.1-7.3	Low	0.17	5	<1
Navasan	6-65	2-10	1.40-1.60	6.0-20	0.07-0.11	5.1-7.3	Low	0.17		
	65-75	5-15	1.40-1.60	0.2-0.6	0.10-0.15	4.5-7.3	Low	0.24		
	75-95	12-35	1.40-1.65	0.2-0.6	0.13-0.18	5.1-6.0	Moderate	0.24		
NoA	0-18	10-27	1.30-1.50	0.6-2.0	0.17-0.21	7.4-8.4	Low	0.43	5	.5-2
Norwood	18-45	18-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	Low	0.43		
	45-80	10-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	Low	0.43		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
NrA----------	0-16	27-40	1.30-1.50	0.6-2.0	0.18-0.22	7.4-8.4	Moderate-----	0.32	5	.5-2
Norwood	16-52	18-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	Low----------	0.43		
	52-63	10-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	Low----------	0.43		
OkA----------	0-16	10-18	1.30-1.60	2.0-6.0	0.13-0.20	7.4-8.4	Low----------	0.32	5	.5-1
Oklared	16-73	10-44	1.45-1.70	2.0-6.0	0.12-0.16	7.4-8.4	Low----------	0.32		
On*:										
Oklared---------	0-4	10-18	1.30-1.60	2.0-6.0	0.13-0.20	7.4-8.4	Low----------	0.32	5	.5-1
	4-60	10-18	1.45-1.70	2.0-6.0	0.12-0.16	7.4-8.4	Low----------	0.32		
Norwood---------	0-8	10-27	1.30-1.50	0.6-2.0	0.17-0.21	7.4-8.4	Low----------	0.43	5	.5-2
	8-35	18-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	Low----------	0.43		
	35-60	10-35	1.40-1.60	0.6-2.0	0.15-0.22	7.9-8.4	Low----------	0.43		
PaD----------	0-6	2-10	1.20-1.50	6.0-20	0.07-0.11	5.6-7.3	Very low-----	0.17	5	<1
Padina	6-65	2-10	1.20-1.50	6.0-20	0.05-0.08	5.6-7.3	Very low-----	0.17		
	65-75	18-30	1.40-1.60	0.6-2.0	0.14-0.18	5.1-6.5	Low----------	0.24		
Pt*.										
Pits										
RaA----------	0-12	4-10	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.5	Low----------	0.32	5	.5-2
Rader	12-21	18-30	1.40-1.60	0.2-0.6	0.12-0.18	4.5-5.5	Moderate-----	0.32		
	21-72	35-50	1.45-1.70	<0.06	0.12-0.18	4.5-6.5	High---------	0.32		
RaB----------	0-16	4-10	1.40-1.60	2.0-6.0	0.10-0.15	4.5-6.5	Low----------	0.32	5	.5-2
Rader	16-23	18-30	1.40-1.60	0.2-0.6	0.12-0.18	4.5-5.5	Moderate-----	0.32		
	23-66	35-50	1.45-1.70	<0.06	0.12-0.18	4.5-6.5	High---------	0.32		
ReF*:										
Renish----------	0-14	15-35	1.30-1.50	0.6-2.0	0.15-0.20	7.4-8.4	Low----------	0.32	1	1-3
	14-15	---	---	---	---	---	----------	----		
Rock outcrop.										
RoC----------	0-5	2-10	1.40-1.60	6.0-20	0.04-0.10	5.1-6.5	Low----------	0.24	5	<1
Robco	5-25	2-10	1.40-1.60	6.0-20	0.04-0.10	5.1-6.5	Low----------	0.24		
	25-50	27-35	1.50-1.65	0.2-0.6	0.12-0.18	4.5-6.0	Moderate-----	0.32		
	50-75	20-35	1.55-1.70	0.06-0.2	0.12-0.18	4.5-6.0	High---------	0.37		
RoD----------	0-6	2-10	1.40-1.60	6.0-20	0.04-0.10	5.1-6.5	Low----------	0.24	5	<1
Robco	6-21	2-10	1.40-1.60	6.0-20	0.04-0.10	5.1-6.5	Low----------	0.24		
	21-41	27-35	1.50-1.65	0.2-0.6	0.12-0.18	4.5-6.0	Moderate-----	0.32		
	41-74	25-45	1.55-1.70	0.06-0.2	0.10-0.18	4.5-7.3	Moderate-----	0.37		
SaC----------	0-3	5-15	1.40-1.60	0.6-2.0	0.11-0.15	4.5-6.5	Low----------	0.43	1	<1
Shalba	3-14	40-60	1.40-1.60	<0.06	0.14-0.18	4.5-6.0	High---------	0.32		
	14-40	---	---	0.01-0.6	---	---	----------	----		
SbC*:										
Shalba----------	0-3	5-15	1.40-1.60	0.6-2.0	0.11-0.15	4.5-6.5	Low----------	0.43	1	<1
	3-18	40-60	1.40-1.60	<0.06	0.14-0.18	4.5-6.0	High---------	0.32		
	18-40	---	---	0.01-0.6	---	---	----------	----		
Rock outcrop.										
ShC----------	0-12	5-12	1.35-1.55	2.0-6.0	0.08-0.11	5.1-6.5	Low----------	0.32	2	<1
Shiro	12-24	35-45	1.30-1.50	0.06-0.2	0.14-0.16	4.5-5.5	High---------	0.32		
	24-31	35-45	1.30-1.50	0.06-0.2	0.14-0.16	4.5-7.3	High---------	0.32		
	31-40	---	---	0.01-0.6	---	---	----------	----		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
ShD	0-10	5-12	1.35-1.55	2.0-6.0	0.08-0.11	5.1-6.5	Low	0.32	2	<1
Shiro	10-35	35-45	1.30-1.50	0.06-0.2	0.14-0.16	4.5-5.5	High	0.32		
	35-45	---	---	0.01-0.6	---	---		----		
SlC	0-15	5-15	1.20-1.45	6.0-20	0.07-0.11	5.1-6.5	Low	0.20	5	<2
Silawa	15-40	18-35	1.35-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.32		
	40-48	12-30	1.40-1.65	2.0-6.0	0.08-0.15	4.5-6.0	Low	0.32		
	48-65	2-15	1.40-1.70	6.0-20	0.05-0.11	4.5-6.5	Low	0.20		
SlD	0-12	5-15	1.20-1.45	6.0-20	0.07-0.11	5.1-6.5	Low	0.20	5	<2
Silawa	12-55	18-35	1.35-1.60	0.6-2.0	0.12-0.17	4.5-6.0	Low	0.32		
	55-80	2-15	1.40-1.70	6.0-20	0.05-0.11	4.5-6.5	Low	0.20		
SmC	0-4	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17	5	<1
Silstid	4-35	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17		
	35-54	18-32	1.50-1.70	0.6-2.0	0.10-0.16	5.1-6.5	Low	0.24		
	54-80	18-32	1.50-1.70	0.6-2.0	0.10-0.16	5.1-6.5	Low	0.24		
SmD	0-10	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17	5	<1
Silstid	10-32	3-12	1.40-1.60	6.0-20	0.05-0.10	5.6-7.3	Low	0.17		
	32-52	18-32	1.50-1.70	0.6-2.0	0.10-0.16	5.1-6.5	Low	0.24		
	52-60	18-32	1.50-1.70	0.6-2.0	0.10-0.16	5.1-6.5	Low	0.24		
SnA	0-6	5-20	1.40-1.70	0.6-2.0	0.11-0.18	5.1-6.5	Low	0.43	2	<1
Singleton	6-21	35-50	1.40-1.60	<0.06	0.12-0.18	4.5-6.0	High	0.32		
	21-35	35-45	1.35-1.50	<0.06	0.14-0.18	4.5-7.8	High	0.32		
	35-60	---	---	0.01-0.6	---	---		----		
SnC	0-9	5-20	1.40-1.70	0.6-2.0	0.11-0.18	5.1-6.5	Low	0.43	2	<1
Singleton	9-20	35-50	1.40-1.60	<0.06	0.12-0.18	4.5-6.0	High	0.32		
	20-32	35-45	1.35-1.50	<0.06	0.14-0.18	4.5-7.8	High	0.32		
	32-38	25-40	1.20-1.50	0.06-0.2	0.12-0.18	4.5-8.4	Moderate	0.32		
	38-60	---	---	0.01-0.6	---	---		----		
SpB	0-12	3-15	1.60-1.75	0.6-2.0	0.10-0.18	5.1-6.0	Low	0.43	5	0-2
Splendora	12-30	18-24	1.65-1.75	0.6-2.0	0.10-0.17	4.5-5.5	Low	0.37		
	30-40	18-30	1.65-1.75	0.2-0.6	0.10-0.14	4.5-5.5	Low	0.32		
	40-60	18-30	1.70-1.85	0.06-0.2	0.10-0.12	4.5-5.5	Low	0.32		
TaC	0-14	8-20	1.50-1.60	0.6-2.0	0.11-0.15	5.1-6.5	Low	0.43	5	<1
Tabor	14-45	40-55	1.35-1.55	<0.06	0.09-0.12	4.5-7.3	High	0.32		
	45-72	25-45	1.45-1.65	<0.06	0.14-0.18	5.1-8.4	High	0.32		
Tn	0-6	40-60	1.40-1.50	0.06-0.2	0.15-0.20	7.4-8.4	High	0.32	5	1-4
Tinn	6-96	40-60	1.40-1.50	<0.06	0.15-0.20	7.4-8.4	High	0.32		
ToD	0-4	3-10	1.45-1.65	6.0-20	0.02-0.08	5.6-7.3	Low	0.17	5	<1
Tonkavar	4-72	3-12	1.45-1.65	6.0-20	0.05-0.10	5.1-6.5	Low	0.17		
	72-78	18-35	1.55-1.70	0.6-2.0	0.10-0.17	4.5-6.0	Moderate	0.24		
	78-90	---	---	0.01-0.6	---	---		----		
Wa	0-6	8-15	1.50-1.65	0.6-2.0	0.15-0.20	4.5-6.0	Low	0.43	5	.5-2
Waller	6-26	8-15	1.55-1.70	0.06-0.2	0.15-0.20	4.5-6.0	Low	0.43		
	26-65	18-30	1.50-1.70	0.6-2.0	0.15-0.20	5.6-7.3	Low	0.37		
WlA	0-9	27-35	1.35-1.50	0.2-0.6	0.10-0.17	5.6-7.3	Moderate	0.43	5	.5-2
Wilson	9-25	35-50	1.50-1.60	<0.06	0.12-0.15	5.6-8.4	High	0.37		
	25-60	35-60	1.50-1.60	<0.06	0.12-0.15	6.6-8.4	High	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	g/cc	In/hr	In/in	pH				Pct
WlB----------	0-8	27-35	1.35-1.50	0.2-0.6	0.10-0.17	5.6-7.3	Moderate-----	0.43	5	.5-2
Wilson	8-27	35-50	1.50-1.60	<0.06	0.12-0.15	5.6-8.4	High----------	0.37		
	27-61	35-60	1.50-1.60	<0.06	0.12-0.15	6.6-8.4	High----------	0.37		
ZaC----------	0-6	7-15	1.15-1.30	0.6-2.0	0.11-0.15	5.1-6.5	Low-----------	0.43	3	<1
Zack	6-22	40-60	1.30-1.45	<0.06	0.12-0.18	5.6-7.3	High----------	0.37		
	22-32	35-55	1.30-1.50	<0.06	0.12-0.20	5.6-8.4	High----------	0.37		
	32-48	15-35	1.35-1.60	0.06-0.2	0.07-0.18	7.4-8.4	Low-----------	0.37		
ZaC2---------	0-4	7-15	1.15-1.30	0.6-2.0	0.11-0.15	5.1-6.5	Low-----------	0.43	3	<1
Zack	4-29	40-60	1.30-1.45	<0.06	0.12-0.18	5.6-7.3	High----------	0.37		
	29-60	15-35	1.35-1.60	0.06-0.2	0.07-0.18	7.4-8.4	Low-----------	0.37		
ZuA----------	0-9	4-12	1.50-1.70	0.6-2.0	0.11-0.15	5.6-7.3	Low-----------	0.43	4	<2
Zulch	9-41	35-50	1.40-1.60	<0.06	0.13-0.18	5.6-7.8	High----------	0.32		
	41-60	35-50	1.40-1.70	<0.06	0.10-0.18	6.6-8.4	Moderate-----	0.37		
ZuC----------	0-6	4-12	1.50-1.70	0.6-2.0	0.11-0.15	5.6-7.3	Low-----------	0.43	4	<2
Zulch	6-35	35-50	1.40-1.60	<0.06	0.13-0.18	5.6-7.8	High----------	0.32		
	35-60	35-50	1.40-1.70	<0.06	0.10-0.18	6.6-8.4	Moderate-----	0.37		
ZuC2---------	0-4	4-12	1.50-1.70	0.6-2.0	0.11-0.15	5.6-7.3	Low-----------	0.43	4	<2
Zulch	4-36	35-50	1.40-1.60	<0.06	0.13-0.18	5.6-7.8	High----------	0.32		
	36-60	35-50	1.40-1.70	<0.06	0.10-0.18	6.6-8.4	Moderate-----	0.37		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
AnC, AnC2, AnD---- Annona	D	None	---	---	2.0-4.0	Apparent	Dec-Feb	>60	---	High	Moderate.
Ap*---------- Arents	B	None	---	---	>6.0	---	---	>60	---	High	Moderate.
ArA, ArC---------- Arol	D	None	---	---	1.5-2.5	Perched	Nov-Feb	20-40	Soft	High	Moderate.
AxC, AxC2, AxD---- Axtell	D	None	---	---	>6.0	---	---	>60	---	High	Moderate.
BcA, BcB---------- Bleiblerville	D	None	---	---	>6.0	---	---	>60	---	High	Low.
BfB---------- Boonville	D	None	---	---	0.5-1.0	Perched	Dec-Feb	>60	---	High	Low.
BgD---------- Boy	B	None	---	---	3.5-5.5	Perched	Nov-Feb	>60	---	Moderate	Moderate.
BoA, BoB---------- Brazoria	D	Rare	---	---	>6.0	---	---	>60	---	High	Low.
Bp---------- Brazoria	D	Rare	---	---	+1-3.0	Perched	Dec-Feb	>60	---	High	Low.
BrD---------- Brenham	C	None	---	---	>6.0	---	---	>60	---	High	Low.
BsA---------- Burleson	D	None	---	---	>6.0	---	---	>60	---	High	Low.
BuC, BuE---------- Burlewash	D	None	---	---	>6.0	---	---	20-40	Soft	High	High.
BxE*:											
Burlewash--------	D	None	---	---	>6.0	---	---	20-40	Soft	High	High.
Gullied land-----	D	None	---	---	>6.0	---	---	>60	---	Low	High.
CaC, CaD---------- Carbengle	B	None	---	---	>6.0	---	---	20-40	Soft	Moderate	Low.
ChC, ChD---------- Chazos	C	None	---	---	>6.0	---	---	>60	---	High	High.
CoC, CpC---------- Conroe	B	None	---	---	2.0-3.5	Perched	Nov-May	>60	---	High	High.
CrC, CrC2, CrD---- Crockett	D	None	---	---	>6.0	---	---	>60	---	High	Low.
CuC---------- Cuero	B	None	---	---	>6.0	---	---	>60	---	High	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
DeC, DeD---------- Depcor	B	None--------	---	---	2.0-3.5	Perched	Oct-May	>60	---	High-----	Moderate.
Du*. Dumps											
EmC, EmD---------- Elmina	C	None--------	---	---	1.5-3.5	Perched	Oct-Jun	40-60	Soft	High-----	High.
FaC, FaC2--------- Falba	D	None--------	---	---	0.5-1.5	Perched	Oct-May	20-40	Soft	High-----	Moderate.
FeC--------------- Fetzer	C	None--------	---	---	1.5-3.5	Perched	Oct-May	>60	---	High-----	High.
FlA, FlB---------- Flatonia	D	None--------	---	---	>6.0	---	---	40-60	Soft	High-----	Low.
FrC, FrC2--------- Frelsburg	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
GbC, GbE---------- Gibbonscreek	C	None--------	---	---	>6.0	---	---	>60	---	High-----	Moderate.
Gd---------------- Gladewater	D	Frequent----	Long or very long.	Nov-May	1.0-3.5	Apparent	Nov-May	>60	---	High-----	Moderate.
GmC--------------- Gomery	B	None--------	---	---	3.0-4.5	Perched	Oct-Jun	40-60	Soft	High-----	High.
Go, Gp------------ Gowker	C	Frequent----	Brief-----	Oct-May	0.5-2.5	Perched	Oct-May	>60	---	High-----	Moderate.
GrC, GrE---------- Gredge	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
GvC, GvD---------- Greenvine	D	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Low.
Ha---------------- Hatliff	C	Frequent----	Brief-----	Nov-May	0-2.0	Apparent	Nov-Mar	>60	---	Low------	Moderate.
HuC, HuD---------- Huntsburg	D	None--------	---	---	0.5-2.0	Perched	Oct-May	>60	---	High-----	High.
Ka---------------- Kaman	D	Frequent----	Long------	Nov-Jun	1.5-3.0	Apparent	Sep-Jul	>60	---	High-----	Moderate.
KlC, KlD---------- Klump	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Moderate.
KnC, KnD---------- Knolle	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
KrD*: Koether---------	D	None--------	---	---	>6.0	---	---	7-20	Hard	Low------	High.
Rock outcrop.											

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
LaC---------- Landman	B	None	---	---	4.0-6.0	Perched	Oct-May	>60	---	Moderate	Moderate.
LtD, LtD3---------- Latium	D	None	---	---	>6.0	---	---	>60	---	High	Low.
LuA, LuB---------- Lufkin	D	None	---	---	0.5-1.0	Perched	Oct-Mar	>60	---	High	Moderate.
LxB*:											
Lufkin----------	D	None	---	---	0.5-1.0	Perched	Oct-Mar	>60	---	High	Moderate.
Rader----------	D	None	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High	Moderate.
MaA, MaB---------- Mabank	D	None	---	---	0.6-1.0	Perched	Dec-Mar	>60	---	High	Moderate.
Na---------- Nahatche	C	Frequent	Long	Nov-May	0.5-1.5	Apparent	Nov-May	>60	---	High	Moderate.
NdC---------- Navasan	A	Rare	---	---	4.0-6.0	Perched	Jan-Dec	>60	---	High	High.
NoA, NrA---------- Norwood	B	Rare	---	---	>6.0	---	---	>60	---	High	Low.
OkA---------- Oklared	B	Rare	---	---	3.5-5.0	Apparent	Mar-May	>60	---	Moderate	Low.
On*:											
Oklared----------	B	Frequent	Very brief	Oct-May	3.5-5.0	Apparent	Mar-May	>60	---	Moderate	Low.
Norwood----------	B	Frequent	Very brief	Oct-May	>6.0	---	---	>60	---	High	Low.
PaD---------- Padina	B	None	---	---	>6.0	---	---	>60	---	High	Moderate.
Pt*. Pits											
RaA, RaB---------- Rader	D	None	---	---	2.0-5.0	Perched	Dec-Mar	>60	---	High	Moderate.
ReF*:											
Renish----------	C	None	---	---	>6.0	---	---	4-20	Hard	Moderate	Low.
Rock outcrop.											
RoC, RoD---------- Robco	C	None	---	---	1.5-3.5	Perched	Jan-Apr	>60	---	High	High.
SaC---------- Shalba	D	None	---	---	1.0-1.5	Perched	Nov-Feb	7-20	Soft	High	Moderate.
SbC*:											
Shalba----------	D	None	---	---	1.0-1.5	Perched	Nov-Feb	7-20	Soft	High	Moderate.
Rock outcrop.											
ShC, ShD---------- Shiro	C	None	---	---	>6.0	---	---	20-40	Soft	High	Moderate.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
SlC, SlD---------- Silawa	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
SmC, SmD---------- Silstid	A	None--------	---	---	>6.0	---	---	>60	---	Moderate	Moderate.
SnA, SnC---------- Singleton	D	None--------	---	---	>6.0	---	---	20-40	Soft	High-----	Moderate.
SpB---------- Splendora	C	None--------	---	---	0.5-2.0	Perched	Dec-May	>60	---	High-----	High.
TaC---------- Tabor	D	None--------	---	---	>6.0	---	---	>60	---	High-----	High.
Tn---------- Tinn	D	Frequent----	Brief-----	Feb-May	1.5-3.0	Apparent	Nov-Feb	>60	---	High-----	Low.
ToD---------- Tonkavar	A	None--------	---	---	4.0-6.0	Perched	Nov-May	>60	---	Moderate	High.
Wa---------- Waller	B/D	None--------	---	---	0-2.5	Apparent	Nov-Jun	>60	---	High-----	Moderate.
WlA, WlB---------- Wilson	D	None--------	---	---	0.5-1.5	Perched	Nov-Mar	>60	---	High-----	High.
ZaC, ZaC2--------- Zack	D	None--------	---	---	>6.0	---	---	>60	---	High-----	Low.
ZuA, ZuC, ZuC2---- Zulch	D	None--------	---	---	0.5-1.0	Perched	Dec-Feb	>60	---	High-----	Moderate.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 18.--PHYSICAL ANALYSIS OF SELECTED SOILS

(Data determined by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas. Dashes indicate that data were not available)

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	COLE	Bulk density: 1/3 bar	Bulk density: Air dry	1/3-bar water content
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/cm	g/cc	g/cc	Pct (wt)
Elmina loamy fine sand:[1,2] (S83TX-185-08)	0-4	Ap	1.0	0.9	12.7	52.8	18.0	85.4	13.1	1.6	.005	1.37	1.39	26.8
	4-9	A	0.1	0.6	13.7	57.7	19.0	91.1	7.1	1.8	.018	1.47	1.55	24.9
	9-19	E1	0.1	0.5	12.3	52.4	17.9	83.2	14.3	2.5	.026	1.50	1.62	24.8
	19-26	E2	0.0	0.5	12.1	51.7	18.7	83.0	14.6	2.4	.006	1.57	1.60	21.4
	26-30	E3	0.0	0.6	11.9	50.2	17.5	80.2	16.5	3.3	.010	1.58	1.63	20.1
	30-33	B/E	0.1	0.6	10.3	35.1	11.7	57.8	11.9	30.3	.051	1.49	1.73	24.8
	33-41	Btg1	0.1	0.2	7.6	30.0	11.7	49.6	6.5	43.9	.094	1.39	1.82	32.6
	41-47	Btgz	0.1	0.1	6.6	39.7	12.5	59.0	6.3	34.7	.070	1.51	1.85	27.9
	47-57	Btg2	0.0	0.1	9.6	51.2	8.9	69.8	4.4	25.8	---	---	---	---
	57-66	Btg3	0.0	0.1	14.6	61.0	9.8	85.5	5.5	9.0	---	---	---	---
	66-80	Btg4	0.0	0.2	21.4	41.9	4.4	67.9	6.5	25.6	---	---	---	---
Falba fine sandy loam:[3,4] (S83TX-185-01)	0-6	Ap	0.6	4.8	19.7	38.2	14.0	77.3	16.5	6.2	.027	1.54	1.67	15.9
	6-14	Btg1	0.4	2.3	8.5	15.3	6.7	33.2	14.9	51.9	.153	1.26	1.93	36.1
	14-24	Btg2	0.5	3.2	9.1	16.2	6.9	35.9	16.0	48.1	.145	1.34	2.01	33.3
	24-30	Btg/C	1.1	2.4	6.1	27.6	8.6	45.8	17.2	37.0	.016	1.23	1.29	30.5
	30-37	Cr1	0.5	1.2	2.3	25.8	8.9	38.7	18.5	42.8	.033	1.19	1.31	30.1
	37-47	Cr2	0.6	0.7	3.0	36.9	5.3	46.5	13.8	39.7	.020	1.45	1.54	19.8
Gomery loamy fine sand:[5] (S83TX-185-04)	0-6	A	2.0	17.0	34.9	23.0	5.7	82.6	14.0	3.4	.010	1.61	1.66	10.7
	6-14	E1	3.1	18.3	32.5	21.2	5.1	80.2	15.7	4.1	.008	1.61	1.65	12.6
	14-18	E2	2.8	18.2	30.6	22.0	5.5	79.1	16.6	4.4	.011	1.73	1.79	8.0
	18-24	E3	3.5	18.0	29.4	21.1	5.5	77.5	16.3	6.2	.016	1.68	1.76	10.6
	24-30	Bt	4.9	18.0	24.9	15.6	3.5	66.9	11.1	22.0	.027	1.56	1.69	15.0
	30-43	Btg1	5.9	21.0	24.8	15.2	3.1	70.0	7.3	22.7	.016	1.60	1.68	13.5
	43-60	Btg2	3.6	16.0	22.9	25.1	2.1	69.7	3.0	27.3	.026	1.62	1.75	15.6
	60-62	Cr	---	---	---	---	---	---	---	---	---	---	---	---
Shiro loamy fine sand:[6,7] (S83TX-185-03)	0-7	A	1.4	4.1	41.1	25.5	13.5	85.6	10.4	4.0	.030	1.41	1.54	19.5
	7-12	E	0.4	3.4	40.1	26.0	14.9	84.8	8.8	6.4	.015	1.50	1.57	16.7
	12-19	Bt	0.2	2.2	27.8	14.4	5.4	50.0	4.3	45.7	.052	1.34	1.56	27.2
	19-30	Btg1	0.1	4.9	40.6	10.4	1.0	57.0	1.9	41.1	.044	1.38	1.57	26.7
	30-37	Btg2	2.0	3.5	15.5	6.4	5.1	32.5	7.9	59.6	.094	1.04	1.36	46.0
	37-44	Cr	---	---	---	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 18.--PHYSICAL ANALYSIS OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	COLE	Bulk density: 1/3 bar	Bulk density: Air dry	1/3-bar water content
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	Cm/cm	g/cc	g/cc	Pct (wt)
Tonkavar sand:[8]														
(S83TX-185-02)	0-5	A	1.4	4.9	40.7	38.0	3.4	88.4	8.2	3.4	---	---	---	---
	5-20	E1	0.5	4.9	41.0	37.6	3.7	87.7	8.3	4.0	---	---	---	---
	20-38	E2	0.4	4.5	39.7	38.7	3.9	87.2	8.9	4.0	.012	1.59	1.65	11.9
	38-53	E3	0.6	3.9	36.2	41.0	4.2	85.9	9.9	4.3	.010	1.58	1.63	10.4
	53-62	Bt1	0.2	1.9	33.1	32.6	1.5	69.3	5.0	25.7	.024	1.64	1.76	13.9
	62-69	Bt2	0.2	1.2	28.3	41.8	1.7	73.2	2.6	24.2	029	1.46	1.59	22.2
	69-77	Cr1	1.2	16.9	46.6	18.5	2.5	85.7	1.3	13.0	.002	1.62	1.63	22.3
	77-85	Cr2	1.4	12.8	44.9	18.9	1.8	79.8	2.2	18.0	.009	1.52	1.56	15.0

[1] This pedon is a taxadjunct to the Elmina series because it does not have the cemented layer at a depth of 40 to 60 inches that is defined for the series.

[2] From Roans Prairie, 0.5 mile east on Texas Highway 30, about 0.6 mile north on a county road to a ranch entrance, and 250 feet north of a house in a pasture of coastal bermudagrass.

[3] This pedon is outside the range in characteristics of the Falba series because the pH is too low.

[4] From Roans Prairie, 1.9 miles west on Texas Highway 30, about 0.1 mile north and east on a county road, and 150 north of the road in a pasture.

[5] From Roans Prairie, 1.9 miles north on Texas Highway 90, about 0.3 mile west and 0.1 mile north on a county road, and 100 feet east of the road in an area of woodland.

[6] This pedon is a taxadjunct to the Shiro series because the base saturation is lower than is defined for the series.

[7] From Roans Prairie, 2.8 miles west on Texas Highway 30, about 0.6 mile south on a private road, and 50 feet west of the road in an area of woodland.

[8] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

TABLE 19.--CHEMICAL ANAYLSES OF SELECTED SOILS

(Data determined by the Soil Characterization Laboratory, Texas Agricultural Experiment Station, College Station, Texas. CEC means cation-exchange capacity; ESP, exchangeable sodium percentage; and SAR, sodium adsorption ratio. Dashes indicate that data were not available)

Soil name and sample number	Depth	Horizon	Extractable bases					CEC	Base	Organic	pH	ESP	SAR	Electrical
			Ca	Mg	Na	K	Sum	Sum of cations	saturation (sum)	carbon	H_2O (1:1)			conductivity
	In		----Milliequivalents/100 grams of soil-----						Pct	Pct		Pct	Pct	mmhos/cm
Elmina loamy fine sand:[1,2] (S83TX-185-08)	0-4	Ap	1.0	0.3	0.0	0.2	1.5	3.0	50	0.70	5.1	0	1	0.3
	4-9	A	0.6	0.2	0.0	0.2	1.0	1.9	56	0.26	5.0	0	1	0.1
	9-19	E1	0.7	0.2	0.0	0.2	1.1	1.4	79	0.13	5.4	0	0	0.1
	19-26	E2	0.6	0.1	0.0	0.1	0.8	1.0	80	0.07	5.8	---	6	1.0
	26-30	E3	0.6	0.1	0.0	0.1	0.8	1.0	80	0.08	5.6	---	15	1.0
	30-33	B/E	3.2	1.0	0.5	0.2	4.9	12.7	45	0.24	4.7	4	6	0.3
	33-41	Btg1	5.0	4.0	1.2	0.4	10.6	23.8	44	0.20	4.3	4	8	0.3
	41-47	Btgz	4.2	3.4	1.1	0.3	9.0	21.0	43	0.14	4.2	5	9	0.3
	47-57	Btg2	2.8	2.6	0.9	0.2	6.5	15.5	42	0.13	4.4	5	9	0.3
	57-66	Btg3	0.7	0.6	0.2	0.1	1.6	4.7	34	0.12	5.0	3	7	0.2
	66-80	Btg4	5.5	1.8	1.0	0.2	8.5	13.6	63	0.19	4.7	7	6	0.2
Falba fine sandy loam:[3,4] (S83TX-185-01)	0-6	Ap	0.8	0.4	0.0	0.1	1.3	3.4	38	0.50	4.1	0	1	0.8
	6-14	Btg1	9.5	5.7	1.6	0.3	17.1	30.3	56	0.52	4.3	5	7	0.3
	14-24	Btg2	8.9	5.5	1.8	0.3	16.4	27.5	60	0.51	4.0	6	5	0.4
	24-30	Btg2C	10.1	6.1	2.9	0.2	19.3	29.3	66	0.40	4.1	9	7	1.2
	30-37	Cr1	12.6	7.4	3.9	0.3	24.2	33.1	73	0.22	4.0	9	8	2.2
	37-47	Cr2	10.8	6.6	3.4	0.2	21.0	27.2	77	0.13	4.1	9	8	2.9
Gomery loamy fine sand:[5] (S83TX-185-04)	0-6	A	0.5	0.0	0.0	0.1	0.6	2.7	22	0.60	5.0	0	---	---
	6-14	E1	0.0	0.0	0.0	0.0	0.0	1.9	---	0.22	5.2	0	---	---
	14-18	E2	0.0	0.0	0.0	0.0	0.0	1.5	---	0.11	5.3	0	---	---
	18-24	E3	1.4	0.3	0.0	0.1	1.8	1.8	100	0.10	5.3	0	---	---
	24-30	Bt	1.7	0.8	0.1	0.1	2.7	6.2	44	0.24	4.4	2	---	---
	30-43	Btg1	1.4	1.0	0.1	0.1	2.6	6.9	38	0.18	4.3	1	---	---
	43-60	Btg2	1.2	1.7	0.1	0.1	3.1	9.0	35	0.13	4.1	1	---	---
	60-62	Cr	---	---	---	---	---	---	---	---	---	---	---	---
Shiro loamy fine sand:[6,7] (S83TX-185-03)	0-7	A	1.4	0.2	0.1	0.1	1.8	6.5	28	1.52	4.6	2	---	---
	7-12	E	0.7	0.2	0.0	0.0	0.9	2.7	33	0.33	5.2	0	---	---
	12-19	Bt	1.7	1.7	0.1	0.2	3.7	16.0	24	0.63	4.4	1	---	---
	19-30	Btg1	0.3	1.1	0.2	0.2	1.8	14.9	12	0.36	4.1	1	---	---
	30-37	Btg2	0.6	2.9	0.6	0.3	4.4	27.1	16	0.31	3.8	2	---	---
	37-44	Cr	---	---	---	---	---	---	---	---	---	---	---	---

See footnotes at end of table.

TABLE 19.---CHEMICAL ANAYLSES OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Extractable bases					CEC	Base	Organic	pH	ESP	SAR	Electrical
			Ca	Mg	Na	K	Sum	Sum of cations	saturation (sum)	carbon	H_2O (1:1)			conductivity
	In		----Milliequivalents/100 grams of soil-----						Pct	Pct		Pct	Pct	mmhos/cm
Tonkavar sand:[8] (S83TX-185-02)	0-5	A	1.6	0.4	0.0	0.0	2.0	5.3	38	1.34	5.5	0	---	---
	5-20	E1	0.6	0.0	0.0	0.0	0.6	1.2	50	0.12	6.2	0	---	---
	20-39	E2	0.8	0.0	0.0	0.0	0.8	1.1	73	0.08	6.8	0	---	---
	39-55	E3	0.3	0.2	0.0	0.0	0.5	1.0	50	0.07	6.5	0	---	---
	55-63	Bt1	4.2	0.8	0.0	0.2	5.2	7.1	73	0.16	6.8	0	---	---
	63-70	Bt2	5.4	1.2	0.1	0.2	6.9	7.8	88	0.12	6.6	1	---	---
	70-78	Cr1	1.1	0.6	0.1	0.1	1.9	3.9	49	0.05	4.6	3	---	---
	78-86	Cr2	1.1	0.6	0.1	0.1	1.9	5.2	37	0.09	4.0	2	---	---

[1] This pedon is a taxadjunct to the Elmina series because it does not have the cemented layer at a depth of 40 to 60 inches that is defined for the series.

[2] From Roans Prairie, 0.5 mile east on Texas Highway 30, about 0.6 mile north on a county road to a ranch entrance, and 250 feet north of a house in a pasture of coastal bermudagrass.

[3] This pedon is outside the range in characteristics of the Falba series because the pH is too low.

[4] From Roans Prairie, 1.9 miles west on Texas Highway 30, about 0.1 mile north and east on a county road, and 150 feet north of the road in a pasture.

[5] From Roans Prairie, 1.9 miles north on Texas Highway 90, about 0.3 mile west and 0.1 mile north on a county road, and 100 feet east of the road in an area of woodland.

[6] This pedon is a taxadjunct to the Shiro series because the base saturation is lower than is defined for the series.

[7] From Roans Prairie, 2.8 miles west on Texas Highway 30, about 0.6 mile south on a private road, and 50 feet west of the road in an area of woodland.

[8] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

TABLE 20.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve-- 5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 60	No. 200	Percentage smaller than-- .05 mm	.005 mm	.002 mm	.001 mm	Particle density	Liquid limit[1]	Plasticity index[1]	Shrinkage: Limit	Ratio	Linear
	AASHTO	Unified												g/cc	Pct		Pct		Pct
Brenham clay loam:[2] (S82TX-182-001)																			
A------- 0 to 12	A-7-6(11)	CL	100	100	100	99	96	88	59	52	33	27	23	2.64	44	24	19.0	1.81	11.8
Bk1---- 12 to 30	A-7-6(30)	CH	100	100	98	95	94	93	86	77	50	36	28	2.70	52	34	13.0	2.00	17.6
Bk2---- 30 to 35	A-7-6(48)	CH	100	100	99	97	96	96	93	86	69	52	40	2.65	65	47	12.0	2.08	21.9
C------ 55 to 120	A-7-6(32)	CH	100	100	98	95	94	94	93	88	54	35	30	2.73	52	32	18.0	1.86	15.1
Depcor loamy fine sand:[2] (S82TX-185-005)																			
A------- 0 to 7	A-2-4(0)	SM	100	100	100	99	87	65	15	7	2	0	0	2.57	20	1	20.0	1.67	0.0
E------ 7 to 28	A-2-4(0)	SM	100	100	100	99	85	63	14	10	2	1	0	2.65	19	2	15.0	1.84	0.0
Bt1---- 28 to 35	A-2-6(0)	SC	100	100	100	99	89	32	28	25	22	21	20	2.60	29	15	17.0	1.79	6.1
Bt2---- 35 to 40	A-7-6(9)	CL	100	100	100	100	94	83	54	45	42	38	38	2.71	47	22	21.0	1.70	11.4
Btv---- 40 to 60	A-7-6(3)	SC	100	100	100	100	93	79	38	21	19	18	17	2.72	41	21	20.0	1.75	9.8
Falba fine sandy loam:[3] (S82TX-185-002)																			
Ap------ 0 to 6	A-2-4(0)	SM	100	100	100	100	92	76	32	22	9	7	6	---	17	2	17.0	1.70	0.0
Btg1--- 6 to 14	A-7-6(27)	CH	100	100	100	100	97	96	76	63	53	50	49	---	55	35	11.0	1.99	19.0
Btg2--- 14 to 24	A-7-6(20)	CH	100	100	100	100	96	88	64	59	49	43	41	---	51	35	12.0	1.97	17.0
Btg/C-- 24 to 30	A-2-7(4)	SC	72	65	60	58	53	50	37	32	24	20	16	---	50	28	17.0	1.75	14.0
Cr----- 30 to 40	A-7-6(14)	CL	99	97	95	93	89	86	55	50	38	32	26	---	46	33	21.0	1.64	10.6
Gibbonscreek clay loam:[5] (S85TX-185-005)																			
Ap------ 0 to 8	A-7-6(18)	CH	100	94	84	73	59	58	51	45	25	21	17	2.60	67	44	19.0	1.69	18.0
C1----- 8 to 17	A-7-6(17)	CH	98	89	80	71	60	59	52	45	23	16	14	2.58	66	40	22.0	1.62	16.3
C2----- 17 to 80	A-7-6(13)	CH	93	89	82	72	55	53	46	35	23	17	12	2.59	66	39	23.0	1.61	15.8
Gladewater clay:[4] (S82TX-185-003)																			
A------- 0 to 15	A-7-6(50)	CH	100	100	100	100	100	100	94	85	72	63	58	2.65	72	46	16.0	1.90	21.4
Cg1---- 15 to 35	A-7-6(43)	CH	100	100	100	100	100	100	92	85	69	60	55	2.67	66	41	16.0	1.91	19.8
Cg2---- 35 to 60	A-7-6(50)	CH	100	100	100	100	100	100	100	83	66	57	53	2.65	66	43	17.0	1.87	19.5

See footnotes at end of table.

TABLE 20.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve--							Grain-size distribution: Percentage smaller than--				Particle density	Liquid limit[1]	Plasticity index[1]	Shrinkage: Limit	Shrinkage: Ratio	Shrinkage: Linear
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 60	No. 200	.05 mm	.005 mm	.002 mm	.001 mm						
														g/cc	Pct		Pct		Pct
Gomery loamy fine sand:[5]																			
(S85TX-185-004)																			
A------- 0 to 5	A-2-4(0)	SM	100	100	100	100	72	52	25	23	7	6	6	2.59	14	1	15.0	1.72	0.0
E1----- 5 to 14	A-2-4(0)	SM	100	100	100	100	73	49	23	20	3	2	0	2.58	11	1	11.0	1.85	0.0
E2----- 14 to 18	A-2-4(0)	SM	100	100	100	100	67	54	30	23	8	4	3	2.59	13	1	13.0	1.91	0.0
E3----- 18 to 24	A-2-4(0)	SM	100	100	100	99	65	45	24	20	8	5	4	2.66	12	1	12.0	1.95	0.0
Bt----- 24 to 31	A-6(3)	SC	100	100	100	99	66	54	37	33	25	22	21	2.65	36	22	14.0	1.92	11.3
Btg1--- 31 to 44	A-6(2)	SC	100	100	100	99	65	52	35	31	22	22	21	2.65	35	20	14.0	1.90	10.3
Btg2--- 44 to 61	A-7-6(4)	SC	100	100	100	99	70	55	36	34	32	29	28	2.69	42	26	15.0	1.86	12.7
Greenvine clay:[2]																			
(S85TX-185-004)																			
A------- 5 to 15	A-7-6(60)	CH	100	100	100	100	100	99	92	84	63	54	48	2.64	86	56	14.0	1.99	25.6
Bw----- 15 to 30	A-7-6(69)	CH	100	100	100	100	99	99	95	86	72	57	50	2.68	92	62	21.0	1.78	24.0
Cr----- 30 to 60	A-7-6(66)	CH	100	100	100	100	100	100	100	94	82	55	52	2.70	89	54	23.0	1.69	22.0
Shiro loamy fine sand:[2]																			
(S82TX-185-002)																			
A------- 0 to 6	A-2-4(0)	SM	100	100	100	100	87	53	17	8	3	3	1	2.62	20	7	18.0	1.84	0.0
Bt1---- 12 to 18	A-7-6(8)	CL	100	100	100	100	90	69	51	44	41	40	40	2.64	47	23	17.0	1.82	13.7
Bt2---- 18 to 24	A-7-6(18)	CH	100	100	100	99	90	71	60	54	50	49	49	2.62	59	34	15.0	1.92	18.3
Bt3---- 24 to 31	A-7-6(12)	SC	100	100	100	100	77	54	47	43	39	36	35	2.63	61	36	17.0	1.85	17.9
Cr----- 31 to 40	A-2-7(2)	SC	100	100	100	97	57	40	27	21	10	9	7	2.58	50	23	30.0	1.45	8.1
Singleton fine sandy loam:[6,7]																			
(S85TX-185-001)																			
A1------ 0 to 6	A-4(0)	ML	100	100	100	99	98	92	56	43	14	8	6	2.62	17	2	16.0	1.82	0.6
E1----- 6 to 10	A-4(0)	ML	100	100	100	99	98	92	56	47	13	8	6	2.56	16	2	15.0	1.83	0.8
Bt----- 10 to 26	A-6(12)	CL	100	100	100	100	99	96	70	63	36	28	26	2.60	34	21	12.0	1.96	11.0
Cr1---- 26 to 67	A-6(13)	CL	100	100	100	100	99	96	62	53	34	27	24	2.64	38	26	14.0	1.91	11.8
Cr2---- 67 to 80	A-2-4(0)	SM-SC	100	100	100	100	100	96	13	7	4	4	2	2.61	25	5	20.0	1.67	0.0

See footnotes at end of table.

TABLE 20.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution: Percentage passing sieve--							Grain-size distribution: Percentage smaller than--				Particle density	Liquid limit[1]	Plasticity index[1]	Shrinkage: Limit	Shrinkage: Ratio	Shrinkage: Linear
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 40	No. 60	No. 200	.05 mm	.005 mm	.002 mm	.001 mm						
														g/cc	Pct		Pct		Pct
Tonkavar sand:[2]																			
(S85TX-185-003)																			
A------- 0 to 5	A-2-4(0)	SM	100	100	100	100	92	54	15	8	2	2	2	2.56	20	2	20.0	1.56	0.0
E1----- 5 to 20	A-2-4(0)	SM	100	100	100	100	91	53	13	12	7	4	4	2.61	16	2	15.0	1.69	0.0
E2----- 20 to 38	A-2-4(0)	SM	100	100	100	100	90	55	14	13	5	3	2	2.62	14	1	15.0	1.69	0.0
E3----- 38 to 53	A-2-4(0)	SM	100	100	100	100	92	58	15	14	7	5	4	2.62	15	1	14.0	1.76	0.0
Bt1---- 53 to 62	A-2-6(1)	SC	100	100	100	100	97	72	35	34	31	28	27	2.61	24	14	15.0	1.85	4.9
Bt2---- 62 to 69	A-2-6(1)	SC	100	100	100	100	98	73	30	27	24	21	20	2.61	33	18	21.0	1.68	6.2
Cr1---- 69 to 77	A-2-6(0)	SC	100	100	100	100	100	55	25	23	14	12	12	2.53	39	12	33.0	1.39	2.9

[1] Liquid limit and plasticity index were determined by the AASHTO-89 and AASHTO-90 methods except that soil was added to water.

[2] Locations of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[3] From Roans Prairie, 1.9 miles west on Texas Highway 30, about 0.1 mile north and east on a county road, and 150 feet north in a pasture.

[4] From Iola, 4.4 miles south on Farm Road 244, about 4.3 miles west on a county road, and 100 feet north in an area of rangeland.

[5] From Roans Prairie, 1.9 miles north on Texas Highway 90, about 0.3 mile west and 0.1 mile north on a county road, and 100 feet east of the road in an area of woodland.

[6] From the intersection of Texas Highway 30 and Farm Road 244 in Carlos, 2.6 miles west on Texas Highway 30, about 4.2 miles south on a county road, and 100 feet south in a pasture.

[7] This pedon is a taxadjunct to the Singleton series because it has less clay and a lower liquid limit and plasticity index than is defined for the series.

TABLE 21.--CLASSIFICATION OF THE SOILS

(An asterisk in the first column indicates that the soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series)

Soil name	Family or higher taxonomic class
Annona	Fine, montmorillonitic, thermic Vertic Paleudalfs
Arents	Arents
*Arol	Fine, montmorillonitic, thermic Aquic Paleustalfs
Axtell	Fine, montmorillonitic, thermic Udertic Paleustalfs
Bleiblerville	Fine, montmorillonitic, thermic Udic Pellusterts
Boonville	Fine, montmorillonitic, thermic Ruptic Vertic Albaqualfs
Boy	Loamy, siliceous, thermic Grossarenic Plinthic Paleudalfs
Brazoria	Very-fine, mixed, thermic Typic Chromuderts
Brenham	Fine-silty, carbonatic, thermic Udic Calciustolls
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Burlewash	Fine, montmorillonitic, thermic Ultic Paleustalfs
Carbengle	Fine-loamy, carbonatic, thermic Udic Calciustolls
Chazos	Fine, montmorillonitic, thermic Aquic Paleustalfs
Conroe	Clayey, kaolinitic, thermic Arenic Plinthic Paleudults
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Cuero	Fine-loamy, mixed, thermic Pachic Argiustolls
Depcor	Loamy, siliceous, thermic Arenic Plinthic Paleudalfs
Elmina	Clayey, montmorillonitic, thermic Aquic Arenic Hapludalfs
Falba	Fine, montmorillonitic, thermic Aquic Paleustalfs
Fetzer	Fine-loamy, siliceous, thermic Aquic Paleudalfs
Flatonia	Fine, montmorillonitic, thermic Udertic Argiustolls
Frelsburg	Fine, montmorillonitic, thermic Udorthentic Pellusterts
Gibbonscreek	Fine-loamy, mixed, nonacid, thermic Typic Ustorthents
Gladewater	Fine, montmorillonitic, thermic Entic Pelluderts
Gomery	Loamy, siliceous, thermic Arenic Hapludults
*Gowker	Fine-loamy, siliceous, thermic Cumulic Hapludolls
Gredge	Fine, montmorillonitic, thermic Aquic Paleustalfs
Greenvine	Fine, montmorillonitic, thermic Udic Pellusterts
Hatliff	Coarse-loamy, siliceous, nonacid, thermic Aquic Udifluvents
Huntsburg	Fine, mixed, thermic Aquic Paleudalfs
*Kaman	Fine, montmorillonitic, thermic Typic Pelluderts
Klump	Fine-loamy, siliceous, thermic Udic Argiustolls
Knolle	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Koether	Sandy-skeletal, siliceous, thermic Lithic Ustorthents
Landman	Loamy, siliceous, thermic Grossarenic Paleudalfs
Latium	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Lufkin	Fine, montmorillonitic, thermic Vertic Albaqualfs
Mabank	Fine, montmorillonitic, thermic Vertic Albaqualfs
Nahatche	Fine-loamy, siliceous, nonacid, thermic Aeric Fluvaquents
Navasan	Loamy, siliceous, thermic Grossarenic Paleustalfs
Norwood	Fine-silty, mixed (calcareous), thermic Typic Udifluvents
Oklared	Coarse-loamy, mixed (calcareous), thermic Typic Udifluvents
Padina	Loamy, siliceous, thermic Grossarenic Paleustalfs
Rader	Fine-loamy, mixed, thermic Aquic Paleustalfs
Renish	Loamy, mixed, thermic Lithic Haplustolls
Robco	Loamy, siliceous, thermic Aquic Arenic Paleustalfs
Shalba	Clayey, montmorillonitic, thermic, shallow Udic Haplustalfs
Shiro	Fine, mixed, thermic Aquic Paleustalfs
Silawa	Fine-loamy, siliceous, thermic Ultic Haplustalfs
Silstid	Loamy, siliceous, thermic Arenic Paleustalfs
Singleton	Fine, montmorillonitic, thermic Aquic Paleustalfs
*Splendora	Fine-loamy, siliceous, thermic Fragic Glossudalfs
Tabor	Fine, montmorillonitic, thermic Udertic Paleustalfs
Tinn	Fine, montmorillonitic, thermic Typic Pelluderts
Tonkavar	Loamy, siliceous, thermic Grossarenic Paleudalfs
Waller	Fine-loamy, siliceous, thermic Typic Glossaqualfs
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs
Zack	Fine, montmorillonitic, thermic Udic Paleustalfs
Zulch	Fine, montmorillonitic, thermic Udertic Paleustalfs

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