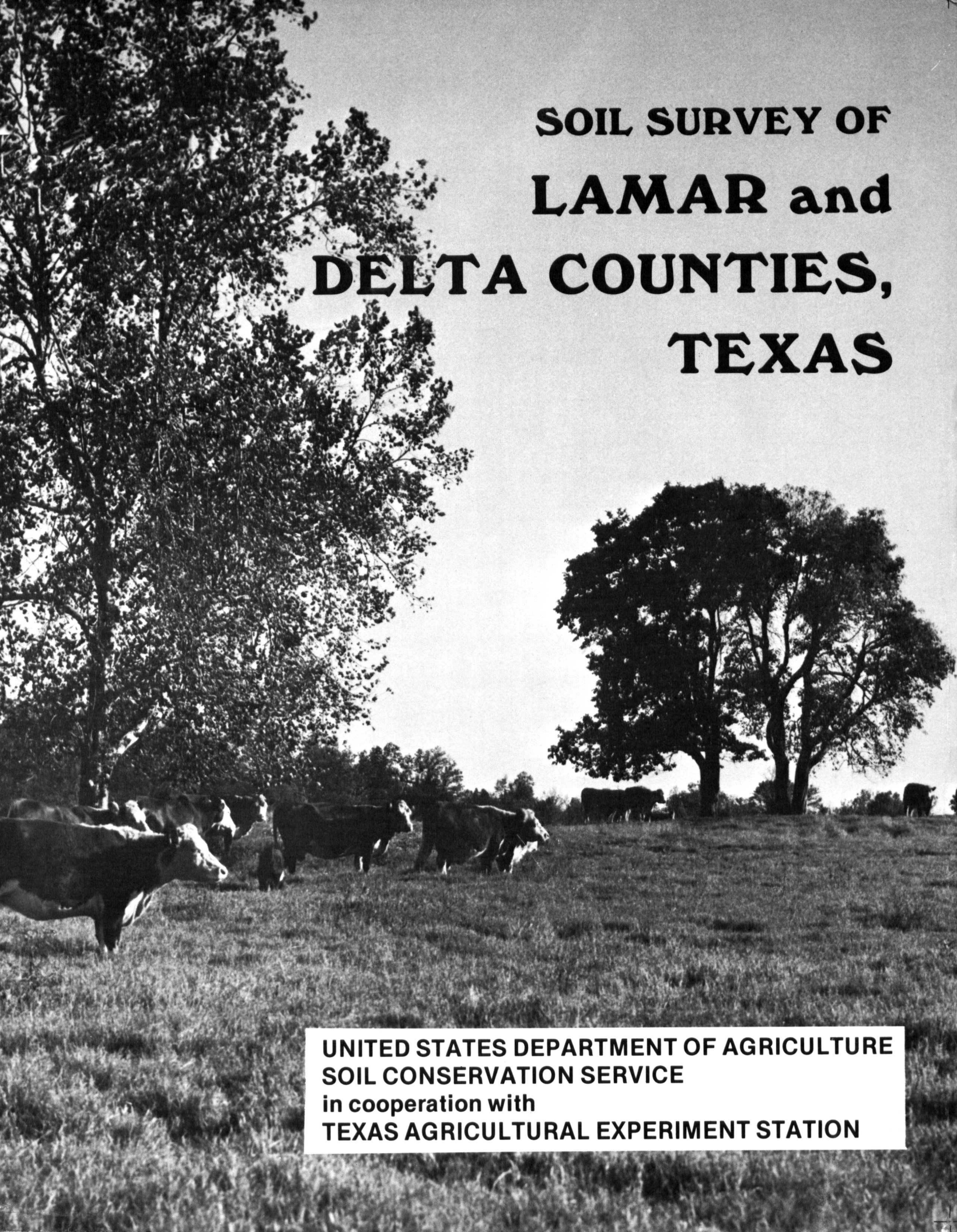
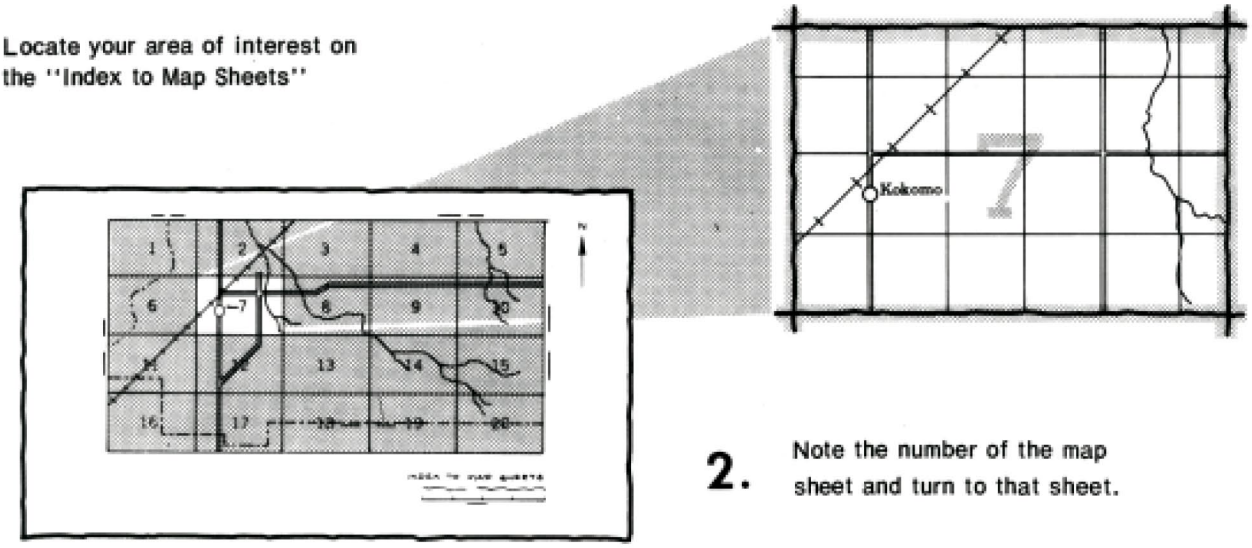


SOIL SURVEY OF LAMAR and DELTA COUNTIES, TEXAS

UNITED STATES DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
in cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION

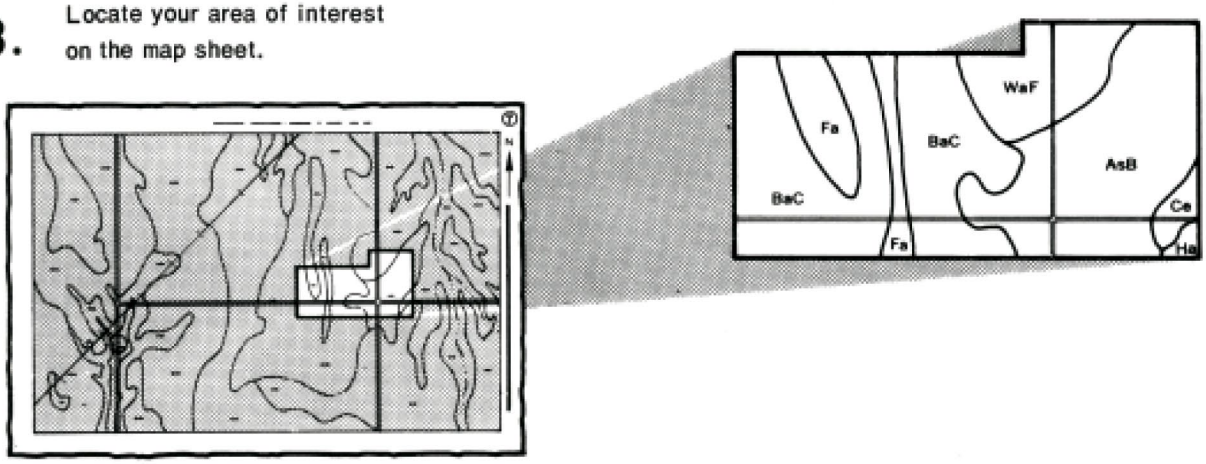
HOW TO USE

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

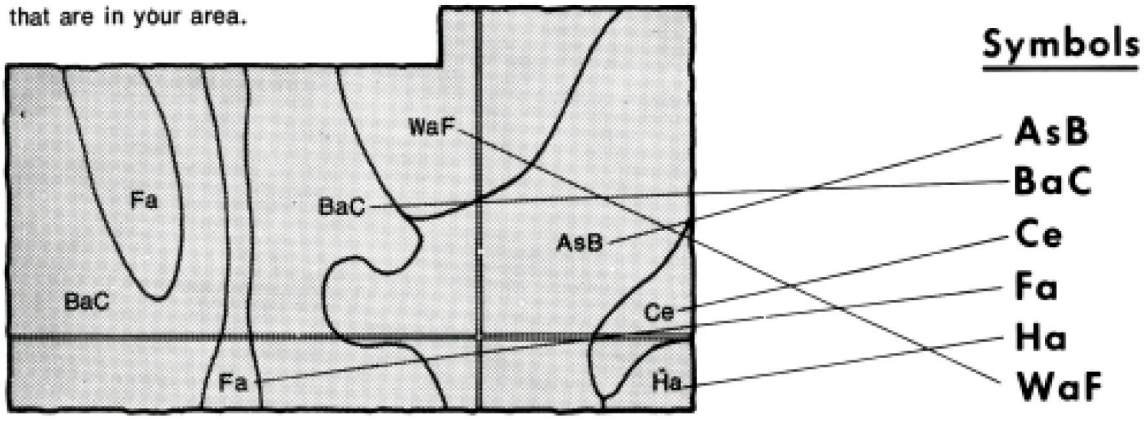


2. Note the number of the map sheet and turn to that sheet.

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

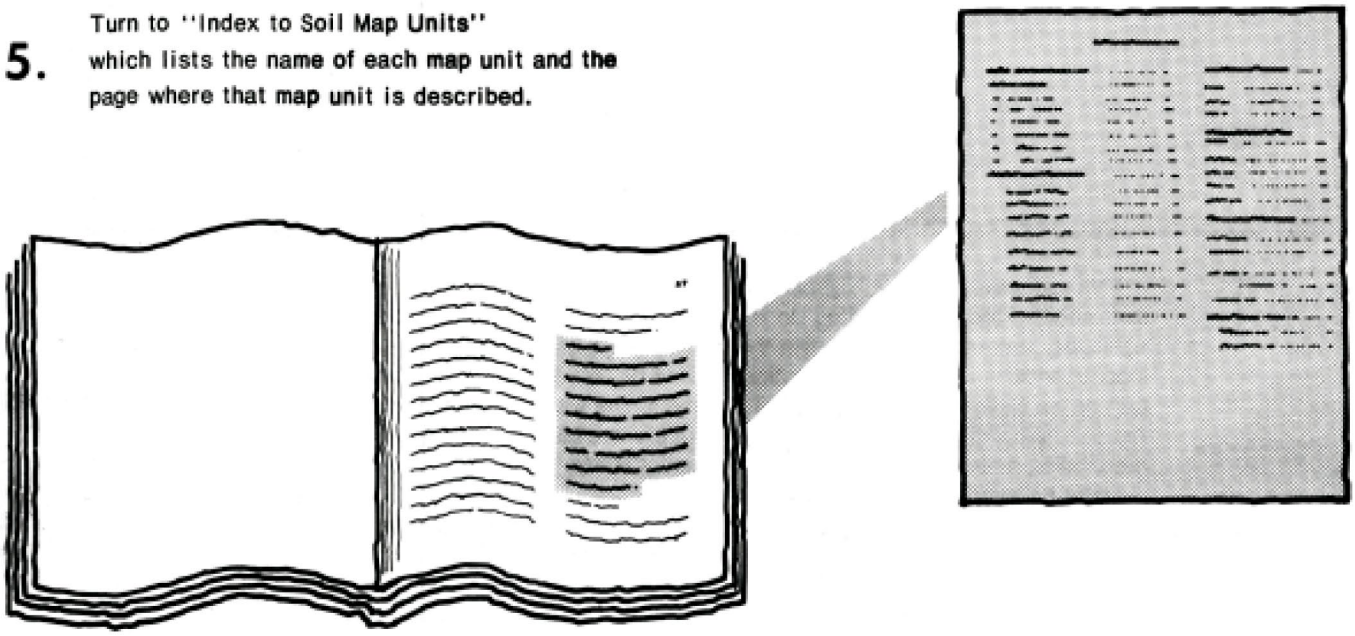


4. List the map unit symbols that are in your area.

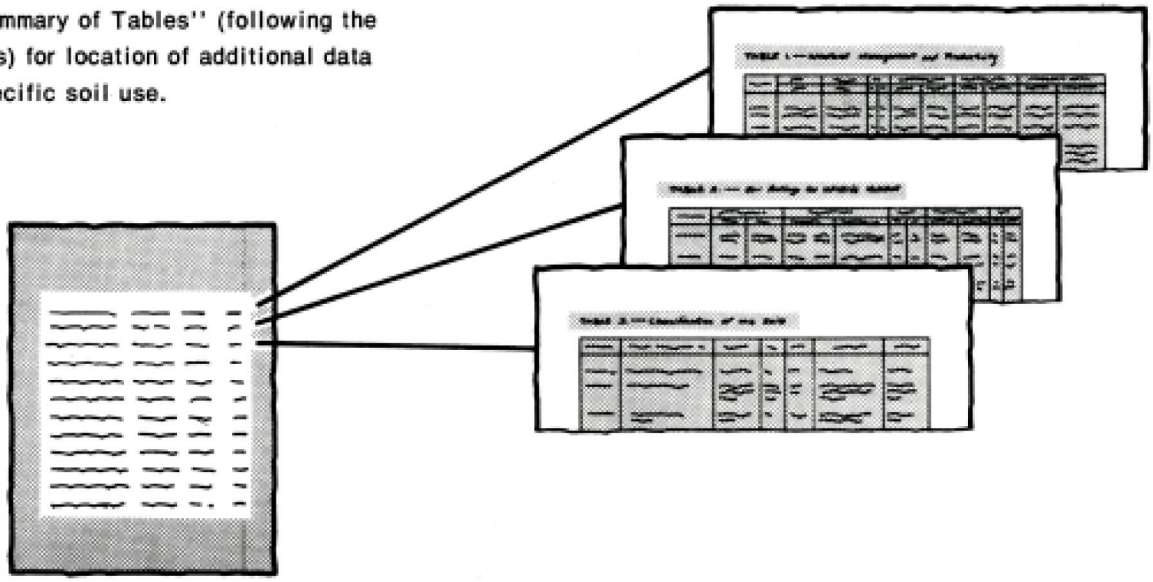


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was completed in the period 1967-74. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1974. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Lamar and Delta Soil and Water Conservation Districts.

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

Cover: Bermudagrass on Whakana fine sandy loam, 1 to 5 percent slopes.

Contents

Issued May 1979

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Summary of Tables

Foreword

The Soil Survey of Lamar and Delta Counties contains much information useful in any land-planning program. Of prime importance are the predictions of soil behavior for selected land uses. Also highlighted are limitations or hazards to land uses that are inherent in the soil, improvements needed to overcome these limitations, and the impact that selected land uses will have on the environment.

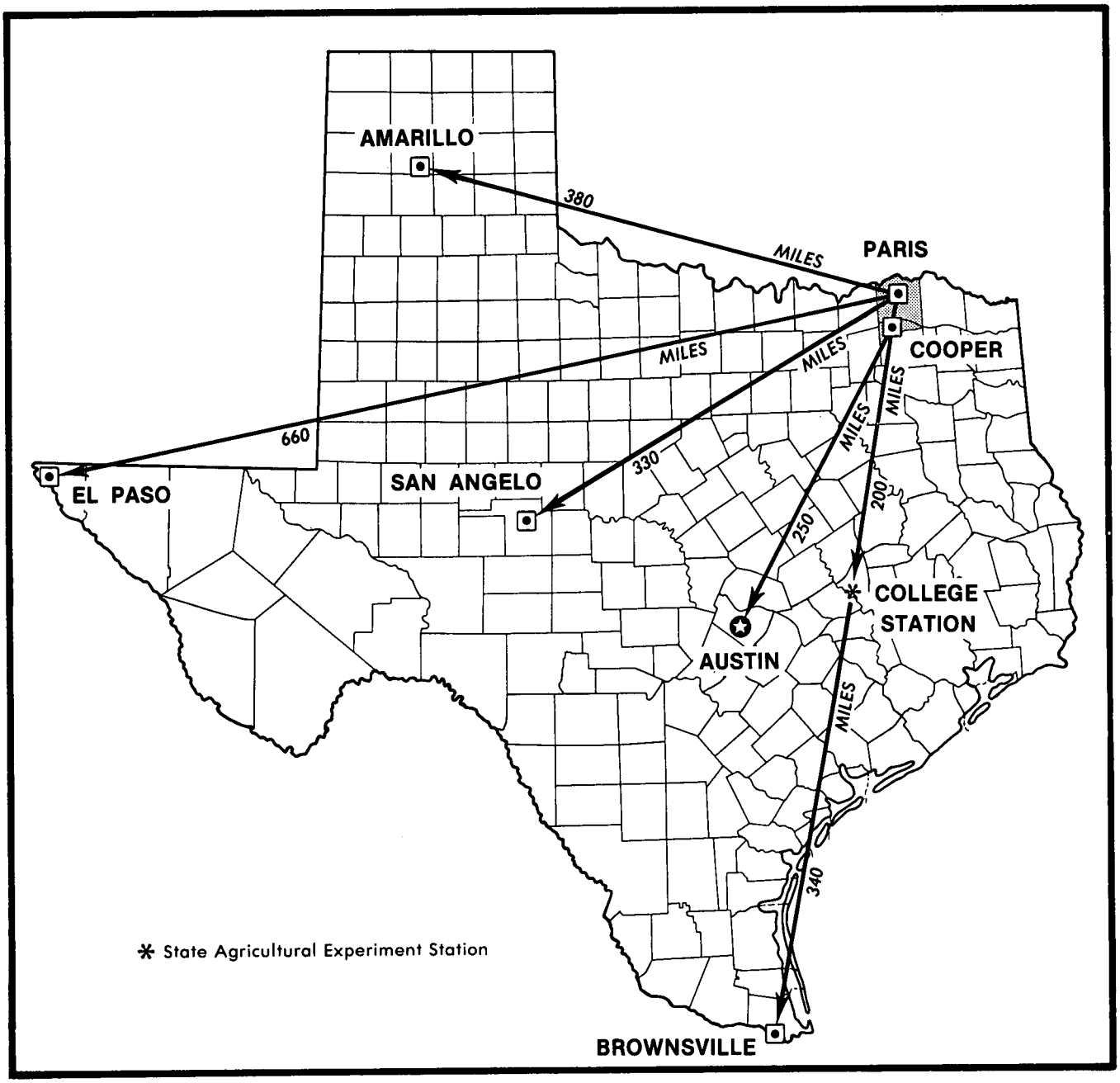
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers can use it to plan land use, select sites for construction, develop soil resources, or identify any special practices that may be needed to insure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the soil survey to help them understand, protect, and enhance the environment.

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

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map; the location of each kind of soil is shown on detailed soil maps. Each kind of soil in the survey area is described, and much information is given about each soil for specific uses. Additional information or assistance in using this publication can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

This soil survey can be useful in the conservation, development, and productive use of soil, water, and other resources.

George C. Marks
State Conservationist
Soil Conservation Service



Location of Lamar and Delta Counties in Texas.

SOIL SURVEY OF LAMAR AND DELTA COUNTIES, TEXAS

By Dennis Ressel, Soil Conservation Service

Dan A. Blackstock, Roy L. Robbins, and Jesse R. Thomas, Jr., soil scientists, Soil Conservation Service, assisted in the field mapping

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

LAMAR AND DELTA COUNTIES are in northeastern Texas (see map on facing page). The area of the two counties is 1,185 square miles, or 758,400 acres. Red River is the northern boundary of Lamar County, and South Sulphur River is the southern boundary of Delta County. The old channel of North Sulphur River is the boundary between Lamar and Delta Counties. Paris is the county seat of Lamar County, and Cooper is the seat of Delta County.

The area is dissected by many well-defined drainageways. Lamar County north of Paris drains northeast into Red River. South of Paris the county drains southeast into North Sulphur River. All of Delta County drains southeast into South Sulphur River except the area near North Sulphur River. The elevation in the two counties ranges from about 335 feet above sea level in the southeastern part of the area to about 620 feet on the highest watershed divides.

These are cattle-producing and farming counties. About 42 percent of the area is used for pasture and hay, 33 percent for crops, 13 percent for woodland, and 4 percent for range. The remaining 8 percent is urban land, federal military land, and water area. Farming in the two counties has evolved from primarily cotton in the early 1950's to a diverse agriculture today. Cotton is still a major crop, but improved bermudagrass, fescue, grain sorghum, soybeans, and small grains have become important in recent years.

There are great differences among soils in the area. About 51 percent of the soils formed on uplands under prairie, 30 percent formed on uplands under forest, and the remaining 19 percent formed on flood plains. Unprotected sloping areas are subject to water erosion. It is common to have periods of continuous wet or dry weather 4 to 6 months long.

General nature of the counties

This section gives general information about Lamar and Delta Counties. It briefly discusses the settlement and population, farming, climate, and natural resources of the area.

Settlement and population

Settlement of Lamar County began in 1821. The county was organized officially in 1841 and was named in honor of the President of the Republic of Texas, Mirabeau B. Lamar.

Paris, the seat of Lamar County, has a population of about 24,050. In 1970, the population of Lamar County was 36,062.

Delta County was created from Lamar and Hopkins Counties in 1870. The name was taken from the Greek letter delta. The county is between the north and south forks of the Sulphur River.

Cooper, the seat of Delta County, has a population of about 2,495. In 1970, the population of Delta County was 4,927.

Climate

The National Oceanic and Atmospheric Administration, National Weather Service, assisted in the preparation of this section.

The climate of Lamar and Delta Counties is humid subtropical with warm summers. The climate is continental also, characterized by extreme variations in temperature. Tropical maritime air masses flow through the area in late spring, summer, and early fall, and polar air masses frequent the area in winter. Temperature and precipitation data from Paris, in Lamar County, are given in table 1.

Rainfall is abundant and is evenly distributed throughout the year. Mean annual precipitation is 45.32 inches. Since records began in 1891, annual rainfall has ranged

from 18.21 inches in 1899 to 75.65 inches in 1957. Prevailing winds are southerly to southeasterly during most months. In January and February northerly winds prodominate. The mean annual relative humidity is 83 percent at 6 A.M., 56 percent at noon, and 55 percent at 6 P.M.

In winter, temperatures are mild. A low temperature of 32 degrees F or below occurs on about 2 nights out of 3. The daily high fails to exceed 32 degrees on an average of about 4 days per year. The area experiences frequent surges of cold continental air in winter. Cold fronts moving down from the north often are accompanied by strong gusty winds and sudden drops in temperature; however, cold spells are short, rarely lasting longer than 48 hours before rapid warming occurs. Precipitation may fall as rain, freezing rain, sleet, or snow.

In summer, days are warm, particularly in July and August. There is little variation in the day-to-day weather during these months. Sunshine is about 75 percent of the total possible during summer. Refrigerated air conditioning provides the maximum comfort indoors.

Spring and fall are characterized by warm days and cool nights. Cloudiness and showers are slightly more frequent in spring than in fall. Also, average windspeed is stronger in spring.

The growing season (freeze-free period) averages 228 days. The average dates of the last freeze in the spring and the first in the fall are March 26 and November 9. About 50 thunderstorms occur each year. A few of these thunderstorms are accompanied by destructive wind, hail, or high intensity rain.

Farming

Farming is the leading industry in Lamar and Delta Counties. About 77 percent of Lamar County and 83 percent of Delta County is suited to cultivation. The average farm size is 271 acres in Lamar County and 147 acres in Delta County. In recent years more people have been purchasing farms to supplement income from industry.

The main farm enterprises are crops, livestock, dairying, and poultry. A few hardwood logs are harvested each year. The main cash crops are cotton, soybeans, grain sorghum, corn, wheat, peanuts, and alfalfa. A large acreage of bermudagrass is cut for hay.

Livestock operations are primarily cow-calf. Supplemental feeding is generally heavy from December to late February or March. There are few commercial feedlots in these counties.

Natural resources

Soil is the most important natural resource in Lamar and Delta Counties. Forage for livestock and food, fiber, and timber for market and home consumption produced from the soils of the counties are a major source of livelihood for many people.

Water is an important natural resource. Several lakes provide high quality water for homes and industry. Scattered aquifers throughout the area provide high quality water for home use.

Wildlife produced on the farms, ranches, and game management areas provides recreation for many residents.

Gravel from high terrace deposits of the Red River and from the rectified North Sulphur River channel and chalk and limestone mined from bedrock provide material for local road construction.

Natural gas is produced by a few wells in the eastern part of Delta County.

How this survey was made

Soil scientists made this survey to learn what kinds of soil are in the survey area, where they are, and how they can be used. The soil scientists went into the area knowing they likely would locate many soils they already knew something about and perhaps identify some they had never seen before. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; the kinds of rock; and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material, which has been changed very little by leaching or by the action of plant roots.

The soil scientists recorded the characteristics of the profiles they studied, and they compared those profiles with others in counties nearby and in places more distant. Thus, through correlation, they classified and named the soils according to nationwide, uniform procedures.

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

The areas shown on a soil map are called soil map units. Some map units are made up of one kind of soil, others are made up of two or more kinds of soil, and a few have little or no soil material at all. Map units are discussed in the sections "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of soils are taken as needed for laboratory measurements and for engineering tests. The soils are field tested, and interpretations of their behavior are modified as necessary

during the course of the survey. New interpretations are added to meet local needs, mainly through field observations of different kinds of soil in different uses under different levels of management. Also, data are assembled from other sources, such as test results, records, field experience, and information available from state and local specialists. For example, data on crop yields under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it is readily available to different groups of users, among them farmers, managers of rangeland and woodland, engineers, planners, developers and builders, homebuyers, and those seeking recreation.

General soil map for broad land use planning

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

The general soil map provides a broad perspective of the soils and landscapes in the survey area. It provides a basis for comparing the potential of large areas for general kinds of land use. Areas that are, for the most part, suited to certain kinds of farming or to other land uses can be identified on the map. Likewise, areas of soils having properties that are distinctly unfavorable for certain land uses can be located.

Because of its small scale, the map does not show the kind of soil at a specific site. Thus, it is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The kinds of soil in any one map unit differ from place to place in slope, depth, stoniness, drainage, or other characteristics that affect their management.

The soils in the survey area vary widely in their potential for major land uses. Table 2 shows the extent of the map units shown on the general soil map and gives general ratings of the potential of each, in relation to the other map units, for major land uses. Soil properties that pose limitations to the use are indicated. The ratings of soil potential are based on the assumption that practices in common use in the survey area are being used to overcome soil limitations. These ratings reflect the ease of overcoming the soil limitations and the probability of soil problems persisting after such practices are used.

Each map unit is rated for *cultivated farm crops, pasture and hay, range, woodland, woodland grazing, urban uses,* and *recreation*. Cultivated farm crops are those grown extensively by farmers in the survey area. Pasture and hay consist of grasses established for grazing or cutting. Woodland refers to land that is producing either trees native to the area or introduced species. Woodland grazing is using grassy areas in woodland for grazing. Urban uses include residential, commercial, and industrial developments. Recreation includes campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic and areas used for nature study and as wilderness.

Descriptions of the general soil map units

1. Houston Black-Leson-Heiden

Nearly level to gently sloping, very slowly permeable, clayey soils on uplands

This map unit consists of clayey prairie soils that crack when dry. Slopes are 0 to 5 percent (fig. 1).

This unit makes up about 32 percent of the survey area. It is about 32 percent Houston Black soils, 18 percent Leson soils, 12 percent Heiden soils, and 38 percent other soils.

Houston Black soils are on sides and tops and at the foot of ridges. These soils are moderately well drained. They are moderately alkaline throughout. The surface layer is very dark gray clay about 5 inches thick. Between depths of 5 and 23 inches, the soil is black clay. Between depths of 23 and 38 inches, the soil is very dark clay. Between depths of 38 and 51 inches, the soil is olive gray clay that has light olive brown and gray mottles. Between depths of 51 and 77 inches, the soil is light olive brown clay over grayish brown clay that has mottles of yellow, gray, and brownish yellow. The underlying material is brownish yellow and light brownish gray, stratified shaly clay to a depth of 80 inches.

Leson soils are on tops and sides of ridges. These soils are moderately well drained. The surface layer is black, slightly acid clay about 20 inches thick. Between depths of 20 and 39 inches, the soil is very dark gray, neutral clay that has yellowish brown mottles. Between depths of 39 and 57 inches, the soil is dark grayish brown, mildly alkaline clay that has olive mottles. Between depths of 57 and 66 inches, the soil is olive, moderately alkaline clay that has brownish mottles. The underlying material is light brownish gray and pale olive, moderately alkaline, stratified shaly clay to a depth of 75 inches.

Heiden soils are on sides of ridges. These soils are well drained and are moderately alkaline throughout. The surface layer is very dark grayish brown clay about 26 inches thick. Between depths of 26 and 48 inches, the soil is olive gray clay. Between depths of 48 and 62 inches, the soil is mottled dark grayish brown, light olive

brown, and brownish yellow clay. The underlying material is stratified, platy, and brownish yellow, light olive brown, and light olive gray shale to a depth of 80 inches.

Other soils are Ferris, Deport, Burleson, Austin, Stephen, Eddy, Trinity, and Elbon soils. Ferris, Deport, and Burleson soils are clayey, nearly level to strongly sloping soils on ridges and breaks. Austin, Stephen, and Eddy soils are friable, gently sloping, silty clay on uplands underlain by chalk. Trinity and Elbon soils are nearly level soils on flood plains.

The soils in this unit are used mainly for crops and pasture and hay. Many ponds and flood prevention structures provide recreation. Some areas are covered with urban works and structures, mainly residential. The soils in this unit have high potential for crops, for range, and for pasture and hay. Potential for woodland is low because the soils are clayey and very slowly permeable. There is no woodland grazing in this unit.

The soils have low potential for urban development. The soils shrink and swell greatly with changes in moisture content. They also are corrosive and have low strength. Potential for recreation is low because of very slow permeability and the clayey surface layer.

2. Annona-Freestone-Woodtell

Nearly level to strongly sloping, slowly permeable to very slowly permeable, loamy soils on uplands

This map unit consists of forested soils that have a loamy surface layer and a clayey subsoil. Slopes are 0 to 12 percent (fig. 2). This unit makes up about 23 percent of the survey area. It is about 27 percent Annona soils, 19 percent Freestone soils, 11 percent Woodtell soils, and 43 percent other soils.

Annona soils are gently sloping and are on tops and sides of ridges. These soils are somewhat poorly drained and very slowly permeable. The surface layer is dark grayish brown, slightly acid loam about 4 inches thick. Between depths of 4 and 9 inches, the soil is light yellowish brown, strongly acid loam that has light grayish brown and brownish yellow mottles. Between depths of 9 and 16 inches, the soil is dark red, very strongly acid clay that has gray mottles. Between depths of 16 inches 26 inches, the soil is light brownish gray, very strongly acid clay that has dark red and gray mottles. Between depths of 26 and 42 inches, the soil is gray, strongly acid clay that has dark red and yellowish brown mottles. Between depths of 42 and 55 inches, the soil is yellowish brown, slightly acid clay that has gray and reddish brown mottles. Between depths of 55 and 75 inches, the soil is mottled gray and yellowish brown, mildly alkaline clay.

Freestone soils are nearly level to gently sloping and are on ridges. These soils are moderately well drained and slowly permeable. The surface layer is brown, slightly acid fine sandy loam about 6 inches thick. Between depths of 6 and 16 inches, the soil is light yellowish brown, medium acid fine sandy loam. Between depths of 16 and 23 inches, the soil is yellowish brown, strongly acid loam that has strong brown mottles. Between depths of 23 and 33 inches, the soil is yellowish brown, strongly acid clay loam that has red and grayish brown mottles. Between depths of 33 and 44 inches, the soil is light gray, very strongly acid clay loam that has dark red and yellowish brown mottles; uncoated sand and silt grains are on vertical faces of peds. Between depths of 44 and 59 inches, the soil is light brownish gray, medium acid clay that has dark red and yellowish brown mottles. Between depths of 59 and 80 inches, the soil is light brownish gray, medium acid clay loam that has olive yellow, yellowish brown, and dark red mottles.

Woodtell soils are sloping to strongly sloping and are on sides of ridges. These soils are moderately well drained and very slowly permeable. The surface layer is very dark grayish brown, slightly acid loam about 4 inches thick. Between depths of 4 and 12 inches, the soil is yellowish red, very strongly acid clay that has light olive brown and light brownish gray mottles. Between depths of 12 and 26 inches, the soil is red, very strongly acid clay that has light brownish gray and light olive brown mottles. Between depths of 26 and 41 inches, the soil is mottled red and light gray, very strongly acid clay. Between depths of 41 and 51 inches, the soil is light brownish gray, very strongly acid clay that has light yellowish brown and light olive brown mottles. Between depths of 51 and 63 inches, the soil is stratified grayish brown, partially weathered shale and clay that have yellowish brown mottles.

Other soils are Derly, Hicota, Raino, Bernaldo, Guyton, Ambia, and Roxton soils. Derly soils are loamy, poorly drained, nearly level soils on terraces and ridgetops. Hicota and Raino soils are loamy soils on mounds within areas of Freestone and Derly soils. Bernaldo soils are loamy, well drained, gently sloping soils on ridges. Guyton, Ambia, and Roxton soils are on frequently flooded bottom lands.

The soils in this unit have medium potential for crops, pasture and hay, and timber. Because of slope, wetness, and low fertility, nearly all of this unit is used for pasture and hay or for timber. The gently sloping soils in this unit are suited to soybeans, corn, peanuts, truck crops, improved bermudagrass, clover, and tall fescue. Potential for woodland grazing is medium because of low fertility. There is no range in this unit.

The soils in this unit have medium potential for most urban uses. The soils shrink and swell with changes in moisture content. Other limiting features are slope, low strength, and wetness. Potential for recreation is medium because of slope, slow or very slow permeability, and wetness.

3. Wilson-Normangee-Crockett

Nearly level to gently sloping, very slowly permeable, loamy soils on uplands

This map unit consists of prairie soils that have a loamy surface layer and a clayey subsoil. Slopes are 0 to 5 percent (fig. 3). This unit makes up about 22 percent of the survey areas. It is about 30 percent Wilson soils, 26 percent Normangee soils, 22 percent Crockett soils, and 22 percent other soils.

Wilson soils are nearly level to gently sloping and are on ridgetops and foot slopes. These soils are somewhat poorly drained. The surface layer is very dark gray, slightly acid silt loam about 6 inches thick. Between depths of 6 and 9 inches, the soil is very dark gray, medium acid clay loam. Between depths of 9 and 28 inches, the soil is very dark gray, slightly acid clay. Between depths of 28 and 39 inches, the soil is dark gray, neutral clay. Between depths of 39 and 80 inches, the soil is grayish brown, mildly alkaline clay that has light olive brown and olive yellow mottles.

Normangee soils are gently sloping and are on tops and sides of ridges. These soils are moderately well drained. The surface layer is dark brown, slightly acid clay loam about 7 inches thick. Between depths of 7 and 16 inches, the soil is brown, medium acid clay that has red, reddish brown, and dark grayish brown mottles. Between depths of 16 and 28 inches, the soil is yellowish brown, neutral clay that has mottles in shades of red and brown. Between depths of 28 and 38 inches, the soil is mottled grayish brown and light olive brown, mildly alkaline clay. Between depths of 38 and 48 inches, the soil is light olive brown, moderately alkaline clay that has grayish brown mottles. Between depths of 48 and 57 inches, the soil is mottled olive, light olive brown, and yellowish brown, moderately alkaline clay. The underlying material is light olive gray, moderately alkaline weathered shale to a depth of 65 inches. It has light olive brown mottles.

Crockett soils are gently sloping and are on tops and sides of ridges. These soils are moderately well drained. The surface is very dark grayish brown, slightly acid loam about 8 inches thick. Between depths of 8 and 17 inches, the soil is mottled brown and reddish brown, slightly acid clay. Between depths of 17 and 29 inches, the soil is mottled light olive brown and olive, slightly acid clay. Between depths of 29 and 39 inches, the soil is olive, neutral clay that has strong brown and yellowish red mottles. Between depths of 39 and 51 inches, the soil is olive brown, mildly alkaline clay. Between depths of 51 and 59 inches, the soil is light olive brown, moderately alkaline clay loam that has grayish brown and light olive brown mottles. Between depths of 59 and 73 inches, the soil is mottled light gray and brownish yellow, moderately alkaline loam.

Other soils are Parisian, Mabank, Lassiter, and Roxton soils. Parisian and Mabank soils have a loamy surface layer and a clayey subsoil. They are gently sloping and nearly level and are on uplands. The loamy Lassiter and clayey Roxton soils are frequently flooded and are on bottom lands.

The soils in this unit have high potential for pasture and hay. They have medium potential for crops and range. They have very slow permeability, erode easily, and are droughty. Potential for woodland is low because of very slow permeability. There is no woodland grazing in this unit. Soils in this unit are used mainly for range or for pasture and hay.

The soils in this unit have medium potential for most urban uses. Limiting factors are low strength and the shrinking and swelling with changes in moisture content. The potential for recreation is medium because of the very slow permeability.

4. Trinity-Kaufman

Nearly level, very slowly permeable, clayey soils on flood plains

This map unit consists of clayey soils that crack when dry. Slopes are 0 to 1 percent. This unit makes up about 10 percent of the survey area. It is about 59 percent Trinity soils, 33 percent Kaufman soils, and 8 percent other soils.

Trinity soils are somewhat poorly drained. The surface layer is very dark gray, moderately alkaline clay about 29 inches thick. Between depths of 29 and 72 inches, the soil is black, moderately alkaline clay.

Kaufman soils are somewhat poorly drained. The surface layer is black, slightly acid clay about 35 inches thick. Between depths of 35 and 80 inches, the soil is very dark gray, slightly acid clay that has olive brown and dark yellowish brown mottles.

Other soils are Varro and Elbon soils. These soils are frequently flooded, loamy soils on bottom lands.

Soils in this unit have high potential for pasture and hay, woodland, and woodland grazing. Potential for crops is medium because of flooding. There is no range in this unit.

The potential for urban uses and recreation is low because of flooding, the clayey surface layer, and wetness.

5. Whakana-Porum

Gently sloping to moderately steep, moderately permeable to very slowly permeable, loamy soils on uplands

This map unit consists of forested soils that have a loamy surface layer and a loamy and clayey subsoil. Slopes are 1 to 20 percent (fig. 4). This unit makes up about 9 percent of the survey area. It is about 38 percent Whakana soils, 15 percent Porum soils, and 47 percent other soils.

Whakana soils are gently sloping to moderately steep and are on tops and sides of ridges of high terraces of major streams. These soils are well drained and moderately permeable. The surface layer is brown, medium acid fine sandy loam about 15 inches thick. Between depths of 15 and 25 inches, the soil is red, very strongly

acid clay loam. Between depths of 25 and 42 inches, the soil is yellowish red, very strongly acid clay loam that has vertical streaks of uncoated sand grains. Between depths of 42 and 80 inches, the soil is red and yellowish red, very strongly acid sandy clay loam that has vertical streaks of uncoated sand grains.

Porum soils are strongly sloping to moderately steep and are on sides of dissected high terraces of major streams. These soils are moderately well drained and very slowly permeable. The surface layer is dark grayish brown, medium acid fine sandy loam about 3 inches thick. Between depths of 3 and 7 inches, the soil is pale brown, medium acid fine sandy loam. Between depths of 7 and 17 inches, the soil is red, very strongly acid clay that has strong brown mottles. Between depths of 17 and 31 inches, the soil is yellowish red, very strongly acid clay that has strong brown and light gray mottles. Between depths of 31 and 42 inches, the soil is yellowish red, strongly acid sandy clay loam that has gray, strong brown, and red mottles. Between depths of 42 and 65 inches, the soil is strong brown, medium acid sandy clay loam that has light gray and yellowish red mottles and vertical streaks of uncoated sand grains.

Other soils are Annona, Woodtell, Freestone, Derly, Karma, Raino, Hicota, and Guyton soils. Annona, Woodtell, Freestone, and Derly soils are loamy, have a clay subsoil, and are on uplands. Karma soils are loamy and are on low terraces. Raino and Hicota soils are loamy soils on mounds within areas of Derly and Freestone soils. Guyton soils are loamy, are frequently flooded, and are on narrow bottom lands.

The soils in this unit have medium potential for cultivated crops and pasture and hay because of slope and erodibility. These soils are suited to corn, soybeans, improved bermudagrass, clover, and fescue grass. There is no range in this unit. Potential for woodland and woodland grazing is medium because of low fertility. The more sloping soils are suited to these uses.

Potential of the soils in this unit for urban uses and recreation is medium. Slope, shrinking and swelling with moisture changes, and low strength are the main limiting factors.

6. Severn-Caspiana-Desha

Nearly level to gently sloping, moderately rapidly permeable to very slowly permeable, loamy and clayey soils on flood plains

This map unit consists of soils on bottom lands and low stream terraces. Slopes are 0 to 5 percent (fig. 4). This unit makes up about 4 percent of the survey area. It is about 30 percent Severn soils, 17 percent Caspiana soils, 16 percent Desha soils, and 37 percent other soils.

Severn soils are nearly level to gently sloping and are on flood plains. These soils are well drained and moderately rapidly permeable. The surface layer is reddish brown, very fine sandy loam about 4 inches thick. Between depths of 4 and 63 inches, the soil is reddish brown, very fine sandy loam that has thin strata of loam and many bedding planes. Many areas of Severn soils have thin layers of silty clay loam overwash.

Caspiana soils are nearly level and are on low terraces. These soils are well drained and moderately permeable. The surface layer is dark brown, slightly acid silt loam about 10 inches thick. Between depths of 10 and 16 inches, the soil is dark reddish brown, neutral silt loam. Between depths of 16 and 19 inches, the soil is dark brown, neutral silt loam. Between depths of 19 and 48 inches, the soil is reddish brown, neutral silt loam. Between depths of 48 and 80 inches, the soil is yellowish red, neutral silt loam.

Desha soils are nearly level and are in backswamp areas and depressional meander belts. These soils are somewhat poorly drained and very slowly permeable. The surface layer is dark reddish brown, mildly alkaline clay about 26 inches thick. Between depths of 26 and 70 inches, the soil is reddish brown, moderately alkaline clay.

Other soils are Redlake, Belk, Muldrow, Norwood, Harjo, and Kiomatia soils. Redlake, Belk, Muldrow, Norwood, Harjo, and Kiomatia soils are nearly level to gently sloping and are on flood plains. The clayey Redlake and Belk soils and the loamy Muldrow and Norwood soils are on bottom lands and are rarely inundated. The clayey Harjo and the sandy Kiomatia soils are frequently flooded.

The soils in this unit have high potential for cultivated crops and pasture and hay. Row crops, forage crops, legumes, and small grains grow well. Surface drainage may be needed in some places that are somewhat poorly drained or poorly drained. These soils are the most productive and intensely cultivated in the survey area. Potential for woodland and woodland grazing is high. There is no range.

The potential for most urban uses is low because of flooding. Potential for recreation is low because of flooding and a surface layer that is too clayey.

Land use considerations

Deciding which land should be used for crops, pasture and hay, range, woodland, urban uses, or recreation is an important issue in this survey area. Each year a considerable amount of land is developed for each of these uses. The general soil map is most helpful in the general planning of development; however, it cannot be used for the selection of sites for specific uses. In general, the soils that have high potential for crops, pasture and hay, and range have low potential for urban uses and recreation. The data about specific soils elsewhere in this survey can be helpful in planning future land use.

General soil map units 1 and 6 have high potential for crops and pasture and hay but low potential for urban uses and recreation. The soils in these units are the

most intensively cultivated in the survey area. They have the highest natural fertility and largest yields of crops and pasture and hay. Most are clay and are difficult to cultivate.

Water erosion is a severe problem in map unit 1 where there is continuous down-cutting of stream channels. Wetness and flooding limit some of the soils in map unit 6. Proper surface drainage overcomes this limitation for warm season crops. Map unit 1 has high potential for range. Shrink-swell potential, low strength, corrosivity, very slow permeability, clayey texture, wetness, and flooding limit nonfarm uses of these soils. The soils in map unit 6 are subject to flooding. The clayey soils in map unit 1 form deep, wide cracks when dry. Sloping areas are very unstable. Properly designed and carefully installed development is very costly on these soils.

Map units 2, 3, 4, and 5 have medium potential for farm crops and medium or high potential for pasture and hay. Map unit 3 has medium potential for range. Map units 2, 3, and 5 have medium potential for urban use and recreation, but map unit 4 has only low potential because of flooding. With the exception of the Whakana soils in unit 5 and the soils in unit 4, the soils in these map units have a loamy surface layer underlain by a clayey subsoil. The droughty nature of the clayey subsoil limits production of most warm season crops. The potential for cool season crops is high except on the somewhat poorly drained Wilson soils and the sloping Woodtell, Whakana, and Porum soils. Pasture and hay yields are high on all of these soils except Woodtell and Porum soils. Wetness, shrink-swell potential, low strength, corrosivity, and slope limit nonfarm uses of these soils. Proper drainage, proper design, and careful installation overcome these limitations.

Slightly less than half of the soils in the survey area have high or medium potential for woodland and woodland grazing. However, soils of the Houston Black-Leson-Heiden and the Wilson-Normangee-Crockett map units, are prairie soils and either do not grow trees naturally or produce poor wood species. The Trinity-Kaufman and Severn-Caspiana-Desha map units are bottom land soils that have high potential for hardwoods. The Annona-Freestone-Woodtell and Whakana-Porum map unit are upland soils that have medium potential for pine and hardwoods.

Vegetables and other specialty crops are suited to soils of the Annona-Freestone-Woodtell and Whakana-Porum map units. These map units are also suited to such crops as peanuts, as are the Crockett soils of the Wilson-Normangee-Crockett map unit. Alfalfa is well suited to the moderately well drained and well drained soils of the Severn-Caspiana-Desha map unit. Nurseries and fruits are suited to Freestone and Whakana soils where slope is not too steep.

Soil maps for detailed planning

The map units shown on the detailed soil maps at the back of this publication represent the kinds of soil in the survey area. They are described in this section. The descriptions together with the soil maps can be useful in determining the potential of a soil and in managing it for food and fiber production; in planning land use and developing soil resources; and in enhancing, protecting, and preserving the environment. More information for each map unit, or soil, is given in the section "Use and management of the soils."

Preceding the name of each map unit is the symbol that identifies the soil on the detailed soil maps. Each soil description includes general facts about the soil and a brief description of the soil profile. In each description, the principal hazards and limitations are indicated, and the management concerns and practices needed are discussed.

The map units on the detailed soil maps represent an area on the landscape made up mostly of the soil or soils for which the unit is named. Most of the delineations shown on the detailed soil map are phases of soil series.

Soils that have a profile that is almost alike make up a *soil series*. Except for allowable differences in texture of the surface layer or of the underlying substratum, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement in the profile. A soil series commonly is named for a town or geographic feature near the place where a soil of that series was first observed and mapped.

Soils of one series can differ in texture of the surface layer or in the underlying substratum and in slope, erosion, stoniness, salinity, wetness, or other characteristics that affect their use. On the basis of such differences, a soil series is divided into phases. The name of a *soil phase* commonly indicates a feature that affects use or management. For example, Whakana fine sandy loam, 1 to 5 percent slopes, is one of several phases within the Whakana series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes.

A *soil complex* consists of areas of two or more soils that are so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area includes some of each of the two or more dominant soils, and the pattern and proportion are somewhat similar in all areas. Whakana-Porum complex, 8 to 20 percent slopes, is an example.

Most map units include small, scattered areas of soils other than those that appear in the name of the map unit. Some of these soils have properties that differ substantially from those of the dominant soil or soils and thus could significantly affect use and management of the map unit. These soils are described in the description of each map unit. Some of the more unusual or

strongly contrasting soils that are included are identified by a special symbol on the soil map.

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

The acreage and proportionate extent of each map unit are given in table 3, and additional information on properties, limitations, capabilities, and potentials for many soil uses is given for each kind of soil in other tables in this survey. (See "Summary of tables.") Many of the terms used in describing soils are defined in the Glossary.

1—Ambia clay loam, frequently flooded. This deep, nearly level soil is on wide flood plains of streams that drain prairie and forested soils. A few, deep scour channels and sloughs are present. Slopes are slightly concave and range from 0 to 1 percent.

Typically, the surface layer is very dark grayish brown, slightly acid clay loam about 7 inches thick. Between depths of 7 and 16 inches, the soil is grayish brown, very strongly acid clay loam that has dark yellowish brown mottles. Between depths of 16 and 33 inches, the soil is dark grayish brown, strongly acid clay that has dark yellowish brown and gray mottles. Between depths of 33 and 69 inches, the soil is dark gray, medium acid clay that has dark grayish brown mottles. Between depths of 69 and 80 inches, the soil is very dark gray, neutral clay.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is very slow, and the water erosion hazard is slight. The soil is inundated 3 to 5 times per year for periods of 2 to 7 days. The seasonal high water table is at a depth of less than 1.5 feet.

Included with this soil in mapping are small areas of Guyton soils and poorly drained, gray, clayey soils. Also included are a few areas of soils protected by levees and channels; these areas flood once every 2 to 5 years. Areas of included soils are as large as 60 acres and make up less than 20 percent of any mapped area.

This soil is used mainly for pasture. The potential for pasture and hay is high. Dallisgrass, tall fescue, white clover, and singletary peas are well suited to this soil. The potential for crops is low because of flooding. Areas that can be protected from flooding have high potential for crops.

About 25 percent of the area of this soil is in hardwood timber. The potential for hardwood trees is high. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and for wetland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has low potential for urban uses and recreation because of flooding.

Capability subclass Vw; woodland group 2w; Clayey Bottomland grazing group.

2—Annona loam, 1 to 4 percent slopes. This deep, gently sloping soil is on tops and sides of ridges. Natural drainageways are common. Areas are oblong in shape and range from 5 acres to about 1,500 acres in size.

Typically, the surface layer is dark grayish brown, slightly acid loam about 4 inches thick. Between depths of 4 and 9 inches, the soil is light yellowish brown, strongly acid loam that has light grayish brown and brownish yellow mottles. Between depths of 9 and 16 inches, the soil is dark red, very strongly acid clay that has gray mottles. Between depths of 16 and 26 inches, the soil is light brownish gray, very strongly acid clay that has dark red and gray mottles. Between depths of 26 and 42 inches, the soil is gray, strongly acid clay that has dark red and yellowish brown mottles. Between depths of 42 and 55 inches, the soil is yellowish brown, slightly acid clay that has gray and reddish brown mottles. Between depths of 55 and 75 inches, the soil is mottled gray and yellowish brown, mildly alkaline clay.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is moderate if slopes are not protected. The soil is seasonally wet or droughty, and it cracks when dry. The seasonal high water table is at a depth of 2 to 4 feet.

Included with this soil in mapping are small areas of Freestone and Woodtell soils. Freestone soils are on narrow ridgetops and foot slopes near natural drainageways and on scattered circular mounds 10 to 25 feet across and 1 to 2 feet high in areas where slopes are less than 2 percent. Woodtell soils are along natural draingeways where slope is more than 4 percent. Also included are areas of Annona soils from which the surface layer was removed by erosion. Included soils make up less than 15 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is medium. Bahiagrass, tall fescue, crimson clover, arrowleaf clover, and vetch are well suited to this soil. The potential for crops is low. Low fertility, acid condition, and the droughty, clayey subsoil limit production. Growing close-spaced cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces are needed if row crops are grown. Lime is often needed.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. Potential is medium for wood-

land grazing and high for openland and woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has medium potential for most urban uses. Shrinking and swelling, low strength, corrosivity, and wetness can be partially overcome by good design and careful installation. The potential is low for recreation because of wetness and very slow permeability.

Capability subclass IIIe; woodland group 4c; Tight Sandy Loam grazing group.

3—Annona-Urban land complex, 1 to 4 percent slopes. This complex is on gently sloping ridges and side slopes. Slopes range from slightly convex to slightly concave. This complex is about 47 percent Annona soil, 43 percent Urban land, and 10 percent other soils. The parts of this complex are so intricately mixed that it is not practical to separate them at the scale of the soil map.

Typically, the Annona soil has a surface layer of dark grayish brown, slightly acid loam about 4 inches thick. Between depths of 4 and 9 inches, the soil is light yellowish brown, strongly acid loam that has light grayish brown and brownish yellow mottles. Between depths of 9 and 16 inches, the soil is dark red, very strongly acid clay that has gray mottles. Between depths of 16 and 26 inches, the soil is light brownish gray, very strongly acid clay that has dark red and gray mottles. Between depths of 26 and 42 inches, the soil is gray, strongly acid clay that has dark red and yellowish brown mottles. Between depths of 42 and 55 inches, the soil is yellowish brown, slightly acid clay that has gray and reddish brown mottles. Between depths of 55 and 75 inches, the soil is mottled gray and yellowish brown, mildly alkaline clay.

The Annona soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is moderate if slopes are not protected. The seasonal high water table is at a depth of 2 to 4 feet.

Urban land consists of works, structures, and cuts and fills. The original soils have been altered and disturbed so that they cannot be classified. The main works and structures are single-unit dwellings, sidewalks, patios, driveways, streets, apartments, shopping centers, service stations, schools, churches, and paved parking lots. Most yards are topped with 2 to 10 inches of imported loamy material.

Runoff is rapid. Water reaches major drains quickly.

Included with this complex in mapping are small areas of Freestone, Hicota, and Woodtell soils and loamy soils on narrow flood plains.

This complex has high potential for many trees, flowers, shrubs, and lawn grasses. Lime may be needed.

The complex has medium potential for most urban uses. Shrinking and swelling, low strength, corrosivity, very slow permeability, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of wetness and very slow permeability.

Not placed in a capability subclass, range site, woodland group, or grazing group.

4—Austin silty clay, 1 to 3 percent slopes. This moderately deep, gently sloping soil is on tops and sides of ridges. Areas are oblong and follow the contour of the landscape. They range from 5 acres to about 45 acres in size.

Typically, the surface layer is very dark brown, moderately alkaline silty clay about 5 inches thick. Between depths of 5 and 12 inches, the soil is very dark grayish brown, moderately alkaline silty clay. Between depths of 12 and 27 inches, the soil is brown, moderately alkaline silty clay. Between depths of 27 and 37 inches, the soil is pale brown, moderately alkaline silty clay loam that has brownish yellow and yellow mottles; 30 percent of this layer is platy chalk fragments. The underlying material is white and very pale brown platy chalk to a depth of 44 inches.

This soil is well drained. Permeability is moderately slow, and available water capacity is low. Runoff is medium, and the water erosion hazard is moderate. The soil is crumbly and is moderately difficult to work. Rooting depth is limited.

Included with this soil in mapping are small areas of Stephen soils and soils that have a noncalcareous surface layer and small amounts of carbonate clay above the underlying material. These soils are in no particular pattern. They are generally smaller than 4 acres and make up less than 20 percent of any mapped area.

This soil is used mainly for crops. The potential is medium for row crops and high for small grains and cool season legumes. Restricted rooting depth limits production of warm season crops. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces are needed if row crops are grown. The potential for pasture and hay is medium. Tall fescue, kleingrass, black medic, vetch, and singletary peas are well suited to this soil.

This soil has high potential for range and medium potential for openland and rangeland wildlife habitat. The climax plant community is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has medium potential for most urban uses. Shrinking and swelling, low strength, and depth to rock can be overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer.

Capability subclass IIIe; Clay Loam range site.

5—Belk clay. This deep, nearly level soil is on swales and low ridges on flood plains. Areas are oblong and

range from 10 to 175 acres in size. Slopes are slightly convex and are 0 to 1 percent.

Typically, the surface layer is reddish brown, moderately alkaline clay about 26 inches thick. Between depths of 26 and 73 inches, the soil is stratified reddish brown, moderately alkaline silt loam in the upper part and stratified yellowish red, moderately alkaline silt loam in the lower part.

This soil is well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil is rarely to commonly flooded. A seedbed is moderately difficult to prepare because of the clayey texture and the slow rate at which the soils dries.

Included with this soil in mapping are small areas of Redlake and Severn soils. Redlake soils are in low, slightly concave areas commonly farthest away from the river channel. Severn soils are on long, narrow, low ridges. Also included are a few small areas of Belk soils that are in low lying areas near the channel and are subject to occasional flooding. Included soils make up less than 20 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops, small grains, and alfalfa is high. Incorporating plant residue into the soil helps to maintain organic matter content and tilth. Growing deep-rooted crops helps to improve structure and permeability. The potential for pasture and hay is high. Tall fescue, johnsongrass, black medic, white clover, vetch, and singletary peas are well suited to this soil.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and for woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban uses is low because of the flood hazard. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IIIw; woodland group 2c; Clayey Bottomland grazing group.

6—Benklin silt loam. This deep, nearly level soil is along major streams on terraces above the level of flooding. Areas are long and narrow and range from 5 acres to about 350 acres in size. Slopes are slightly concave and range from 0 to 1 percent.

Typically, the surface layer is very dark grayish brown, neutral silt loam about 6 inches thick. Between depths of 6 and 18 inches, the soil is very dark brown, neutral loam. Between depths of 18 and 33 inches, the soil is very dark grayish brown, neutral loam that has dark grayish brown and brown mottles. Between depths of 33 and 41 inches, the soil is dark grayish brown, mildly alkaline clay loam that has brown and yellowish brown mottles. Between depths of 41 and 63 inches, the soil is mottled yellowish brown and grayish brown, mildly alkaline clay loam.

This soil is somewhat poorly drained. Permeability is moderately slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The seasonal high water table is at a depth of 1 foot to 3 feet. A few small areas are subject to brief flooding from runoff from adjacent uplands.

Included with this soil in mapping are small areas of Elbon, Kaufman, Lassiter, and Trinity soils in narrow drainageways. Lassiter soils are also on alluvial fans of natural drainageways. A few areas of alkali soils smaller than two acres are in some mapped areas. Included soils make up less than 12 percent of any mapped area.

About half of the area of this soil is used for crops. The potential for row crops and small grains is high. Incorporating plant residue into the soil helps to maintain organic matter content and tilth. Some areas need protection from runoff from higher lying soils. Other areas need graded drainage channels and properly laid out rows to remove excess water. Timely and limited tillage reduces compaction. The potential for pasture and hay is high. Bahiagrass, dallisgrass, improved bermudagrass, tall fescue, white clover, and singletary peas are well suited to this soil.

The potential for trees is high. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and for openland and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has medium potential for most urban uses. Wetness and low strength can be overcome by good design and careful installation. The potential for recreation is medium. Wetness restricts use during some seasons.

Capability subclass IIw; woodland group 2o; Loamy Bottomland grazing group.

7—Bernaldo fine sandy loam, 1 to 3 percent slopes. This deep, gently sloping soil is on tops and sides of ridges. Areas are irregular to oblong in shape and range from 12 to 75 acres in size.

Typically, the surface layer is brown, slightly acid fine sandy loam about 9 inches thick. Between depths of 9 and 16 inches, the soil is light yellowish brown, slightly acid fine sandy loam. Between depths of 16 and 25 inches, the soil is yellowish brown, medium acid sandy clay loam that has strong brown mottles. Between depths of 25 and 32 inches, the soil is yellowish brown, very strongly acid sandy clay loam that has strong brown and red mottles. Between depths of 32 and 65 inches, the soil is yellowish brown, very strongly acid sandy clay

loam that has light brownish gray and red mottles and vertical streaks of uncoated sand grains.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is slow, and the water erosion hazard is moderate. The seasonal high water table is at a depth of 2.5 to 5 feet. Bare areas crust after rain and are susceptible to wind erosion.

Included with this soil in mapping are small areas of Freestone soils and a few scattered areas of soils on mounds that have a fine sandy loam surface layer about 28 inches thick. Freestone soils are in slightly concave areas near small side drainageways. A few small areas of Bernaldo soils that have slopes of as much as 5 percent are also included. Included soils make up less than 15 percent of any mapped area.

Nearly all areas of this soil are used for pasture and hay. The potential for bahiagrass, lovegrass, arrowleaf clover, crimson clover, and vetch is high. The potential for crops is high. Peanuts and truck crops are well suited to this soil. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces are needed if row crops are grown. Lime is needed in some places.

The potential for trees is high. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for openland and woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has high potential for urban uses. Low strength and wetness can easily be overcome by good design and careful installation. The potential for recreation is high.

Capability subclass IIe; woodland group 2o; Sandy Loam grazing group.

8—Burleson clay, 0 to 1 percent slopes. This deep, nearly level soil is on high alluvial stream terraces and ridgetops. Undisturbed areas have gilgai microrelief. Areas are oblong and range from 8 acres to about 250 acres in size.

Typically, the surface layer is very dark gray, neutral clay about 5 inches thick. Between depths of 5 and 22 inches, the soil is black, neutral clay. Between depths of 22 and 57 inches, the soil is very dark gray, mildly alkaline clay. Between depths of 57 and 80 inches, the soil is dark gray, calcareous clay in the upper part and gray, moderately alkaline clay that has light brownish gray, light olive brown, and yellowish brown mottles in the lower part.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium. Water enters the soil rapidly when it is dry and cracked and very slowly when it is moist. Runoff is slow, and the water erosion hazard is slight. At times, flat areas remain wet and delay planting early in spring. The soil is difficult to work. A thick crust forms on the surface when dry.

Included with this soil in mapping are small areas of Houston Black and Wilson soils. These soils are in a random pattern and make up less than 12 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops is high. Growing deep rooted, soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity. Delaying cultivation a few days until the soil is dry reduces compaction. Rows should be so laid out that excess water will drain away. The potential for pasture and hay is high. Grazing when the soil is wet causes poor tilth in the surface layer. Tall fescue, white clover, arrowleaf clover, black medic, and singletary peas are well suited to this soil.

The potential for range is high. The climax plant community is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management. The potential for openland wildlife habitat is medium.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, wetness, very slow permeability, and corrosivity can be partially overcome by good design and careful installation. The potential for recreation is low. The clayey surface layer, very slow permeability, and slow runoff are limitations.

Capability subclass IIw; Blackland range site.

9—Caspiana silt loam. This deep, nearly level soil is on stream terraces. Areas are oblong and range from 20 to 350 acres in size. Slopes are plane and range from 0 to 1 percent.

Typically, the surface is dark brown, slightly acid silt loam about 10 inches thick. Between depths of 10 and 16 inches, the soil is dark reddish brown, neutral silt loam. Between depths of 16 and 19 inches, the soil is dark brown, neutral silt loam. Between depths of 19 and 48 inches, the soil is reddish brown, neutral silt loam. Between depths of 48 and 80 inches, the soil is yellowish red, neutral silt loam.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil dries early in spring, and cultivation is easy.

Included with this soil in mapping are small areas of Benklin soils. These soils are in slightly depressional areas and make up less than 10 percent of any mapped area. Also included are a few areas of soils that are fine sandy loam to a depth of about 30 inches and reddish loam below.

This soil is used mainly for crops. The potential for row crops, small grains, and alfalfa is high. Incorporating plant residue into the soil aids in maintaining tilth and productivity. Cultivation should be timely and limited. The potential for pasture and hay is high. Tall fescue, klein-

grass, vetch, arrowleaf clover, and white clover are well suited to this soil.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and for openland and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban use is medium. Shrinking and swelling and low strength can be easily overcome by good design and careful installation; however, flooding is possible under abnormal conditions. The potential for recreation is high.

Capability class I; woodland group 2o; Loamy Bottomland grazing group.

10—Crockett loam, 1 to 3 percent slopes. This deep, gently sloping soil is on tops and sides of ridges. Areas are oblong and follow the contour of the slope. They average about 50 acres in size.

Typically, the surface layer is very dark grayish brown, slightly acid loam about 8 inches thick. Between depths of 8 and 17 inches, the soil is mottled brown and reddish brown, slightly acid clay. Between depths of 17 and 29 inches, the soil is mottled light olive brown and olive, slightly acid clay. Between depths of 29 and 39 inches, the soil is olive, neutral clay that has strong brown and yellowish red mottles. Between depths of 39 and 51 inches, the soil is olive brown, mildly alkaline clay. Between depths of 51 and 59 inches, the soil is light olive brown, moderately alkaline clay loam that has grayish brown and light olive brown mottles. Between depths of 59 and 73 inches, the soil is mottled light gray and brownish yellow, moderately alkaline loam.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the water erosion hazard is moderate. The soil is seasonally wet or droughty and cracks when dry.

Included with this soil in mapping are small areas of Normangee, Parisian, and Wilson soils. Normangee soils are in eroded areas. Parisian soils are in a random pattern in areas that have never been cultivated. Wilson soils are in concave areas near drainageways and foot slopes. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is medium. Kleingrass, lovegrass, bahiagrass, ryegrass, and vetch are suited to this soil. This soil has medium potential for row crops and high potential for small grains. Low fertility and the droughty nature of this soil limit production. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain productivity and tilth. Contour farming and terraces are needed to control erosion if row crops are grown.

This soil has medium potential for range and for openland and rangeland wildlife habitat. The climax plant community is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has medium potential for most urban uses. Shrinking and swelling, low strength, and very slow permeability can be partially overcome by good design and careful installation. The potential for recreation is medium because of very slow permeability.

Capability subclass IIIe; Claypan Prairie range site.

11—Deport clay, 0 to 1 percent slopes. This deep, nearly level soil is on old stream terraces. Undisturbed areas have gilgai microrelief. Areas are irregular in shape and range from 5 acres to more than 500 acres in size.

Typically, the surface layer is dark gray, medium acid clay that is about 43 inches thick and has brownish yellow mottles in the lower part. Between depths of 43 and 65 inches, the soil is mottled gray and light brownish gray, moderately alkaline clay.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is medium. Water enters the soil rapidly when it is dry and cracked and very slowly when it is moist. Runoff is medium, and the water erosion hazard is slight. The soil is seasonally wet and is difficult to work. The seasonal high water table is at a depth of less than 2 feet. Planting is delayed on this soil early in spring. A thick crust forms on the surface when dry.

Included with this soil in mapping are small areas of Burleson and Derly soils. These soils are in no particular pattern. Areas are smaller than 3 acres and make up less than 8 percent of any mapped area.

This soil is used mainly for pasture and hay. It has medium potential for grasses and legumes. Tall fescue, bahiagrass, arrowleaf clover, and singletary peas are suited to this soil. Grazing when the soil is wet compacts the surface layer. The potential for crops is medium. Low fertility and wetness limit production. Growing deep rooted, soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity. Tillage should be timely and limited.

This soil has medium potential for range and openland wildlife habitat. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has low potential for urban uses. Shrinking and swelling, low strength, very slow permeability, corrosivity, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of seasonal wetness, clayey surface layer, and very slow permeability.

Capability subclass IIIw; Blackland range site.

12—Deport clay, 1 to 3 percent slopes. This deep, gently sloping soil is on foot slopes and sides of ridges. Undisturbed areas have gilgai microrelief. Areas are oblong and follow the contour of the slope. They range from 5 acres to about 125 acres in size.

Typically, the surface layer is dark gray, medium acid clay that is about 25 inches thick and has grayish brown and yellowish brown mottles in the lower part. Between depths of 25 and 65 inches, the soil is gray, slightly acid clay that has strong brown and light yellowish brown mottles. Between depths of 65 and 70 inches, the soil is gray, mildly alkaline shaly clay that has light yellowish brown and brownish yellow mottles.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is medium. When the surface is dry and cracked, water enters the soil rapidly. When the cracks swell shut, water enters very slowly. Runoff is slow, and the water erosion hazard is moderate. The seasonal high water table is at a depth of less than 2 feet. The soil is difficult to work. A thick crust forms on the surface layer when the soil is dry.

Included with this soil in mapping are small areas of Leson and Wilson soils. Leson soils are in a random pattern. Wilson soils are on foot slopes and near drainageways. These included soils make less than 20 percent of any mapped area. Also included are a few areas of soils that have slopes of as much as 4 percent. These soils make up as much as 30 percent of some mapped areas.

This soil is used mainly for pasture and hay. It has medium potential for pasture and hay. Tall fescue, arrowleaf clover, black medic, vetch, and singletary peas are suited to this soil. Seedbed preparation is difficult. Grazing when the soil is wet causes poor tilth in the surface layer. The potential for crops is medium. Growing cover crops, deep rooted crops, and soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity and control erosion. Contour farming and terraces are needed if row crops are grown.

This soil has medium potential for range and openland wildlife habitat. The climax plant community is tall and mid grasses. Controlled grazing, proper stocking, and brush management are management considerations.

The potential for most urban uses is low. Shrinking and swelling, low strength, corrosivity, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IIIe; Blackland range site.

13—Deport-Urban land complex, 0 to 2 percent slopes. This complex is on nearly level to gently sloping uplands. This complex is about 53 percent Deport soil, 37 percent Urban land, and 10 percent other soils. The parts of this complex are so intricately mixed that it is not practical to separate them at the scale of the soil map.

Typically, the Deport soil has a surface layer of dark gray, medium acid clay that is about 25 inches thick and has grayish brown and yellowish brown mottles in the lower part. Between depths of 25 and 65 inches, the soil is gray, slightly acid clay that has strong brown and light yellowish brown mottles. The underlying material, to a depth of 70 inches, is gray, mildly alkaline shaly clay that has light yellowish brown and brownish yellow mottles.

The Deport soil is somewhat poorly drained. Permeability is very slow, and available water capacity is medium. Runoff is medium, and the water erosion hazard is moderate. These soils crack when dry. Cultivation is difficult. The seasonal high water table is at a depth of less than 2 feet.

Urban land consists of works, structures, and cuts and fills. The original soils have been altered and disturbed so that they cannot be classified. The main works and structures are railroads, warehouses, factories, and paved parking lots. There are a few service stations and single-unit houses that have adjacent driveways, streets, and patios. Many yards are topped with 2 to 12 inches of imported loamy material.

Included with this complex in mapping are small areas of Leson and Wilson soils. Included soils make up about 10 percent of any mapped area.

The soils in this complex have medium potential for many trees, shrubs, flowers, and lawn grasses. Seedbed preparation is difficult. The potential for most urban uses is low. Shrinking and swelling, low strength, very slow permeability, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of wetness, very slow permeability, and the clayey surface layer.

Not placed in a capability subclass, range site, woodland group, or grazing group.

14—Derly silt loam, 0 to 1 percent slopes. This deep, nearly level soil is on broad, upland flats. Soils are oblong and average about 50 acres in size.

Typically, the surface layer is grayish brown, very strongly acid silt loam about 2 inches thick. Between depths of 2 and 9 inches, the soil is light gray, very strongly acid silt loam. Between depths of 9 and 13 inches, the soil is light brownish gray, very strongly acid silty clay loam that contains pockets of light gray silt loam. Between depths of 13 and 22 inches, the soil is light brownish gray, very strongly acid silty clay that contains vertical streaks of light gray silt loam. Between depths of 22 and 37 inches, the soil is grayish brown, strongly acid clay that has yellowish brown mottles. Between depths of 37 and 56 inches, the soil is grayish brown, medium acid clay that has brown mottles and dark grayish brown coats on peds. Between depths of 56 and 72 inches, the soil is grayish brown, slightly acid clay that has brown, strong brown, and light grayish brown mottles. Between depths of 73 and 80 inches, the soil is mottled light gray and light brownish gray, neutral

clay that has yellowish brown and brownish yellow mottles.

This soil is poorly drained. Permeability is very slow, and available water capacity is high. Runoff is very slow, and the water erosion hazard is slight. This soil is seasonally wet or droughty and cracks when dry.

Included with this soil in mapping are small areas of Raino soils and soils that are similar to Derly soils but that have a surface layer of silty clay loam. The Raino soils are on scattered mounds. Included soils make up less than 20 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is low. The potential for crops is low. Low fertility, wetness, acid condition, and the droughty nature of the clayey subsoil limit production.

The potential for trees is medium. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for wetland wildlife habitat. Management considerations include controlled grazing and proper stocking.

The potential for urban uses is low. Shrinking and swelling, low strength, corrosivity, and wetness can be partially overcome by good design and careful installation. This soil has low potential for recreation because of very slow permeability and seasonal wetness.

Capability subclass IIIw; woodland group 4w; Flatwoods grazing group.

15—Derly-Raino complex. This complex is on nearly level, broad ridgetops and foot slopes. Oblong mounds protrude in a random pattern. The mounds are 20 to 125 feet across, 2 to 4.5 feet high, and 5 to 300 feet apart. Areas are irregular in shape and range from 5 acres to more than 1,000 acres in size. Slopes are concave and range from 0 to 1 percent. This complex is about 69 percent Derly soil, 23 percent Raino soil, and 8 percent other soils. Areas of these soils are so small and intricately mixed that it is not practical to separate them at the scale of the soil map. The Derly soil is between the mounds in winding drainageways without channels or in shallow, ponded areas. The Raino soil is on the mounds.

Typically, the Derly soil has a surface layer of grayish brown, medium acid silt loam about 3 inches thick. Between depths of 3 and 8 inches, the soil is light brownish gray, very strongly acid silt loam that has light yellowish brown mottles. Between depths of 8 and 12 inches, the soil is light brownish gray, very strongly acid clay loam that has light olive brown mottles and pockets of light brownish gray material. Between depths of 12 and 31 inches, the soil is grayish brown, very strongly acid clay that has vertical streaks of light brownish gray silt loam. Between depths of 31 and 42 inches, the soil is grayish brown, very strongly acid clay. Between depths of 42 and 50 inches, the soil is grayish brown, strongly acid clay that has yellowish brown mottles. Between depths of 50 and 74 inches, the soil is light brownish gray, slightly acid clay that has light olive brown mottles. Between depths of 74 and 80 inches, the soil is mottled light gray and light brownish gray, neutral clay that has brownish yellow mottles.

The Derly soil is poorly drained. Permeability is very slow, and available water capacity is high. Runoff is very slow, and the water erosion hazard is slight. This soil is seasonally wet or droughty, and it cracks when dry. The seasonal high water table is at a depth of less than 1.5 feet.

Typically, the Raino soil has a surface layer of brown, medium acid fine sandy loam about 4 inches thick. Between depths of 4 and 25 inches, the soil is strong brown, very strongly acid loam. Between depths of 25 and 36 inches, the soil is light yellowish brown, very strongly acid loam that has light brownish gray, strong brown, and red mottles and pockets of uncoated sand. Between depths of 36 and 42 inches, the soil is light brownish gray, very strongly acid clay that has yellowish brown and red mottles and pockets of uncoated sand and silt. Between depths of 42 and 59 inches, the soil is light brownish gray, strongly acid clay that has yellowish brown and yellowish red mottles. Between depths of 59 and 63 inches, the soil is mottled yellowish brown and light brownish gray, medium acid clay that has yellowish red mottles.

The Raino soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The seasonal high water table is at a depth of 2 to 5 feet.

Included with this complex in mapping are small areas of Annona and Freestone soils. Annona soils are on low ridges. Freestone soils are on low ridges and foot slopes of mounds. These included soils make up less than 15 percent of any mapped area.

The soils of this complex are used mainly for pasture and hay. They have medium potential for grasses and legumes. Tall fescue, bahiagrass, lespedeza, and singletary peas are suited to these soils. These soils have low potential for crops because of low fertility, wetness, acid condition, and the droughty nature of the Derly soil. Liming the soil and draining water from between the mounds are needed in places. Returning plant residue to the soil and growing soil-improving crops help to maintain tilth and productivity.

This complex has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting trees on a planned schedule. The potential for woodland grazing and openland and woodland wildlife habitat is medium. Management considerations include controlled grazing and proper stocking.

The potential for urban use is low. Shrinking and swelling, low strength, corrosivity, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of wetness and very slow permeability.

Derly part in capability subclass IIIw; woodland group 4w; Flatwoods grazing group. Raino part in capability subclass IIIs; woodland group 3w; and Sandy Loam grazing group.

16—Desha clay. This deep, nearly level soil is in backswamps and depressional meander belts on the flood plains of major streams. Areas are broad, long and narrow, or irregular in shape and range from 10 acres to more than 300 acres in size. A drainage system has been installed in most areas. Slopes are slightly depressional and range from 0 to 1 percent.

Typically, the surface layer is dark reddish brown, mildly alkaline clay about 26 inches thick. Between depths of 26 and 70 inches, the soil is reddish brown, moderately alkaline clay.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is very slow, and the water erosion hazard is slight. Damaging overflow during the warm growing season of crops is rare. The soil is seasonally wet, and it cracks when dry. The high water table is at a depth of less than 1 foot. Water ponds on the surface after heavy rains. A seedbed is difficult to prepare because of the heavy clay texture and the slow rate at which the soil dries in spring.

Included with this soil in mapping are areas of Harjo soils. These soils are in long and narrow depressions where water ponds most of the year. Also included are a few small, narrow bands of Desha soils that have slopes of as much as 3 percent. Included soils make up less than 8 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops is high. Management considerations are removing excess water and maintaining organic matter content and tilth. The soil is easily compacted if tilled when wet. Growing deep rooted crops helps to open up the soil. The potential for pasture and hay is high. Tall fescue, white clover, burclover, vetch, and singletary peas are well suited to this soil. Grazing when the soil is wet causes poor tilth in the surface layer.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and for wetland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has low potential for urban uses. Shrinking and swelling, low strength, wetness, and flood hazard are limitations. The potential for recreation is low because of wetness and the clayey surface layer.

Capability subclass IIIw; woodland group 2w; Clayey Bottomland grazing group.

17—Elbon silty clay loam. This deep, nearly level soil is on flood plains of streams that drain loamy and clayey soils on prairies. Areas are protected from frequent flooding by levees and deep channels on the flood plains. Slopes are plane and range from 0 to 1 percent.

Typically, the surface layer is very dark grayish brown, moderately alkaline silty clay loam about 18 inches thick (fig. 5). Between depths of 18 and 41 inches, the soil is dark grayish brown, moderately alkaline clay loam that has very dark grayish brown, grayish brown, and brown very fine sandy loam bedding planes. Between depths of 41 and 61 inches, the soil is very dark gray, moderately alkaline clay that has grayish brown and brown bedding planes in the upper part.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight except for stream bank caving. These soils are rarely flooded during the warm season. During the cool season they are inundated about once every four years. The seasonal high water table is at a depth of 2.5 to 3.5 feet.

Included with this soil in mapping are small areas of Trinity and Varro soils. Trinity soils are near major streams. Varro soils are on natural levees along streams. Included soils make up less than 15 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops, legumes, and small grains is high. Growing soil-improving crops and incorporating plant residue into the soil help to maintain productivity and tilth. The potential for pasture and hay is high. Tall fescue, johnsongrass, white clover, vetch, and alfalfa are well suited to this soil.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has low potential for urban uses. Shrinking and swelling, low strength, and flooding are limitations. The potential for recreation is low because of flooding and the clayey surface layer.

Capability subclass IIw; woodland group 2c; Clayey Bottomland grazing group.

18—Elbon silty clay loam, frequently flooded. This deep, nearly level soil is on flood plains of streams that drain eroded loamy and clayey soils on uplands. Shallow scour channels are common. Slopes are plane and range from 0 to 1 percent.

Typically, the surface layer is very dark grayish brown, moderately alkaline silty clay loam that is about 21 inches thick and has thin pockets and lenses of very fine sandy loam in the lower part. Between depths of 21 and 39 inches, the soil is dark grayish brown, moderately alkaline silty clay loam that has bedding planes. Between depths of 39 and 64 inches, the soil is very dark grayish brown, moderately alkaline silty clay loam that has bedding planes. Between depths of 64 and 80 inches, the soil is dark grayish brown, moderately alkaline silty clay loam that has thin lenses of very fine sandy loam.

This soil is moderately well drained. Permeability is moderately slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil is inundated for as long as 3 days 1 to 5 times each year. Floods during the growing season of crops are common. The seasonal high water table is at a depth of 2.5 to 3.5 feet.

Included with this soil in mapping are small areas of Trinity and Varro soils. Varro soils are on natural levees near stream channels. Trinity soils are on outer edges of wide flood plains. Included soils make up less than 35 percent of any mapped area.

This soil is used for pasture and hay. The potential for grasses and legumes, such as johnsongrass, tall fescue, white clover, burclover, and singletary peas, is high. The potential for crops is low because of frequent flooding.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban uses and recreation is low because of frequent flooding.

Capability subclass Vw; woodland group 2c; Clayey Bottomland grazing group.

19—Ferris clay, 5 to 12 percent slopes, eroded. This deep, sloping to strongly sloping soil is on sides of ridges. Areas are long, irregular bands that follow the contour of the landscape and range from 5 to 150 acres in size. Nearly all areas of this soil were formerly cultivated. Erosion has removed 6 to 8 inches of the soil from the upper parts of the side slopes. Natural drainageways and uncrossable gullies 200 to 400 yards apart are common. Many gullied areas have been smoothed. Slopes are convex and range from 5 to 12 percent.

Typically, the surface layer is dark grayish brown, moderately alkaline clay about 4 inches thick. Between depths of 4 and 9 inches, the soil is light olive brown, moderately alkaline clay. Between depths of 9 and 43 inches, the soil is olive, moderately alkaline clay that has light brownish gray and light yellowish brown mottles. Between depths of 43 and 55 inches, the underlying material is pale olive, stratified shale that has pale brown mottles.

This soil is well drained. Permeability is very slow, and available water capacity is high. Water enters rapidly when the soil is dry and cracked and very slowly when it is moist. Runoff is rapid, and the water erosion hazard is severe.

Included with this soil in mapping are small areas of Heiden and Lamar soils. Heiden soils are on floot slopes. Lamar soils are on rounded points that break into wide bottom lands. Included soils make up less than 12 percent of any mapped area. Severely gullied areas of 1 to 4 acres are common in some mapped areas.

This soil is used mainly for pasture. The potential for pasture and hay is low. Seedbeds are difficult to prepare, because gullies are apt to form before the soil can be protected by vegetation. Sloping topography, past erosion, and rapid runoff limit production. The potential for crops is low.

The potential for range and openland wildlife habitat is medium. The climax vegetation is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has low potential for urban uses. Shrinking and swelling, low strength, and steep slopes can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer, very slow permeability, and steep slopes.

Capability subclass VIe; Eroded Blackland range site.

20—Freestone-Hicota complex, 0 to 3 percent slopes. This complex is on nearly level to gently sloping, broad mounded ridges. Areas are irregular in shape, and range from 12 acres to about 200 acres in size. This complex is about 63 percent Freestone soil, 24 percent Hicota soil, and 13 percent other soils. The areas of these soils are so small and so intricately mixed that it is not practical to separate them at the scale of the soil map. The Freestone soil is between the mounds. The Hicota soil is on oblong mounds that protrude in a random pattern. In uncultivated areas, these mounds are 35 to 85 feet across, 24 to 44 inches high, and 50 to 200 feet apart. In cultivated areas, the mounds have been smoothed by extensive cultivation.

Typically, the Freestone soil has a surface layer of brown, slightly acid fine sandy loam about 6 inches thick. Between depths of 6 and 16 inches, the soil is light yellowish brown, medium acid fine sandy loam. Between depths of 16 and 23 inches, the soil is yellowish brown, strongly acid loam that has strong brown mottles. Between depths of 23 and 33 inches, the soil is yellowish brown, strongly acid clay loam that has red and grayish brown mottles. Between depths of 33 and 44 inches, the soil is light gray, very strongly acid clay loam that has dark red and yellowish brown mottles; uncoated sand and silt grains are on vertical faces of peds. Between

depths of 44 and 59 inches, the soil is light brownish gray, medium acid clay that has dark red and yellowish brown mottles. Between depths of 59 and 80 inches, the soil is light brownish gray, medium acid clay loam that has olive yellow, yellowish brown, and dark red mottles.

This Freestone soil is moderately well drained. Permeability is slow, and available water capacity is medium. Runoff is slow, and the water erosion hazard is slight. The seasonal high water table is at a depth of 1 foot to 3 feet.

Typically the Hicota soil has a surface layer of brown, slightly acid very fine sandy loam about 4 inches thick. Between depths of 4 and 32 inches, the soil is light yellowish brown, medium acid very fine sandy loam. Between depths of 32 and 44 inches, the soil is yellowish brown, very strongly acid loam that has strong brown mottles; uncoated sand and silt grains are on vertical faces of peds. Between depths of 44 and 54 inches, the soil is yellowish brown, very strongly acid clay loam that has light brownish gray and red mottles. Between depths of 54 and 67 inches, the soil is gray, very strongly acid clay loam that has dark red and yellowish brown mottles. Between depths of 67 and 80 inches, the soil is light brownish gray, very strongly acid clay that has dark red and yellowish brown mottles.

This Hicota soil is moderately well drained. Permeability is slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The seasonal high water table is at a depth of 3 to 5 feet.

Included with this complex in mapping are small areas of Annona, Derly, and Raino soils. Annona soils are on low narrow ridges. Derly soils are in poorly drained, slightly depressional areas, and Raino soils are on mounds within areas of Derly soils. These included soils make up less than 30 percent of any mapped area.

This complex is used mainly for pasture and hay (fig. 6). The potential for grasses and legumes is high. Bahiagrass, tall fescue, arrowleaf clover, crimson clover, and vetch are well suited to the soils of this complex. The potential for crops is medium. Peanuts and truck crops are well suited. Low fertility and acid conditions limit production. Growing soil-improving crops and incorporating plant residue into the soil help to maintain productivity and tilth. Lime is needed in some places.

This complex has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for openland and woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This complex has high potential for most urban uses. Shrinking and swelling, low strength, corrosivity, and wetness can be overcome by good design and careful installation. The potential for recreation is medium because of wetness and slow permeability.

Freestone part in capability subclass IIe; woodland group 3w. Hicota part in capability subclass IIs; woodland group 4o. Both parts in Sandy Loam grazing group.

21—Freestone-Urban land complex, 0 to 3 percent slopes. This complex, is on nearly level to gently sloping, broad ridges. This complex is about 44 percent Freestone soil, 38 percent Urban land, and 18 percent other soils. The parts of this complex are so intricately mixed that it is not practical to separate them at the scale of the soil map.

Typically, the Freestone soil has a surface layer of brown, slightly acid fine sandy loam about 6 inches thick. Between depths of 6 and 16 inches, the soil is light yellowish brown, medium acid fine sandy loam. Between depths of 16 and 23 inches, the soil is yellowish brown, strongly acid loam that has strong brown mottles. Between depths of 23 and 33 inches, the soil is yellowish brown, strongly acid clay loam that has red and grayish brown mottles. Between depths of 33 and 44 inches, the soil is light gray, very strongly acid clay loam that has dark red and yellowish brown mottles; uncoated sand and silt grains are on vertical faces of peds. Between depths of 44 and 59 inches, the soil is light brownish gray, medium acid clay that has dark red and yellowish brown mottles. Between depths of 59 and 80 inches, the soil is light brownish gray, medium acid clay loam that has olive yellow, yellowish brown, and dark red mottles.

This soil is moderately well drained. Permeability is slow, and available water capacity is medium. Runoff is slow, and the water erosion hazard is slight. The seasonal high water table is at a depth of 1 foot to 3 feet.

Urban land consists of works, structures, and cuts and fills. The original soils have been altered and disturbed so that they cannot be classified. The main works and structures are single-unit dwellings, streets, driveways, patios, and sidewalks. Apartments, service stations, schools, shopping centers, and paved parking lots are also present.

Runoff is rapid on Urban land. Water reaches major drains quickly. Included with this complex in mapping are small areas of Annona, Bernaldo, and Hicota soils.

This complex has high potential for many trees, flowers, shrubs, and lawn grasses. Lime is needed in places.

This complex has high potential for most urban uses. Shrinking and swelling, low strength, corrosivity, and wetness can be overcome by good design and careful installation. The potential for recreation is medium because of slow permeability and wetness.

Not placed in a capability subclass range site, woodland group, or grazing group.

22—Guyton silt loam, frequently flooded. This deep, nearly level soil is on flood plains of streams that drain loamy soils on forested uplands. The flood plains are generally less than 250 yards wide. There are many

shallow scour channels and low natural levees. Slopes are concave and range from 0 to 1 percent.

Typically, the surface layer is grayish brown, medium acid silt loam that is 5 inches thick and has strong brown mottles. Between depths of 5 to 16 inches, the soil is light brownish gray, medium acid silt loam that has yellowish brown mottles. Between depths of 16 to 20 inches, the soil is grayish brown, medium acid silty clay loam that has yellowish brown and strong brown mottles and pockets of uncoated sand and silt grains. Between depths of 20 and 36 inches, the soil is light grayish brown, strongly acid silt loam that has yellowish brown mottles and pockets and vertical streaks of uncoated sand and silt grains. Between depths of 36 and 44 inches, the soil is grayish brown, strongly acid silty clay loam that has yellowish brown mottles and pockets and vertical streaks of light gray silt loam. Between depths of 44 and 72 inches, the soil is gray, slightly acid silty clay loam that has strong brown mottles and pockets of light gray silt loam.

This soil is poorly drained. Permeability is slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The seasonal high water table is at a depth of less than 1.5 feet. The soil is inundated 1 to 6 times per year for 1 to 7 days.

Included with this soil in mapping are areas of soils that have a layer of overwashed fine sandy loam or silty clay loam about 2 to 7 inches thick. Also included are areas of moderately well drained soils that have a stratified, fine sandy loam surface layer. These included soils are on narrow flood plains, natural levees, and alluvial fans of adjoining, sloping side drainageways. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is medium. Bahiagrass, tall fescue, white clover, and singletary peas are suited to this soil. Wetness and low fertility limit production. Lime is needed in some places. The potential for crops is low because of frequent flooding.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, controlling or removing inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is medium. Management considerations include proper stocking and controlled grazing.

The potential for urban uses and recreation is low because of frequent flooding.

Capability subclass Vw; woodland group 2w; Loamy Bottomland grazing group.

23—Harjo clay, frequently flooded. This deep, nearly level soil is in long winding sloughs and depressions on flood plains. Areas are long and narrow and average about 30 acres in size. Slopes are concave and range from 0 to 1 percent.

Typically, the surface layer is dark reddish gray, moderately alkaline clay about 13 inches thick. Between depths of 13 and 24 inches, the soil is reddish brown, moderately alkaline clay that has lenses of reddish brown loamy material. Between depths of 24 and 80 inches, the soil is reddish brown, moderately alkaline clay that has gray mottles.

This soil is poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. Water is on the surface or near the surface most of the year.

Included with this soil in mapping are small areas of Desha soils on the outer edges of mapped areas. Also included are soils that have loamy stratified layers above a depth of 20 inches. Included soils make up about 20 percent of mapped areas.

This soil is used for pasture and woodland. The potential for pasture and hay and for crops is low. Water is on the surface for long periods. Areas of this soil that can be successfully drained have high potential for tall fescue, white clover, and black medic.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland and wetland wildlife habitat is medium. Management considerations include proper stocking and controlled grazing.

This soil has low potential for urban uses and recreation because of frequent flooding.

Capability subclass VIIw; woodland group 4w; Clayey Bottomland grazing group.

24—Heiden clay, 2 to 5 percent slopes. This deep, gently sloping soil is on tops and sides of ridges. Undisturbed areas have gilgai microrelief. Areas are oblong and follow the contour of the slope. They range from 8 to 75 acres in size. Natural drainageways are common.

Typically, the surface layer is very dark grayish brown, moderately alkaline clay about 26 inches thick. Between depths of 26 and 48 inches, the soil is olive gray, moderately alkaline clay. Between depths of 48 and 62 inches, the soil is mottled dark grayish brown, light olive brown, and brownish yellow, moderately alkaline clay. The underlying material, which extends to a depth of about 80 inches, is stratified brownish yellow, light olive brown, and light olive gray, platy shale.

This soil is well drained. Permeability is very slow, and available water capacity is high. When this soil is dry, it cracks. Water enters the soil rapidly until the cracks swell shut. Then water enters very slowly, runoff becomes rapid, and the water erosion hazard is severe. The clayey nature of these soils makes them difficult to work. They are easily compacted if worked when too wet.

Included with this soil in mapping are small areas of Ferris, Houston Black, and Leson soils. Ferris soils are on steeper side slopes and eroded areas. Houston Black and Leson soils are in lower areas and convex areas near drainageways. Areas of these soils are generally smaller than 4 acres and make up less than 20 percent of any mapped area. A few areas are sheet eroded and rilled, and some of these areas have one or more uncrossable gullies or deeply eroded, natural drainageways.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is medium. King Ranch bluestem, johnsongrass, black medic, vetch, and singletary peas are suited to this soil. The potential for crops is medium. Row crops and small grains are suited. Rapid runoff limits productivity. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces and stable outlets are needed.

This soil has high potential for range and medium potential for openland and rangeland wildlife habitat. The climax plant community is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, very slow permeability, and the erosion hazard can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IVe; Blackland range site.

25—Heiden-Ferris complex, 3 to 5 percent slopes. This complex is on gently sloping, eroded, complex side slopes. Areas are oblong and range from 15 to 60 acres in size. This complex is about 48 percent Heiden soil, 44 percent Ferris soil, and 8 percent other soils. The areas of these soils are too intricately mixed to be separated at the scale of the soil map. The Heiden soil is on the slightly concave, lower parts of mapped areas. The Ferris soil is on steeper, convex upper parts and the bottoms of wide, parabolic-shaped, shallow gullies that are common in many areas.

Typically, the Heiden soil has a surface layer of very dark grayish brown, moderately alkaline clay about 22 inches thick. Between depths of 22 and 38 inches, the soil is dark grayish brown, moderately alkaline clay. Between depths of 38 and 58 inches, the soil is yellowish brown, moderately alkaline clay. The underlying material, to a depth of 63 inches, is stratified, light yellowish brown and light brownish gray, moderately alkaline, soft, platy shale.

This Heiden soil is well drained. Permeability is very slow, and available water capacity is high. This soil cracks when dry. Water enters the soil rapidly until the cracks swell shut. Runoff is rapid, and the water erosion hazard is severe. The clayey nature of this soil makes cultivation difficult.

Typically, the Ferris soil has a surface layer of very dark grayish brown, moderately alkaline clay about 5 inches thick. Between depths of 5 and 16 inches, the soil is dark grayish brown, moderately alkaline clay. Between depths of 16 and 42 inches, the soil is pale olive, moderately alkaline clay. Between depths of 42 and 53 inches, the underlying material is stratified light yellowish brown and light brownish gray, moderately alkaline, soft shale.

The Ferris soil is well drained. Permeability is very slow, and available water capacity is high. This soil cracks when dry. Water enters the soil rapidly until the cracks swell shut. Runoff is rapid, and the water erosion hazard is severe. The clayey nature of this soil makes cultivation difficult.

Included with this complex in mapping are small areas of Houston Black, Deport, and Leson soils. Houston Black soils are on narrow ridgetops and next to drainageways. Deport and Leson soils are in concave areas near drainageways. Included soils make up less than 14 percent of any mapped area. Gullies 1 to 5 feet deep, 8 to 65 feet wide, and 60 to 300 feet apart run the length of the slope.

This complex is used mainly for range and pasture and hay. The potential for range and openland and rangeland wildlife habitat is medium. Little of the original native vegetation is present. Meadow dropseed, threeawns, johnsongrass, and low quality bluestems are now dominant. Proper stocking, controlled grazing, and brush management are needed.

This complex has low potential for pasture and hay. The potential for crops is low. Slope, rapid runoff, and past erosion limit production.

This complex has low potential for most urban uses. Shrinking and swelling, low strength, very slow permeability, and the erosion hazard can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Heiden part in capability subclass IIIe; Blackland range site. Ferris part in capability subclass IVe; Eroded Blackland range site.

26—Houston Black clay, 0 to 1 percent slopes. This deep, nearly level soil is on broad upland flats. Undisturbed areas have gilgai microrelief. Areas are irregular in shape and range from 5 acres to more than 1,200 acres in size.

Typically, the surface layer is black, moderately alkaline clay about 22 inches thick. Between depths of 22 and 41 inches, the soil is very dark gray, moderately alkaline clay. Between depths of 41 and 72 inches, the soil is grayish brown, moderately alkaline clay that has gray and olive mottles.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Water enters rapidly when the soil is dry and cracked, but enters very slowly when it is moist. Runoff is slow, and the water erosion hazard is slight. The soil is difficult to work. Flat areas remain wet, delaying planting in spring and harvesting in fall.

Included with this soil in mapping are small areas of Burleson soils in slight depressions. These included soils make up less than 10 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops is high. Proper tillage is needed to remove excess water. Growing deep-rooted, soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity. The potential for pasture and hay is high. Tall fescue, King Ranch bluestem, johnsongrass, vetch, and singletary peas are well suited to this soil.

This soil has high potential for range and medium potential for openland and rangeland wildlife habitat. The climax vegetation is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, slow runoff, and very slow permeability can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IIw; Blackland range site.

27—Houston Black clay, 1 to 3 percent slopes. This deep, gently sloping soil is on broad ridges, sides of ridges, and long, narrow foot slopes. Undisturbed areas have gilgai microrelief. In some areas, many deep, wide gullies have formed in natural drainageways. Areas are irregular in shape and range from 8 acres to more than 1,000 acres in size.

Typically, the surface layer is very dark gray, moderately alkaline clay about 5 inches thick. Between depths of 5 and 23 inches, the soil is black, moderately alkaline clay. Between depths of 23 and 38 inches, the soil is very dark gray, moderately alkaline clay. Between depths of 38 and 51 inches, the soil is olive gray, moderately alkaline clay that has light olive brown and gray mottles. Between depths of 51 and 69 inches, the soil is light olive brown, moderately alkaline clay that has yellow and gray mottles. Between depths of 69 and 77 inches, the soil is grayish brown, moderately alkaline clay that has brownish yellow mottles. Between depths of 77 and 80 inches, the soil is brownish yellow and light brownish gray, moderately alkaline, stratified shaly clay.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Water enters rapidly when the soil is dry and cracked, and very slowly when it is moist. Runoff is medium, and the water erosion hazard is moderate. This soil is difficult to work.

Included with this soil in mapping are small areas of Leson soils in concave areas near heads of small drainageways. Also included are a few areas of soils that have slopes of as much as 4 percent. Included soils make up less than 15 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops is high. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces and stable outlets are needed if row crops are grown. The potential for pasture and hay is high. Tall fescue, King Ranch bluestem, black medic, vetch, and singletary peas are well suited to this soil.

This soil has high potential for range and medium potential for openland and rangeland wildlife habitat. The climax plant community is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, and very slow permeability can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IIe; Blackland range site.

28—Karma fine sandy loam, 0 to 1 percent slopes. This deep, nearly level soil is on low terraces along major streams. Areas are oblong and are as large as 320 acres.

Typically, the surface layer is brown, slightly acid fine sandy loam about 12 inches thick. Between depths of 12 and 34 inches, the soil is yellowish red, slightly acid sandy clay loam. Between depths of 34 and 46 inches, the soil is reddish brown, slightly acid sandy clay loam. Between depths of 46 and 73 inches, the soil is yellowish red, slightly acid fine sandy loam.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight.

Included with this soil in mapping are scattered, slightly depressional areas of soils that have a dark brown surface layer. Also included are smooth circular mounds of soils that have a fine sandy loam surface layer about 26 inches thick, and a few areas of soils that have slopes of as much as 2 percent. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops, small grains, peanuts, and truck crops is high. Growing soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. This soil has high potential for pasture and hay. Tall fescue, lovegrass, arrowleaf clover, crimson clover, and vetch are well suited to this soil.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees

on a planned schedule. The potential for woodland grazing and openland and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has high potential for most urban uses. Low strength can be easily overcome by good design and careful installation. The potential for recreation is high.

Capability class I; woodland group 3o; Sandy Loam grazing group.

29—Kaufman clay. This deep, nearly level soil is on flood plains of large streams that drain loamy and clayey soils on prairies. Areas are protected from frequent flooding by levees and deep drainage channels. Slopes are plane and range from 0 to 1 percent.

Typically, the surface layer is black, slightly acid clay about 35 inches thick. Between depths of 35 and 80 inches, the soil is very dark gray, slightly acid clay that has olive brown and dark yellowish brown mottles and intersecting slickensides.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. When these soils are dry, they crack. Water enters the soil rapidly until the cracks swell shut. Then water enters very slowly. Runoff is slow, and the water erosion hazard is slight. These soils are rarely flooded during the warm season. During the cool season, they are inundated about once every 2 to 10 years. The seasonal high water table is at a depth of less than 3.5 feet. The clayey nature of these soils makes them difficult to work. They are easily compacted if worked when too wet.

Included with this soil in mapping are a few areas of poorly drained soils that have mottled dark grayish brown and dark gray layers near the surface. Also included are small areas of brownish loamy soils. Included soils make up less than 15 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops is high. Rows should be laid out to effectively remove excess surface water in some places. Growing soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity. The potential for pasture and hay is high. Tall fescue, johnsongrass, white clover, vetch, and singletary peas are well suited to this soil.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has low potential for urban use and recreation because of the flooding hazard.

Capability subclass IIIw; woodland group 1w; Clayey Bottomland grazing group.

30—Kaufman clay, frequently flooded. This deep, nearly level soil is on flood plains of large streams that drain loamy and clayey soils on prairies. There are a few shallow scour channels. Slopes are plane and range from 0 to 1 percent.

Typically, the surface layer is very dark gray, slightly acid clay about 7 inches thick. Between depths of 7 and 24 inches, the soil is black, neutral clay. Between depths of 24 and 60 inches, the soil is very dark gray, neutral clay that has grayish and brownish mottles.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. When these soils are dry, they crack. Waters enters the soil rapidly until the cracks swell shut. Then water enters very slowly. Runoff is slow, and the water erosion hazard is slight. These soils are inundated for 1 day to 7 days 1 to 5 times each year. Most floods occur between October and May. The seasonal high water table is at a depth of less than 3.5 feet.

Included with this soil in mapping are small areas that do not flood annually, areas of soils that have a thin, calcareous surface layer, and areas of soils that have a stratified, brownish, loamy surface layer. Included soils make up less than 5 percent of mapped areas.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Tall fescue, dallisgrass, johnsongrass, white clover, and singletary peas are well suited to this soil. The potential for crops is low because of frequent flooding.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban uses and recreation is low because of frequent flooding.

Capability subclass Vw; woodland group 1w; Clayey Bottomland grazing group.

31—Lamar clay loam, 5 to 8 percent slopes. This deep, sloping soil is on breaks and pointed hillsides above large streams. Areas are irregular to elongated in shape, and follow the contour of the landscape. They range from about 20 to 130 acres in size.

Typically, the surface layer is dark grayish brown, moderately alkaline clay loam about 6 inches thick. Between depths of 6 and 44 inches, the soil is light olive brown, moderately alkaline silty clay loam. Between depths of 44 and 65 inches, the soil is mottled light yellowish brown, light brownish gray, and olive yellow, moderately alkaline silty clay loam.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the water erosion hazard is moderate.

Included with this soil in mapping are small areas of Crockett and Ferris soils. Crockett soils are on foot slopes and narrow ridgetops. Ferris soils are in concave areas near natural drainageways. Some areas have many gullies too deep to cross with machinery. Also included are a few areas of soils that have slopes of as much as 12 percent. Included soils make up less than 15 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is medium. King Ranch bluestem, lovegrass, kleingrass, black medic, and vetch are suited to this soil. The potential for crops is low. The soil is better suited to small grains and other close-spaced crops than to most other crops. Past erosion and slope limit production.

This soil has medium potential for range and openland and rangeland wildlife habitat. The climax plant community is tall grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has medium potential for urban uses. Slope, shrinking and swelling, low strength, and the water erosion hazard can be overcome by good design and careful installation. The potential for recreation is medium because of the clayey surface layer.

Capability subclass IVe; Clay Loam range site.

32—Lassiter silt loam, frequently flooded. This deep, nearly level soil is on flood plains of streams that drain loamy soils on prairies. New sediment is deposited every year. There are few to many shallow scour channels. Slopes range from 0 to 1 percent.

Typically, the surface layer is very dark grayish brown, neutral silt loam about 5 inches thick. Between depths of 5 and 28 inches, the soil is brown, neutral silt loam that has dark grayish brown and grayish brown mottles and bedding planes. Between depths of 28 and 42 inches, the soil is very dark grayish brown, slightly acid silt loam that has dark grayish brown mottles. Between depths of 42 and 72 inches, the soil is dark grayish brown, slightly acid clay loam that has grayish and brownish mottles.

This soil is moderately well drained. Permeability is moderate, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil is inundated for 1 day to 7 days 1 to 5 times per year. The seasonal high water table is at a depth of 1.5 to 3.5 feet.

Included with this soil in mapping are small areas of Guyton soils. Also included are areas of soils that have a surface layer of loam or silty clay loam. These included soils make up less than 10 percent of any mapped area.

This soil is used for pasture and hay. The potential for grasses and legumes is high. Tall fescue, dallisgrass, white clover, vetch, and singletary peas are well suited to this soil. The potential for crops is low because of frequent flooding.

The potential for trees is high. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban use and recreation is low because of frequent flooding.

Capability subclass Vw; woodland group 2w; Loamy Bottomland grazing group.

33—Leson clay, 1 to 3 percent slopes. This deep, gently sloping soil is on tops and sides of ridges. Undisturbed areas have gilgai microrelief. Areas are irregular in shape and range from 5 acres to more than 300 acres in size.

Typically, the surface layer is black, slightly acid clay about 20 inches thick. Between depths of 20 and 39 inches, the soil is very dark gray, neutral clay that has yellowish brown mottles. Between depths of 39 and 57 inches, the soil is dark grayish brown, mildly alkaline clay that has olive mottles. Between depths of 57 and 66 inches, the soil is olive, moderately alkaline clay that has brownish mottles. Between depths of 66 and 75 inches, the soil is light brownish gray and pale olive, moderately alkaline, stratified shaly clay.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. When these soils are dry, they crack. Water enters the soil rapidly until the cracks swell shut. Then water enters very slowly, runoff becomes medium, and the water erosion hazard is moderate. The clayey nature of these soils makes them difficult to work. They are easily compacted if worked when too wet.

Included with this soil in mapping are small areas of Deport, Houston Black, and Wilson soils. These soils are in a random pattern and make up less than 20 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops is high. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces and stable outlets are needed if row crops are grown. The potential for pasture and hay is high. Tall fescue, King Ranch bluestem, johnsongrass, black medic, and vetch are well suited to this soil.

This soil has high potential for range and medium potential for openland wildlife habitat. The climax plant community is dominated by tall grasses.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, very slow permeability, and corrosivity can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IIe; Blackland range site.

34—Mabank-Crockett complex, 0 to 1 percent slopes. This complex is on nearly level, broad, mounded ridgetops. Most of the mounds have been smoothed by cultivation. Areas are oval and range from 10 acres to more than 1,100 acres in size. This complex is about 57 percent Mabank soil, 36 percent Crockett soil, and 7 percent other soils. The parts of this complex are so small or intricately mixed that it is not practical to separate them at the scale of the soil map. The Mabank soil is in concave areas near heads of drainageways and in slightly depressional areas between mounds or smoothed mounds. The Crockett soil is in slightly convex areas surrounding mounds or smoothed mounds. Soils that have loamy layers, 18 to 36 inches thick, over a clay subsoil are on mounds. Mounds are 1 to 2 1/2 feet high; smooth mounds are about 1/2 to 1 1/2 feet high. All mounds are circular or somewhat eliptical and are 10 to 25 feet across.

Typically, the Mabank soil has a surface layer of dark grayish brown, slightly acid silt loam about 8 inches thick (fig. 7). Between depths of 8 and 34 inches, the soil is very dark gray, slightly acid clay. Between depths of 34 and 47 inches, the soil is dark grayish brown, neutral clay that has brownish mottles. Between depths of 47 and 61 inches, the soil is grayish brown, mildly alkaline clay that has gray and brownish mottles. Between depths of 61 and 72 inches, the soil is light brownish gray, mildly alkaline clay that has gray and brownish mottles.

This Mabank soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil is seasonally wet or droughty and cracks when dry. The seasonal high water table is at a depth of 0.6 to 1.0 foot.

Typically, the Crockett soil has a surface layer of dark grayish brown, slightly acid silt loam about 8 inches thick. Between depths of 8 and 29 inches, the soil is brown, slightly acid clay that has dark grayish brown, reddish brown, and dark brown mottles. Between depths of 29 and 44 inches, the soil is dark yellowish brown, mildly alkaline clay that has dark brown mottles. Between depths of 44 and 63 inches, the soil is mottled grayish brown and brown, mildly alkaline clay loam that has yellowish brown mottles. Between depths of 63 and 73 inches, the soil is light brownish gray, mildly alkaline clay that has yellowish brown mottles.

This Crockett soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil is seasonally wet or droughty and cracks when dry.

Included with some areas of this complex in mapping are small areas of Parisian soils on convex ridges in areas of uncultivated native prairie near mounds. A few scattered mounds and smoothed mounds are present in all areas. Included soils make up less than 7 percent of any mapped area.

This complex is used mainly for pasture and hay. The potential for grasses and legumes is high. Tall fescue, bahiagrass, arrowleaf clover, vetch, and singletary peas are suited to this soil. The potential for crops is medium. This complex is suited to peanuts. Seasonal wetness and the droughty nature of the clayey subsoil limit production. Growing soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity.

This complex has high potential for range and openland wildlife habitat. The climax plant community is dominated by tall grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This complex has low potential for most urban uses. Shrinking and swelling, low strength, very slow permeability, corrosivity, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of very slow permeability and wetness.

Mabank part in capability subclass IIIw; Claypan Prairie range site. Crockett part in capability subclass IIIs; Claypan Prairie range site.

35—Muldrow clay loam. This deep, nearly level soil is on long, narrow depressional meander belts on low terraces above flood plains of major streams. Areas average about 55 acres in size. Slopes are concave and range from 0 to 1 percent.

Typically, the surface layer is very dark grayish brown, slightly acid clay loam about 6 inches thick. Between depths of 6 and 16 inches, the soil is very dark brown, neutral clay loam. Between depths of 16 and 37 inches, the soil is very dark brown, mildly alkaline clay that has reddish brown mottles. Between depths of 37 and 48 inches, the soil is very dark grayish brown, mildly alkaline clay that has reddish brown and dark gray mottles. Between depths of 48 and 80 inches, the soil is gray, moderately alkaline silty clay loam that has brownish and grayish mottles.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The seasonal high water table is at a depth of less than 2 feet.

Included with this soil in mapping are small areas of Derly, Desha, and Raino soils. Derly soils are in areas slightly higher than Muldrow soils. Desha soils are in long, narrow bands that occur at random. Raino soils are on scattered mounds within areas of Derly soils. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Tall fescue, bahiagrass, white clover, burclover, and singletary peas are well suited to this soil. The potential for crops is high.

Rows should be laid out to effectively remove excess water in some areas. Growing soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, corrosivity, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of very slow permeability, wetness, and the clayey surface layer.

Capability subclass IIw; woodland group 2w; Clayey Bottomland grazing group.

36—Normangee clay loam, 1 to 3 percent slopes. This deep, gently sloping soil is on tops and sides of ridges. Areas are irregular in shape and range from 5 acres to more than 350 acres in size.

Typically, the surface layer is dark brown, slightly acid clay loam about 7 inches thick. Between depths of 7 and 16 inches, the soil is brown, medium acid clay that has red, reddish brown, and dark grayish brown mottles. Between depths of 16 and 28 inches, the soil is yellowish brown, neutral clay that has mottles in shades of red and brown. Between depths of 28 and 38 inches, the soil is mottled grayish brown and light olive brown, mildly alkaline clay. Between depths of 38 and 48 inches, the soil is light olive brown, moderately alkaline clay that has grayish brown mottles. Between depths of 48 and 57 inches, the soil is mottled olive, light olive brown, and yellowish brown, moderately alkaline clay. Between depths of 57 and 65 inches, the soil is light olive gray, moderately alkaline, weathered shale that has light olive brown mottles.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is medium, and the water erosion hazard is moderate. The soil is seasonally wet or droughty and cracks when dry.

Included with this soil in mapping are small areas of Crockett, Parisian, and Wilson soils. Crockett and Parisian soils are in a random pattern. Wilson soils are in concave areas near drainageways and foot slopes. Included soils make up less than 25 percent of any mapped area. Also included are a few areas of eroded Normangee soils.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Kleingrass, lovegrass, King Ranch bluestem, arrowleaf clover, and vetch are suited to this soil. The potential for crops is medium. Small grains and cool-season legumes are well suited. The droughty nature of this soil limits production of summer crops. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces are needed if row crops are grown.

This soil has medium potential for range and openland and rangeland wildlife habitat. The climax plant community is dominated by tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has medium potential for most urban uses. Shrinking and swelling, low strength, corrosivity, and very slow permeability can be partially overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IIIe; Claypan Prairie range site.

37—Normangee clay loam, 2 to 6 percent slopes, eroded. This deep, gently sloping to sloping soil is on eroded sides of ridges. Areas are oblong and follow the contour of the slope. They range from 5 acres to more than 100 acres in size. Nearly all areas of this soil were formerly cultivated. Erosion has removed the surface layer so that clayey material is exposed on about 25 percent of the acreage. In about 65 percent of the acreage, the loamy surface layer is less than 5 inches thick. The rest is not eroded. A few active gullies are present, but most can be crossed by farm equipment.

Typically, the surface layer is brown, slightly acid clay loam about 3 inches thick. Between depths of 3 and 19 inches, the soil is brown, medium acid clay that has reddish brown and dark grayish brown mottles. Between depths of 19 and 38 inches, the soil is light olive brown, neutral clay that has yellowish brown and dark grayish brown mottles. Between depths of 38 and 44 inches, the soil is mottled light olive brown and dark grayish brown, mildly alkaline clay. Between depths of 44 and 55 inches, the soil has alternating layers of light olive brown, grayish brown, and yellowish brown, mildly alkaline, platy shale.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium. Runoff is rapid, and the water erosion hazard is severe where the surface is not protected. The soil is seasonally droughty and cracks when dry.

Included with this soil in mapping are small areas of Crockett and Ferris soils. Crockett soils are on lower parts of side slopes. Ferris soils are on eroded upper parts of side slopes. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is medium. Bahiagrass, lovegrass, ryegrass, burclover, and vetch are suited to this soil. The potential for crops is low. Past erosion, slope, and the droughty nature of this soil limit production.

This soil has medium potential for range and openland and rangeland wildlife habitat. The climax plant community is tall grasses. Management considerations include controlling erosion, proper stocking, controlled grazing, and brush management.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, corrosivity, very slow permeability, and the erosion hazard are difficult to overcome. The potential for recreation is low because permeability is very slow and the surface layer is too clayey.

Capability subclass IVe; Claypan Prairie range site.

38—Norwood silt loam. This deep, nearly level soil is on flood plains of major streams. Areas are oblong and parallel large drainageways. Areas average about 50 acres. Slopes are convex and range from 0 to 1 percent.

Typically, the surface layer is reddish brown, moderately alkaline silt loam about 16 inches thick. Between depths of 16 and 65 inches, the soil is stratified reddish yellow and reddish brown, moderately alkaline silt loam that has bedding planes and thin strata of silty clay loam and very fine sandy loam.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. Flooding is occasional. The soil is easy to cultivate.

Included with this soil in mapping are small areas of Redlake soils that have a surface layer of silt loam. These soils are in narrow bands between Norwood soils and other Redlake soils. Also included are soils that are fine sandy loam and loamy fine sand below a depth of 30 inches. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops, small grains, and alfalfa is high. Incorporating plant residue into the soil helps to maintain tilth and productivity. The potential for pasture and hay is high. Kleingrass, tall fescue, white clover, vetch, and singletary peas are well suited to this soil.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing or openland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban use is low because of the flood hazard. The potential for recreation is high.

Capability class I; woodland group 2o; Loamy Bottomland grazing group.

39—Parisian silt loam, 1 to 3 percent slopes. This deep, gently sloping soil is on tops and sides of ridges. Areas are oblong and range from 10 to 950 acres in size.

Typically, the surface layer is very dark grayish brown, medium acid silt loam about 11 inches thick. Between depths of 11 and 17 inches, the soil is very dark grayish brown, medium acid silty clay loam. Between depths of 17 and 21 inches, the soil is dark grayish brown, medium acid clay that has dark red and reddish brown mottles. Between depths of 21 and 27 inches, the soil is brown, slightly acid clay that has dark grayish brown, reddish brown, and yellowish brown mottles. Between depths of 27 and 39 inches, the soil is light olive brown, neutral clay that has brown, dark grayish brown, and reddish brown mottles. Between depths of 39 and 56 inches, the soil is dark yellowish brown, neutral clay that has brown and grayish brown mottles. Between depths of 56 and 68 inches, the soil is mottled yellowish brown and grayish brown, mildly alkaline silty clay loam. Between depths of 68 and 80 inches, the soil is mottled yellowish brown, light brownish gray, and pale olive, neutral clay.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is moderate. The seasonal high water table is at a depth of 1 foot to 2 feet.

Included with this soil in mapping are small areas of Crockett, Mabank, and Normangee soils and a few scattered mounds. Crockett soils are in a random pattern. Mabank soils are in slightly depressed areas near drainageways and flat narrow ridges. Normangee soils are on steeper upper parts of side slopes and in eroded areas in cultivated fields. There are about 3 to 5 mounds per acre. Included soils make up less than 15 percent of any mapped area.

This soil is used mainly for hay. The potential for grasses and legumes is high. Kleingrass, lovegrass, arrowleaf clover, vetch, and singletary peas are well suited to this soil. The potential for crops is medium. Small grains and peanuts are well suited. The droughty nature of this soil limits production of warm-season crops. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces and stable outlets are needed if row crops are grown.

This soil has high potential for range and openland and rangeland wildlife habitat. The climax plant community is dominated by tall grasses. Management considerations include proper stocking and controlled grazing.

This soil has medium potential for most urban uses. Shrinking and swelling, low strength, very slow permeability, and wetness can be partially overcome by good design and careful installation. The potential for recreation is medium because of very slow permeability and wetness.

Capability subclass IIe; Loamy Prairie range site.

40—Redlake clay. This deep, nearly level soil is on flood plains of major streams. Areas are long and curved and range from 20 acres to more than 200 acres in size. Slopes are slightly convex and range from 0 to 1 percent.

Typically, the surface layer is dark reddish brown, moderately alkaline clay about 6 inches thick. Between depths of 6 and 45 inches, the soil is reddish brown, moderately alkaline clay. Between depths of 45 and 72 inches, the soil is reddish brown, moderately alkaline clay loam that has thin strata of clay and silt loam.

This soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. Levees and drainage channels protect most areas from flooding. A few areas near river channels flood once every 3 to 5 years during spring. The clayey nature of this soil makes it difficult to cultivate. The soil cracks when dry.

Included with this soil in mapping are areas of Belk soils. Also included are a few areas of Redlake soils that have a loamy surface layer. These included soils make up less than 20 percent of any mapped area.

This soil is used mainly for crops. The potential for row crops, small grains, and alfalfa is high. Growing deep rooted, soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity. The potential for pasture and hay is high. Tall fescue, johnsongrass, white clover, black medic, and vetch are well suited to this soil.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from the fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has low potential for most urban uses because of the flood hazard. The potential for recreation is low because of the clayey surface layer and very slow permeability.

Capability subclass IIIw; woodland group 3w; Clayey Bottomland grazing group.

41—Roxton clay, frequently flooded. This deep, nearly level soil is on flood plains of large creeks that drain clayey soils on prairies. Many narrow scour channels and depressions are ponded most of the year. Slopes are complex and range from 0 to 1 percent.

Typically, the surface layer is very dark gray, mildly alkaline clay about 18 inches thick. Between depths of 18 and 29 inches, the soil is dark gray, neutral clay that has strong brown and dark yellowish brown mottles. Between depths of 29 and 43 inches, the soil is mottled dark gray and grayish brown, slightly acid silty clay that has yellowish brown mottles. Between depths of 43 and 64 inches, the soil is very dark gray, strongly acid clay loam that has dark yellowish brown mottles.

This soil is poorly drained. Permeability is very slow, and available water capacity is high. Runoff is very slow, and the water erosion hazard is slight. The soil is flooded 1 to 4 times each year between October and May. The soil is inundated 1 to 6 days during each flood. The seasonal high water table is at a depth of less than 2 feet.

Included with this soil in mapping are areas of soils that have a dark colored surface layer less than 10 inches thick. These soils are in depressions. A few small areas of brownish loamy soils bordering sloping uplands are included. Included soils make up less than 10 percent of the map unit.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Tall fescue, dallisgrass, johnsongrass, white clover, and singletary peas are suited to this soil. The potential for crops is low because of frequent flooding.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and wetland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban uses and recreation is low because of flooding. Capability subclass Vw; woodland group 3w; Clayey Bottomland grazing group.

42—Severn very fine sandy loam. This deep, nearly level to gently sloping soil is on low ridges and swales on the flood plains of major streams. Areas are oblong and parallel the stream channel. A few long, narrow, steep bands separate areas on benches. Slopes are convex and range from 0 to 2 percent.

Typically, the surface layer is reddish brown, moderately alkaline very fine sandy loam about 4 inches thick. Between depths of 4 and 63 inches, the soil is reddish brown, moderately alkaline very fine sandy loam that has thin strata of loam and many bedding planes.

This soil is well drained. Permeability is moderately rapid, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight except in areas subject to streambank caving. The soil is flooded once every 10 to 20 years.

Included with this soil in mapping are small areas of Kiomatia soils and Severn soils that have a surface layer of silty clay loam. Kiomatia soils are on low ridges and Severn soils are in the bottoms of swales. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Tall fescue, lovegrass, kleingrass, white clover, and vetch are well suited to this soil. The potential for crops is high. Small grains are well suited. Growing cover crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suit-

able species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland and openland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has low potential for most urban uses because of the flood hazard. The potential for recreation is high.

Capability class I; woodland group 2o; Loamy Bottomland grazing group.

43—Severn silty clay loam, overwash. This deep, nearly level to gently sloping soil is on swales and low ridges on flood plains of major streams. Silty clay loam sediment has been deposited on the surface by slow-moving floodwaters. Areas are oblong and parallel the stream channel. Slopes are complex and range from 0 to 3 percent.

Typically, the surface layer is reddish brown, moderately alkaline silty clay loam about 8 inches thick. Between depths of 8 and 65 inches, the soil is reddish brown, moderately alkaline very fine sandy loam that has many thin bedding planes and strata of silt loam and silty clay loam.

This soil is well drained. Permeability is moderately rapid and available water capacity is high. Runoff is slow, and the water erosion hazard is slight, except in areas subject to streambank caving. This soil is flooded once every 10 to 20 years.

Included with this soil in mapping are small areas of Belk, Harjo, and Kiomatia soils. Belk soils are in long, narrow bands in the bottoms of swales. Harjo soils are in depressed, ponded areas. Kiomatia soils are on tops of low ridges. These included soils make up less than 20 percent of any mapped area.

This soil is used dominantly for pasture and hay. The potential for grasses and legumes is high. Kleingrass, lovegrass, tall fescue, white clover, and vetch are well suited to this soil. The potential for crops is high. Small grains are well suited. Incorporating plant residue into the soil helps to maintain tilth and productivity.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and openland and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

The potential for urban uses is low because of the flooding hazard. The potential for recreation is medium because of flooding.

Capability class I; woodland group 2o; Loamy Bottomland grazing group.

44—Severn-Kiomatia complex, frequently flooded. This complex is on nearly level to gently sloping flood plains of major streams. Areas are a series of long narrow ridges, swales, and benches. These areas are 6 to 12 feet higher than normal stream flow and range from 35 to 600 acres in size. Slopes are complex and range from 0 to 5 percent. This complex is about 55 percent Severn soil, 35 percent Kiomatia soil, and 10 percent other soils. The areas of these soils are so intricately mixed that it is not practical to separate them at the scale of the soil map. The Severn soil is on higher elevations farthest from the river channel. The Kiomatia soil is on long, narrow ridgetops and lower elevations nearest to the river channel.

Typically, the Severn soil has a surface layer of reddish brown, moderately alkaline silt loam about 4 inches thick. Between depths of 4 and 63 inches, the soil is reddish yellow, moderately alkaline loamy very fine sand that has thin strata of loamy fine sand and very fine sandy loam.

This Severn soil is well drained. Permeability is moderately rapid, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight except in areas subject to streambank caving. This soil is flooded 1 to 3 times per year for periods of 2 to 10 days. New sediment is commonly deposited during floods. A high water table is above a depth of 60 inches during the cool season.

Typically, the Kiomatia soil has a surface layer of brown, moderately alkaline loamy fine sand about 4 inches thick. Between depths of 4 and 18 inches, the soil is reddish brown, moderately alkaline loamy fine sand that has thin strata of fine sand. Between depths of 18 and 60 inches, the soil is light brown, moderately alkaline fine sand that has many bedding planes and thin strata of silty clay loam.

This Kiomatia soil is well drained. Permeability is rapid, and available water capacity is low. Runoff is slow, and the water erosion hazard is slight except in areas that are subject to streambank caving. The soil is flooded 1 to 3 times per year for periods of 2 to 10 days. New deposits of sediment are received each year. The seasonal high water table is at a depth of 3 to 5 feet.

Included with this complex in mapping are small areas of Belk, Harjo, and Norwood soils. These soils are in the bottoms of some swales. Harjo soils are ponded. Included soils make up less than 25 percent of any mapped area.

This complex is used mainly for woodland grazing. It has high potential for understory vegetation and medium potential for woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

The potential for trees is high. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule.

This complex has high potential for pasture and hay. Kleingrass, lovegrass, tall fescue, white clover, and crimson clover are suited to this soil. The potential for crops is low because of frequent flooding.

This complex has low potential for urban use and recreation because of the flood hazard.

Severn part in capability subclass Vw; woodland group 2o; Loamy Bottomland grazing group. Kiomatia part in capability subclass Vw; woodland group 2w; Sandy Bottomland grazing group.

45—Stephen silty clay, 1 to 3 percent slopes. This very shallow to shallow, gently sloping soil is on tops and sides of ridges. Areas are irregular in shape and range from 5 to 45 acres in size.

Typically, the surface layer is very dark brown, moderately alkaline silty clay about 7 inches thick. Between depths of 7 and 13 inches, the soil is about 60 percent chalk fragments and 40 percent very dark grayish brown, moderately alkaline silty clay. Between depths of 13 and 28 inches, the underlying material is white and very pale brown, platy chalk (fig. 8).

This soil is well drained. Permeability is moderately slow, and available water capacity is very low. Runoff is medium, and the water erosion hazard is moderate. The rooting depth is limited.

Included with this soil in mapping are small areas of Austin and Eddy soils, soils that are less limy than this Stephen soil, and soils that are underlain by narrow bands of hard limestone. Austin soils are in slightly concave areas near foot slopes and heads of drainageways. Eddy soils are in steeper, eroded, convex areas. The less limy soils are in a random pattern. Included soils make up less than 20 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is low, but King Ranch bluestem, johnsongrass, black medic, vetch, and singletary peas will grow. The potential for crops is low. Restricted rooting depth limits production.

This soil has medium potential for range and openland and rangeland wildlife habitat. The climax plant community is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has medium potential for most urban uses. Shrinking and swelling, low strength, and depth to rock can be overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and depth to rock.

Capability subclass IIIe; Chalky Ridge range site.

46—Stephen-Eddy complex, 2 to 5 percent slopes. This complex is on gently sloping tops and sides of ridges. Areas are oblong in shape and range from 8 acres to more than 100 acres in size. This complex is about 50 percent Stephen soil, 34 percent Eddy soil, and 16 percent other soils. Areas of these soils are so small and intricately mixed that it is not practical to separate them at the scale of the soil map. The Stephen soil is on lower parts. Eddy soil is on higher parts in eroded areas.

Typically, the Stephen soil has a surface layer of dark brown, moderately alkaline silty clay about 12 inches thick. Between depths of 12 and 15 inches, the soil is about 65 percent platy chalk fragments and 35 percent dark brown, moderately alkaline silty clay. Between depths of 15 and 28 inches, the underlying material is white and very pale brown chalk.

This Stephen soil is well drained. Permeability is moderately slow, and available water capacity is very low. Runoff is medium, and the water erosion hazard is moderate. The rooting depth is limited.

Typically, the Eddy soil has a surface layer of brown, moderately alkaline gravelly clay loam about 6 inches thick. Between depths of 6 and 10 inches, the soil is about 70 percent platy chalk fragments and 30 percent brown, moderately alkaline clay loam. The underlying material, between depths of 10 and 28 inches, is white, platy chalk (fig. 9).

This Eddy soil is well drained. Permeability is moderately slow, and available water capacity is very low. Runoff is medium, and the water erosion hazard is moderate. The rooting depth is limited.

Included with this complex in mapping are small areas of Austin soils, areas of bare chalk, and chalk and limestone ledges. Austin soils are on foot slopes and in slightly concave areas near heads of drainageways. In some formerly cultivated areas as large as 1 acre, erosion has removed all of the soil material and has exposed areas of chalk bedrock. Also included are timbered chalk and limestone ledges about 6 to 12 feet high, 20 to 50 feet wide, and 1/3 to more than 1 mile long. These included areas make up less than 25 percent of any mapped area.

This complex is used mainly for pasture and hay. It has low potential for grasses and legumes, but King Ranch bluestem, johnsongrass, black medic, vetch, and singletary peas will grow. The potential for crops is low. Restricted rooting depth, past erosion, and slope limit production.

This complex has low potential for range and rangeland wildlife habitat. The climax plant community is tall and mid grasses and scattered trees. Management considerations include erosion control, proper stocking, controlled grazing, and brush management.

This complex has medium potential for most urban uses. Shrinking and swelling, low strength, and depth to rock can be overcome by good design and careful installation. The potential for recreation is low because of the clayey surface layer and depth to rock.

Stephen part in capability subclass IVe; Chalky Ridge range site. Eddy part in capability subclass VIe; Chalky Ridge range site.

47—Trinity clay. This deep, nearly level soil is on wide flood plains of streams that drain clayey soils on prairies. Areas are protected from frequent flooding by levees and deep drainage channels. Slopes are plane and range from 0 to 1 percent.

Typically, the surface layer is very dark gray, moderately alkaline clay about 29 inches thick. Between depths of 29 and 72 inches, the soil is black, moderately alkaline clay.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. When these soils are dry they crack. Water enters the soil rapidly until the cracks swell shut. Then water enters very slowly. Runoff is very slow, and the water erosion hazard is slight except in areas subject to streambank caving. These soils are rarely flooded during the warm season. During the cool season they are inundated about once every 2 to 10 years. The seasonal high water table is at a depth of less than 3 feet. These soils dry slowly in spring, and cultivation is delayed. The clayey nature of these soils makes them difficult to work. They are easily compacted if worked when too wet.

Included with this soil in mapping are areas of brown silty clay loam soils and areas of calcareous overwash less than 20 inches deep. Also included are a few shallow sloughs that carry floodwater. Included soils make up less than 5 percent of the map unit.

This soil is used chiefly for crops. The potential for row crops is high. Growing deep rooted, soil-improving crops and incorporating plant residue into the soil help to maintain tilth and productivity. Rows should be laid out to effectively remove excess surface water from some places. The potential for pasture and hay is high. Tall fescue, johnsongrass, white clover, and singletary peas are well suited to this soil.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential for woodland grazing and woodland wildlife habitat is high. Management considerations include proper stocking and controlled grazing.

This soil has low potential for urban use and recreation because of the flooding hazard.

Capability subclass IIw; woodland group 1w; Clayey Bottomland grazing group.

48—Trinity clay, frequently flooded. This deep, nearly level soil is on wide flood plains of streams that drain clayey soils on prairies. The surface of most areas is marked by partly-filled old stream and scour channels. Many areas are scoured, and other areas receive thin deposits of sediment. New channels are being formed where the natural levees along the old channel are higher than the flood-plain edges. Slopes are plane and range from 0 to 1 percent.

Typically, the surface layer is very dark gray, moderately alkaline clay about 19 inches thick. Between depths of 19 and 38 inches, the soil is black, moderately alkaline clay that has dark grayish brown mottles. Between depths of 38 and 62 inches, the soil is very dark gray, moderately alkaline clay that has dark grayish brown mottles.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. The soil cracks when dry. Water enters the soil rapidly until the cracks swell shut. Then water enters very slowly. Runoff is very slow, and the water erosion hazard is slight except in areas subject to streambank caving. These soils are inundated 1 to 5 times per year for periods of 1 to 7 days. Flooding mainly occurs during the cool season. The seasonal high water table is at a depth of less than 3 feet.

Included with this soil in mapping are small areas of Elbon and Varro soils. These soils are on natural levees along stream channels and fans bordering hillsides. Included soils make up less than 10 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Tall fescue, johnsongrass, white clover, and singletary peas are well suited to this soil. The potential for crops is low because of frequent flooding.

This soil has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential is high for woodland grazing and medium for woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has low potential for urban use and recreation because of the flood hazard.

Capability unit Vw; woodland group 1w; Clayey Bottomland grazing group.

49—Urban land. This map unit consists of the business district of Paris. About 85 percent of the area is covered by pavement and industrial, commerical, government, and church buildings.

Virtually all of the rainfall runs off. Rainwater reaches major drainageways quickly.

Installation of works and structures has so altered and obscured the original soils that they no longer resemble soils described in the various series. Where the natural soil is exposed or is covered by suitable fill material, Urban land is well suited to lawn grasses, trees, and shrubs.

Not placed in a capability subclass, range site, woodland group, or grazing group.

50—Varro clay loam, frequently flooded. This deep, nearly level soil is on flood plains of streams that receive

sediment from each overflow. Eroded prairie uplands, eroded geologic strata from bottoms of deeply cut stream channels, and eroded streambanks contribute sediment in which these soils form. Flooding leaves the surface uneven. Low ridges and shallow scour channels are numerous. Slopes range from 0 to 1 percent.

Typically, the soil is stratified, dark grayish brown, grayish brown, light brownish gray, and very dark grayish brown, moderately alkaline clay loam to a depth of 60 inches.

This soil is well drained. Permeability is moderate, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil is inundated 2 to 3 times per year for periods of 2 to 7 days. Most floods occur from October to May. The seasonal high water table is at a depth of 5 to 6 feet.

Included with this soil in mapping are small areas of Trinity soils in long, narrow, poorly drained areas bordering uplands. These included soils make up less than 5 percent of any mapped area.

This soil is used mainly for timber and grazing. It has high potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule.

The potential is high for woodland grazing and woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has high potential for pasture and hay. Tall fescue, johnsongrass, white clover, vetch, and singletary peas are well suited to this soil. The potential for crops is low. Sediment damage from large floods is severe.

This soil has low potential for urban uses or recreation because of the flood hazard.

Capability subclass Vw; woodland group 1w; Loamy Bottomland grazing group.

51—Whakana fine sandy loam, 1 to 5 percent slopes. This deep, gently sloping soil is on high terraces of major streams. Areas are irregular in shape and average about 15 acres in size.

Typically, the surface layer is brown, medium acid fine sandy loam about 15 inches thick. Between depths of 15 and 25 inches, the soil is red, very strongly acid clay loam. Between depths of 25 and 42 inches, the soil is yellowish red, very strongly acid clay loam that has vertical streaks of uncoated sand grains. Between depths of 42 and 80 inches, the soil is very strongly acid sandy clay loam that has vertical streaks of uncoated sand grains; the upper part is red and the lower part is yellowish red.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is slow, and the water erosion hazard is moderate.

Included with this soil in mapping are small areas of Bernaldo soils. These soils are in concave areas near drainageways and foot slopes. Also included are areas of soils that have a fine sandy loam surface layer that is more than 20 inches thick. These soils are along old fence rows and on scattered circular mounds that have a surface layer as much as 34 inches thick in uncultivated areas; the underlying soil material is similar to that of the Whakana soils. Included soils make up less than 30 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Tall fescue, improved bermudagrass, bahiagrass, lovegrass, arrowleaf clover, and vetch are well suited to this soil. The potential for crops is high. Peanuts, truck crops, and small grains are well suited. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Lime is needed in some areas. Terraces and stable outlets are needed if row crops are grown.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for openland and woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has high potential for most urban uses. Shrinking and swelling, low strength, and corrosivity can easily be overcome by good design and careful installation. The potential for recreation is high.

Capability subclass IIIe; woodland group 3o; Sandy Loam grazing group.

52—Whakana fine sandy loam, 5 to 12 percent slopes. This deep, sloping to strongly sloping soil is on high dissected terraces of major streams. A few uncrossable gullies and natural drainageways are present. Areas are oblong and follow the contour of the slope. Areas range from 10 to 80 acres in size.

Typically, the surface layer is brown, medium acid fine sandy loam about 10 inches thick. Between depths of 10 and 37 inches, the soil is yellowish red, very strongly acid clay loam. Between depths of 37 and 80 inches, the soil is yellowish red, very strongly acid sandy clay loam that has vertical streaks of uncoated sand grains.

This soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the water erosion hazard is severe.

Included with this soil in mapping are small areas of Karma and Porum soils. Karma soils are in a random pattern, and Porum soils are near heads of drainageways. Also included are a few, scattered, 1- to 8-acre areas that have a 20- to 34-inch fine sandy loam surface layer and reddish sandy clay loam lower layers. Included soils make up less than 20 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential for grasses and legumes is high. Bahiagrass,

lovegrass, arrowleaf clover, crimson clover, and vetch are well suited to this soil. The potential for crops is low. Slope, the erosion hazard, and low fertility limit production and choice of crops.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for openland and woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has medium potential for most urban uses. Slope, the erosion hazard, and corrosivity can be overcome by good design and careful installation. The potential is medium for recreation because of slope and the erosion hazard.

Capability subclass IVe; woodland group 3o; Sandy Loam grazing group.

53—Whakana-Porum complex, 8 to 20 percent slopes. This complex is on strongly sloping to moderately steep, dissected, high terraces of major streams. Natural drainageways are common. Areas are oblong and follow the contour of the slope. They average about 200 acres in size. This complex is about 40 percent Whakana soil, 40 percent Porum soil, and 20 percent other soils. The areas of these soils are so intricately mixed that it is not practical to separate them at the scale of the soil map. The Whakana soil is on rounded points of ridges and in convex areas between drainageways. The Porum soil is in convex areas near drainageways and in a random pattern in areas of exposed clayey sediment.

Typically, the Whakana soil has a surface layer of brown, medium acid fine sandy loam about 10 inches thick. Between depths of 10 and 31 inches, the soil is red, very strongly acid sandy clay loam. Between depths of 31 and 72 inches, the soil is red, very strongly acid sandy clay loam that has vertical streaks of uncoated sand grains.

This Whakana soil is well drained. Permeability is moderate, and available water capacity is medium. Runoff is medium, and the water erosion hazard is severe.

Typically, the Porum soil has a surface layer of dark grayish brown, medium acid fine sandy loam about 3 inches thick. Between depths of 3 to 7 inches, the soil is pale brown, medium acid fine sandy loam. Between depths of 7 and 17 inches, the soil is red, very strongly acid clay that has strong brown mottles. Between depths of 17 and 31 inches, the soil is yellowish red, very strongly acid clay that has strong brown and light gray mottles. Between depths of 31 and 42 inches, the soil is yellowish red, strongly acid sandy clay loam that has gray, strong brown, and red mottles. Between depths of 42 and 65 inches, the soil is strong brown, medium acid sandy clay loam that has light gray and yellowish red mottles and vertical streaks of uncoated sand grains.

This Porum soil is moderately well drained. Permeability is very slow, and available water capacity is high. Runoff is rapid, and the water erosion hazard is severe. The seasonal high water table is at a depth of 2 to 3 feet.

Included with this complex in mapping are small areas of Karma and Woodtell soils; soils that have a sandy loam surface layer more than 20 inches thick; reddish, moderately alkaline, clayey soils; and eroded soils. Karma soils and soils that have a fine sandy loam surface layer are in a random pattern. Woodtell soils are in random areas that do not have terrace deposits. The reddish, moderately alkaline, clayey soils are at the heads of steep drainageways and on upper parts of side slopes. In formerly cultivated areas, erosion has exposed the subsoil in places and left a few scattered gullies that cannot be crossed with farm machinery. Included soils make up less than 30 percent of any mapped area.

This complex is used mainly for timber and grazing. It has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, planting suitable species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This complex has low potential for pasture and hay. The potential for crops is low. Slope, the severe erosion hazard, and low fertility limit production.

This complex has low potential for most urban uses. Shrinking and swelling, low strength, the severe erosion hazard, and slope can be partially overcome by good design and careful installation. The potential is low for recreation because of very slow permeability and slope.

Whakana part in capability subclass VIe; woodland group 3o; Sandy Loam grazing group. Porum soil in capability subclass VIe; woodland group 4c; Sandy Loam grazing group.

54—Wilson silt loam, 0 to 2 percent slopes. This deep, nearly level to gently sloping soil is on ridgetops and foot slopes. Areas are oblong and range from 5 acres to more than 150 acres in size.

Typically, the surface layer is very dark gray, slightly acid silt loam about 6 inches thick. Between depths of 6 and 9 inches, the soil is very dark gray, medium acid clay loam. Between depths of 9 and 28 inches, the soil is very dark gray, slightly acid clay. Between depths of 28 and 39 inches, the soil is dark gray, neutral clay. Between depths of 39 and 80 inches, the soil is grayish brown, mildly alkaline clay that has light olive brown and olive yellow mottles.

This soil is somewhat poorly drained. Permeability is very slow, and available water capacity is high. Runoff is slow, and the water erosion hazard is slight. The soil is seasonally wet or droughty and cracks when dry. The

seasonal high water table is at a depth of less than 1 foot. A thick crust forms on the surface when dry.

Included with this soil in mapping are small areas of Crockett, Deport, Burleson, and Mabank soils. Some areas of Wilson soils that have a surface layer of loam, clay loam, or silty clay loam are also included. A combination of all these textures, including silt loam, is common in some areas. Included soils make up less than 18 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential is high for grasses and legumes. King Ranch bluestem, tall fescue, ryegrass, arrowleaf clover, johnsongrass, and singletary peas are suited to this soil. The potential is medium for crops. Seasonal wetness and the droughty nature of this soil limit production. Growing cover crops and soil-improving crops and incorporating plant residue into the soil help to control erosion and maintain tilth and productivity. Terraces and stable outlets are needed on sloping areas if row crops are grown.

This soil has medium potential for range and openland and rangeland wildlife habitat. The climax vegetation is tall and mid grasses. Management considerations include proper stocking, controlled grazing, and brush management.

This soil has low potential for most urban uses. Shrinking and swelling, low strength, very slow permeability, and wetness can be partially overcome by good design and careful installation. The potential for recreation is low because of very slow permeability and wetness.

Capability subclass IIIw; Claypan Prairie range site.

55—Woodtell loam, 5 to 12 percent slopes. This deep, sloping to strongly sloping soil is on sides of ridges. Natural drainageways are common. Areas are oblong and follow the contour of the slope. They average about 85 acres in size.

Typically, the surface layer is very dark grayish brown, slightly acid loam about 4 inches thick. Between depths of 4 and 12 inches, the soil is yellowish red, very strongly acid clay that has light olive brown and light brownish gray mottles. Between depths of 12 and 26 inches, the soil is red, very strongly acid clay that has light brownish gray and light olive brown mottles. Between depths of 26 and 41 inches, the soil is mottled red and light gray, very strongly acid clay. Between depths of 41 and 51 inches, the soil is light brownish gray, very strongly acid clay that has light yellowish brown and light olive brown mottles. Between depths of 51 and 63 inches, the soil is stratified grayish brown, partially weathered shale and clay that has yellowish brown mottles.

This soil is moderately well drained. Permeability is very slow, and available water capacity is medium. Runoff is rapid, and the water erosion hazard is severe. This soil is seasonally droughty and cracks when dry. The seasonal high water table is at a depth of 1.5 to 4 feet.

Included with this soil in mapping are small areas of Annona and Porum soils and soils that have moderately alkaline lower layers. Annona soils are on foot slopes and in concave areas near heads of drainageways. Porum soils are on remnants of terrace deposits. Soils that have moderately alkaline lower layers are in a random pattern. Many areas of Woodtell soils that have sandy loam, sandy clay loam, loam, or clay loam layers below a depth of 30 inches are also included. Included soils make up less than 25 percent of any mapped area.

This soil is used mainly for pasture and hay. The potential is low for grasses and legumes. The potential for crops is low. Slope, the severe erosion hazard, low natural fertility, and the droughty nature of this soil limit production.

This soil has medium potential for trees. Wooded areas can be maintained or improved by protecting them from fire, removing or controlling inferior species, and selectively harvesting the trees on a planned schedule. The potential is medium for woodland grazing and high for woodland wildlife habitat. Management considerations include proper stocking and controlled grazing.

This soil has low potential for most urban uses (fig. 10). Shrinking and swelling, low strength, wetness, the erosion hazard, and corrosivity can be partially overcome by good design and careful installation. The potential for recreation is low because of very slow permeability and slope.

Capability subclass VIe; woodland group 4c; Tight Sandy Loam grazing group.

Use and management of the soils

The soil survey is a detailed inventory and evaluation of the most basic resource of the survey area—the soil. It is useful in adjusting land use, including urbanization, to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in uses of the land.

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic tank disposal systems, and other factors affecting the productivity, potential, and limitations of the soils under various uses and management. In this way, field experience and measured data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section is useful in planning use and management of soils for crops and pasture, rangeland, and woodland; as sites for buildings, highways and other transportation systems, sanitary facilities, and parks and other recreation facilities; and for wildlife habitat. From the data presented, the potential of each soil for speci-

fied land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

Planners and others using the soil survey can evaluate the impact of specific land uses on the overall productivity of the survey area or other broad planning area and on the environment. Productivity and the environment are closely related to the nature of the soil. Plans should maintain or create a land-use pattern in harmony with the natural soil.

Contractors can find information that is useful in locating sources of sand and gravel, roadfill, and topsoil. Other information indicates the presence of bedrock, wetness, or very firm soil horizons that cause difficulty in excavation.

Health officials, highway officials, engineers, and many other specialists also can find useful information in this soil survey. The safe disposal of wastes, for example, is closely related to properties of the soil. Pavements, sidewalks, campsites, playgrounds, lawns, and trees and shrubs are influenced by the nature of the soil.

Crops, pasture, and hay

Alfred L. Pace, agronomist, Soil Conservation Service, helped to prepare this section.

The major management concerns in the use of the soils for crops and pasture are described in this section. In addition, the crops or pasture plants best suited to the soil, including some not commonly grown in the survey area, are discussed; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are presented for each soil.

This section provides information about the overall agricultural potential of the survey area and about the management practices that are needed. The information is useful to equipment dealers, land improvement contractors, fertilizer companies, processing companies, planners, conservationists, and others. For each kind of soil, information about management is presented in the section "Soil maps for detailed planning." Planners of management systems for individual fields or farms should also consider the detailed information given in the description of each soil.

More than 570,000 acres in the survey area was used for crops and pasture in 1967 (*4*). Of this, 322,117 acres was used for pasture and hay; 84,784 acres for row crops, mainly cotton, grain sorghum, and soybeans; 43,336 acres for close-grown crops, mainly wheat, oats, and legumes; 64,295 acres for hay and rotation hay and pasture; and 40,719 acres for conservation use. The rest was idle cropland.

The potential of the soils in Lamar and Delta Counties for increased production of food is high. About 270,902 acres of potentially good to fair cropland is currently used for pasture and hay, about 51,684 acres for woodland, and about 18,208 acres for range. In addition to the reserve productive capacity represented by this land, food production could also be increased considerably by extending the latest crop production technology to all cropland in the counties. This soil survey can greatly facilitate the application of such technology.

Land use is constantly changing in Lamar and Delta Counties. Woodland and cropland are being used for pasture and hay and for range, and pasture and hayland are returning to crops. The area in Urban land and water is gradually increasing. The use of this soil survey to help make land use decisions that will influence the future role of farming in the county is discussed in the section "General soil map for broad land use planning."

Soil erosion is the major soil problem on about 60 percent of the land used for crop and pasture and hay in Lamar and Delta Counties. If slope is more than 1 percent, erosion is a hazard. Annona, Crockett, Deport, Heiden, Houston Black, and Leson soils, for example, have slopes of 1 to 5 percent.

Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Loss of the surface layer is especially damaging on soils that have a clayey subsoil, such as Annona, Crockett, and Normangee soils, and on soils in which bedrock limits the root zone, such as Austin, Eddy, and Stephen soils. Erosion also reduces productivity on soils that tend to be droughty, such as Crockett and Normangee soils. Second, soil erosion on farmland results in sediment entering streams. Controlling erosion minimizes the pollution of streams by sediment and improves quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, preparing a good seedbed and tilling are difficult on clayey or hardpan spots, which have been exposed because the original friable surface layer has been eroded away. Clayey spots are common in areas of moderately eroded Normangee soils.

Erosion is controlled by providing protecting surface cover, reducing runoff, and increasing infiltration. A cropping system that keeps a plant cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soil. On livestock farms, which require pasture and hay, the legume and grass forage crops reduce erosion on sloping land and also provide nitrogen and improve tilth for the following crop.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are most practical on deep soils that have regular slopes. Most deep, sloping soils in Lamar and Delta Counties, except strongly

sloping and moderately steep soils, are suitable for terraces and diversions.

Contouring is a widespread erosion control practice in the survey area. It is best suited to soils that have smooth, uniform slopes, which include most arable soils in the survey area.

Small areas have slopes that are so short and irregular that contour tillage or terracing is not practical. On these soils, cropping systems that provide substantial plant cover are required to control erosion unless minimum tillage is practiced. Minimizing tillage and leaving crop residue on the surface help to increase infiltration and reduce runoff and erosion. These practices can be adapted to most soils in the survey area, but are more difficult to use successfully on the eroded soils. No-tillage for soybeans and small grains is effective in reducing erosion on sloping soils and can be adapted to most loamy soils in the survey area. It is more difficult to practice successfully, however, on the soils that have a clayey surface layer.

Wind erosion is a hazard on the loamy Annona, Bernaldo, Freestone, and Whakana soils. Wind erosion can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining the plant cover, surface mulch, or a rough surface by proper tillage minimizes wind erosion on these soils.

Information and assistance for the design and installation of erosion control practices for each kind of soil is available from local offices of the Soil Conservation Service.

Soil drainage is the major management need on about 20 percent of the acreage used for crops and pasture and hay in the survey area. Surface runoff and internal drainage are so slow that these soils need shallow surface field drains and drainage outlets to remove excess water during wet periods. These are the poorly drained Derly, Harjo, and Roxton soils and the somewhat poorly drained, nearly level Ambia, Deport, Desha, Kaufman, Mabank, Muldrow, Trinity, and Wilson soils.

Soil fertility is naturally high in most of the soils that formed on the flood plains. With the exception of the Guyton soils, these soils are naturally higher in plant nutrients than most upland soils.

The upland soils that formed under prairie are moderately high in plant nutrients. These soils have a loamy to clayey surface layer that ranges from medium acid to moderately alkaline. The lower horizons range from neutral to moderately alkaline. The clayey soils generally have medium to high levels of phosphorus and potash. The loamy soils commonly have low to medium levels of phosphorus and potash. Lime is rarely needed.

Soil fertility is naturally low in most loamy upland soils that formed under forest. Nearly all of these soils have a slightly acid to medium acid surface layer and medium acid to very strongly acid lower layers. Liming these soils generally improves the growth of plants that grow only on nearly neutral soils. Available phosphorus and potash levels are naturally low in most of these soils.

Additions of nitrogen and phosphorus are needed on most crops and on all pastures of improved grasses. For very high levels of pasture and hay production, frequent applications may be needed. On all soils, additions of lime and fertilizer should be based on the results of soil tests, on the needs of the crop, and on the expected yield. The Cooperative Extension Service can help in determining the kinds and amounts 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 with good tilth are granular and porous.

Many of the soils in the survey area have a silt loam, loam, or fine sandy loam surface layer that is light in color and low in content of organic matter. Generally the structure of such soils is weak, and intense rainfall causes a crust to form on the surface. The clayey, noncalcareous Burleson, Deport, Kaufman, and Leson soils also form a thick surface crust.

The crust is hard and nearly impervious to water when dry. Once the crust forms, it reduces infiltration and increases runoff. Regular additions of crop residue, manure, and other organic material can help to improve soil structure and to reduce crust formation.

Fall plowing is generally not a good practice on the light-colored soils that have a loamy surface layer, because a crust forms during winter and spring. Many of the soils are nearly as dense and hard at planting time after fall plowing as they were before they were plowed. Also, about 70 percent of the cropland consists of sloping soils that are subject to damaging erosion if they are plowed in fall.

The dark colored Burleson, Deport, Desha, Heiden, Houston Black, Kaufman, Leson, and Trinity soils are clayey, and tilth is a problem because the soils often stay wet until late in spring. If they are wet when plowed, they tend to be very cloddy when dry, and a good seedbed is difficult to prepare. Fall plowing generally results in good tilth in spring.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Cotton, grain sorghum, and, to an increasing extent, soybeans are the row crops. Corn, sunflowers, peanuts, and some vegetables can be grown.

Wheat and oats are the common close-growing crops. Rye and barley can be grown, and grass and legume seed can be produced from lovegrass, fescue, vetch, and alfalfa.

Special crops grown commercially in the survey area are vegetables, tree fruits, and nursery plants. A small acreage is used for melons, cucumbers, turnips, sweet corn, tomatoes, peas, and other vegetables and small fruits. In addition, large areas can be used for other special crops such as peaches, plums, grapes, and many vegetables.

Deep, loamy soils that have good natural drainage are especially well suited to many vegetables, nursery plants, tree fruits, and small fruits. These are Bernaldo, Caspiana, Freestone, Hicota, Karma, Norwood, Severn, and Whakana soils on slopes of less than 5 percent. They cover about 95,000 acres. Most of these soils are suited to irrigation. Pecan trees are suited to most of the soils in the survey area. They are well suited to the well drained and moderately well drained soils on flood plains.

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

Pasture and hay are important to the economy of Lamar and Delta Counties. About 42 percent of the soils in the survey area is used for pasture and hay.

Pasture is largely made up of perennial warm season species of bermudagrass and cool season legumes. Some acreage is used for cool season perennial fescue. There are small acreages of bahiagrass, lovegrass, kleingrass, King Ranch bluestem, and johnsongrass. The most commonly used legumes are vetch, singletary peas, white clover, arrowleaf clover, crimson clover, burclover, and lespedeza. These are overseeded on established stands of bermudagrass. Bermudagrass is suited to all soils in the survey area, but management is difficult on the strongly sloping and moderately steep soils.

The amount of beef produced is directly related to the amount of forage produced. A well-managed pasture has one main grass, is amply supplied with water, and is free of weeds. It is fertilized according to plant needs, desired production, and soil tests. Weeds can be controlled by mowing, shredding, or using chemical herbicides. Well managed stands of grasses tend to eliminate most weeds. Pastures should be stocked according to the amount of forage available and grazed only to a height that permits plants to remain vigorous. A good grass cover helps to prevent erosion, winterkill, and soil compaction and to insure rapid growth in the spring.

Temporary pasture is often used to supplement permanent pasture. Sudangrass, johnsongrass, pearl millet, and sorghum-sudangrass hybrids make good supplemental summer pasture. Pearl millet is suited to acid soils. Small grains provide good supplemental winter forage.

Latest information and suggestion for planting, fertilizing, and grazing specific forages can be obtained from local offices of the Cooperative Extension Service and the Soil Conservation Service.

Hay in Lamar and Delta Counties is mainly bermudagrass. In Lamar County about 10,000 acres of mixed tall and mid climax prairie grasses is used for hay.

Management of hay requires timely mowing to insure high quality, maximum production, and retained plant vigor. Hay should be cut at a height that has proven best for the plants being used. Mowing too low or too often damages the stand of grasses, as overgrazing damages pasture. Mowing at the proper height helps to maintain plant vigor and leaves residue on the surface to help to control erosion and maintain organic matter content. Harvesting when wet tends to pack the surface layer causing excessive runoff and poor plant growth. Weeds can be controlled by mowing, shredding, or using herbicides.

If native hay is seriously damaged by drought, fire, or poor management, it should not be cut. It should be allowed to make a full season's growth for one or more years. This permits the grasses to reestablish a strong root system and regain their vigor. Weakened grasses are easily winterkilled and easily invaded by weeds.

Well established native grasses generally can be kept vigorous by good management without the use of fertilizer.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. Absence of an estimated yield indicates that the crop is not suited to or not commonly grown on the soil or that a given crop is not commonly irrigated.

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

The yields were estimated assuming that the latest soil and crop management practices were used. Hay and pasture yields were estimated for the most productive varieties of grasses and legumes suited to the climate and the soil. A few farmers may be obtaining average yields higher than those shown in table 4.

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

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

Crops other than those shown in table 4 are grown in the survey area, but estimated yields are not included because the acreage of these crops is small. The local offices of the Soil Conservation Service and the Cooperative Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

Capability classes and subclasses show, in a general way, the suitability of soils for most kinds of field crops. The soils are classed according to their limitations when they are used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops that require special management. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forest trees, or for engineering purposes.

In this survey, all kinds of soil are grouped at two levels: capability class and subclass. These levels are defined in the following paragraphs. A survey area may not have soils of all classes.

Capability classes, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The acreage of soils in each capability class and subclass is indicated in table 5. All soils in the survey area except those named at a level higher than the series are included.

Range

Range is land on which the natural plant community is composed principally of grasses, grasslike plants, forbs, and shrubs that are grazed. About 4 percent of the survey area is range.

Most of the range is on small farms and is used mainly by cow-calf operations. Forage produced on range is supplemented by small improved pasture, crop stubble, and small grains. Supplemental feeding of protein concentrate and hay is necessary in winter if cool-season pasture is not available.

Most of the range is formerly cultivated cropland that has been left idle for several years. Most of the vegetation is low to medium quality grasses, forbs, and weeds that invaded the idle fields. The few remaining areas of native vegetation have been greatly depleted by continued overuse. The amount of forage produced on range may be less than half of the potential. Productivity of the range can be increased by management that is designed for specific soils and range sites.

Where climate and topography are about the same, differences in the kind and amount of vegetation that rangeland can produce are related closely to the kind of soil. Effective management is based on the relationships among soils, vegetation, and water.

Table 6 shows, for each kind of soil, the name of the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the expected percentage of each species in the composition of the potential natural plant community. Soils not listed cannot support a natural plant community of predominately grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 6.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils

that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Total production refers to the amount of vegetation that can be expected to grow annually on well managed rangeland that is supporting the potential natural plant community. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year the amount and distribution of precipitation and the temperatures are such that growing conditions are substantially better than average; in a normal year these conditions are about average for the area; in an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Dry weight refers to the total air-dry vegetation produced per acre each year by the potential natural plant community. Vegetation that is highly palatable to livestock and vegetation that is unpalatable are included. Some of the vegetation can also be grazed extensively by wildlife.

Characteristic species of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed by common name. Under *Composition*, the expected proportion of each species is presented as the percentage, in air-dry weight, of the total annual production of herbaceous and woody plants. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season. Generally all of the vegetation produced is not used.

Range management requires, in addition to knowledge of the kinds of soil and the potential natural plant community, an evaluation of the present condition of the range vegetation in relation to its potential. Range condition is determined by comparing the present plant community with the potential natural plant community on a particular range site. The more closely the existing community resembles the potential community, the better the range condition. The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the maximum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Native tall and mid grasses are well suited to all of the soils in this survey area that are used for range. The deep to moderately deep, clayey soils have high potential productivity and the deep, loamy claypan soils have medium potential productivity. The shallow to very shallow loamy and clayey soils underlain by chalk have low potential productivity because of the restricted rooting depth. In many areas are the scars of past erosion. Water erosion is a severe hazard where the plant cover is thin or absent. Some areas have unstable gullies that are still eroding.

The major management concern on most of the range is control of grazing to reestablish the potential plant community. Range that does not have enough of the desired species to recover from grazing should be seeded. Controlling brush and water erosion is also important. If sound range management based on soil survey information and range inventories is applied, the potential for increasing the production of range is good.

Information on seeding each kind of soil to range is available in local offices of the Soil Conservation Service.

Woodland management and productivity

Norman O. Wilson, forester, Soil Conservation Service, helped in preparing this section.

Approximately 8 percent of Delta County and 15 percent of Lamar County is in woodland (*4*). Soils capable of supporting commercial forest make up about 53 percent of Lamar County and 36 percent of Delta County.

Stands of pine and pine-hardwood occur mainly on the uplands of northern Lamar County, and mixed hardwoods grow mainly on bottom lands in both counties. The forested uplands grow loblolly pine, shortleaf pine, eastern red cedar, and a mixture of low-grade hardwoods. Short-leaf pine is dominant. The forested bottom lands produce a mixture of low to medium grade hardwoods, mostly water oak, willow oak, post oak, red oak, pecan, sweetgum, green ash, and eastern cottonwood.

The potential for commercial wood products is low in Delta County and medium in Lamar County. This area is on the fringe of the timberbelt, and the market for raw woodland products is limited.

Other values of woodland include livestock grazing, wildlife habitat, recreation, natural beauty, and conservation of soil and water.

Table 7 contains information useful to woodland owners or forest managers planning use of soils for wood crops. Mapping unit symbols for soils suitable for wood crops are listed, and the ordination (woodland suitability) symbol for each soil is given. All soils bearing the same ordination symbol require the same general kinds of woodland management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The

second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *x* indicates stoniness or rockiness; *w*, excessive water in or on the soil; *t*, toxic substances in the soil; *d*, restricted root depth; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates insignificant limitations or restrictions. If a soil has more than one limitation, priority in placing the soil into a limitation class is in the following order: x, w, t, d, c, s, f, and r.

In table 7 the soils are also rated for a number of factors to be considered in management. *Slight, moderate,* and *severe* are used to indicate the degree of major soil limitations.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if some measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or equipment; *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree that the soil affects expected mortality of planted tree seedlings. Plant competition is not considered in the ratings. Seedlings from good planting stock that are properly planted during a period of sufficient rainfall are rated. A rating of *slight* indicates that the expected mortality of the planted seedlings is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade or grow if openings are made in the tree canopy. The invading plants compete with native plants or planted seedlings by impeding or preventing their growth. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* means that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed for the control of undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index applies to fully stocked, even-aged, unmanaged stands. Important trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suitable for commercial wood production and that are suited to the soils.

Woodland understory vegetation

Understory vegetation consists of grasses, forbs, shrubs, and other plants. Some types of forest, under proper management, can produce enough understory vegetation to support grazing of livestock or wildlife, or both (fig. 11).

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

Table 8 shows, for each soil suitable for woodland, the potential for producing understory vegetation. The table also lists the common names of the characteristic vegetation that grows on a specified soil and the percentage composition, by air-dry weight, of each kind of plant. The kind and percentage of understory plants listed in the table are those to be expected where canopy density is most nearly typical of forests that yield the highest production of wood crops.

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

Engineering

This section provides information about the use of soils for building sites, sanitary facilities, construction material, and water management. Among those who can benefit from this information are engineers, landowners, community planners, town and city managers, land developers, builders, contractors, and farmers and ranchers.

The ratings in the engineering tables are based on test data and estimated data in the "Soil properties" section. The ratings were determined jointly by soil scientists and engineers of the Soil Conservation Service using known relationships between the soil properties and the behavior of soils in various engineering uses.

Among the soil properties and site conditions identified by a soil survey and used in determining the ratings in this section were grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock that is within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope,

likelihood of flooding, natural soil structure or aggregation, in-place soil density, and geologic origin of the soil material. Where pertinent, data about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of absorbed cations were also considered.

On the basis of information assembled about soil properties, ranges of values can be estimated for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, shear strength, compressibility, slope stability, and other factors of expected soil behavior in engineering uses. As appropriate, these values can be applied to each major horizon of each soil or to the entire profile.

These factors of soil behavior affect construction and maintenance of roads, airport runways, pipelines, foundations for small buildings, ponds and small dams, irrigation projects, drainage systems, sewage and refuse disposal systems, and other engineering works. The ranges of values can be used to (1) select potential residential, commercial, industrial, and recreational uses; (2) make preliminary estimates pertinent to construction in a particular area; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for location of sanitary landfills, onsite sewage disposal systems, and other waste disposal facilities; (5) plan detailed onsite investigations of soils and geology; (6) find sources of gravel, sand, clay, and topsoil; (7) plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; (8) relate performance of structures already built to the properties of the kinds of soil on which they are built so that performance of similar structures on the same or a similar soil in other locations can be predicted; and (9) predict the trafficability of soils for cross-country movement of vehicles and construction equipment.

Data presented in this section are useful for land-use planning and for choosing alternative practices or general designs that will overcome unfavorable soil properties and minimize soil-related failures. Limitations to the use of these data, however, should be well understood. First, the data are generally not presented for soil material below a depth of 5 or 6 feet. Also, because of the scale of the detailed map in this soil survey, small areas of soils that differ from the dominant soil may be included in mapping. Thus, these data do not eliminate the need for onsite investigations, testing, and analysis by personnel having expertise in the specific use contemplated.

The information is presented mainly in tables. Table 9 shows, for each kind of soil, the degree and kind of limitations for building site development; table 10, for sanitary facilities; and table 12, for water management. Table 11 shows the suitability of each kind of soil as a source of construction materials.

The information in the tables, along with the soil map, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations and to construct interpretive maps for specific uses of land.

Some of the terms used in this soil survey have a special meaning in soil science. Many of these terms are defined in the Glossary.

Building site development

The degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets are indicated in table 9. A *slight* limitation indicates that soil properties generally are favorable for the specified use; any limitation is minor and easily overcome. A *moderate* limitation indicates that soil properties and site features are unfavorable for the specified use, but the limitations can be overcome or minimized by special planning and design. A *severe* limitation indicates that one or more soil properties or site features are so unfavorable or difficult to overcome that a major increase in construction effort, special design, or intensive maintenance is required. For some soils rated severe, such costly measures may not be feasible.

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

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

Dwellings and *small commercial buildings* referred to in table 9 are built on undisturbed soil and have foundation loads of a dwelling no more than three stories high. Separate ratings are made for small commercial buildings without basements and for dwellings with and without basements. For such structures, soils should be sufficiently stable that cracking or subsidence of the structure from settling or shear failure of the foundation does not occur. These ratings were determined from estimates of the shear strength, compressibility, and shrink-swell potential of the soil. Soil texture, plasticity and in-place density, soil wetness, and depth to a seasonal high water table were also considered. Soil wetness and depth to a seasonal high water table indicate potential difficulty in providing adequate drainage for basements, lawns, and gardens. Depth to bedrock, slope, and large stones in or on the soil are also important considerations in the choice of sites for these structures and were

considered in determining the ratings. Susceptibility to flooding is a serious hazard.

Local roads and streets referred to in table 9 have an all-weather surface that can carry light to medium traffic all year. They consist of a subgrade of the underlying soil material; a base of gravel, crushed rock fragments, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. The roads are graded with soil material at hand, and most cuts and fills are less than 6 feet deep.

The load supporting capacity and the stability of the soil as well as the quantity and workability of fill material available are important in design and construction of roads and streets. The classifications of the soil and the soil texture, density, shrink-swell potential, and potential frost action are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 10 shows the degree and kind of limitations of each soil for such uses and for use of the soil as daily cover for landfills. It is important to observe local ordinances and regulations.

If the degree of soil limitation is expressed as *slight*, soils are generally favorable for the specified use and limitations are minor and easily overcome; if *moderate*, soil properties or site features are unfavorable for the specified use, but limitations can be overcome by special planning and design; and if *severe*, soil properties or site features are so unfavorable or difficult to overcome that major soil reclamation, special designs, or intensive maintenance is required. Soil suitability is rated by the terms *good*, *fair*, or *poor*, which, respectively, mean about the same as the terms *slight*, *moderate*, and *severe*.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into the natural soil. Only the soil horizons between depths of 18 and 72 inches are evaluated for this use. The soil properties and site features considered are those that affect the absorption of the effluent and those that affect the construction of the system.

Properties and features that affect absorption of the effluent are permeability, depth to seasonal high water table, depth to bedrock, and susceptibility to flooding. Stones, boulders, and shallowness to bedrock interfere with installation. Excessive slope can cause lateral seepage and surfacing of the effluent. Also, soil erosion and soil slippage are hazards if absorption fields are installed on sloping soils.

In some soils, loose sand and gravel or fractured bedrock is less than 4 feet below the tile lines. In these soils the absorption field does not adequately filter the effluent, and ground water in the area may be contaminated.

On many of the soils that have moderate or severe limitations for use as septic tank absorption fields, a system to lower the seasonal water table can be installed or the size of the absorption field can be increased so that performance is satisfactory.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons have a nearly level floor and cut slopes or embankments of compacted soil material. Aerobic lagoons generally are designed to hold sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Soils that are very high in content of organic matter and those that have cobbles, stones, or boulders are not suitable. Unless the soil has very slow permeability, contamination of ground water is a hazard where the seasonal high water table is above the level of the lagoon floor. In soils where the water table is seasonally high, seepage of ground water into the lagoon can seriously reduce the lagoon's capacity for liquid waste. Slope, depth to bedrock, and susceptibility to flooding also affect the suitability of sites for sewage lagoons or the cost of construction. Shear strength and permeability of compacted soil material affect the performance of embankments.

Sanitary landfill is a method of disposing of solid waste by placing refuse in successive layers either in excavated trenches or on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil material. Landfill areas are subject to heavy vehicular traffic. Risk of polluting ground water and trafficability affect the suitability of a soil for this use. The best soils have a loamy or silty texture, have moderate to slow permeability, are deep to a seasonal water table, and are not subject to flooding. Clayey soils are likely to be sticky and difficult to spread. Sandy or gravelly soils generally have rapid permeability, which might allow noxious liquids to contaminate ground water. Soil wetness can be a limitation, because operating heavy equipment on a wet soil is difficult. Seepage into the refuse increases the risk of pollution of ground water.

Ease of excavation affects the suitability of a soil for the trench type of landfill. A suitable soil is deep to bedrock and free of large stones and boulders. If the seasonal water table is high, water will seep into trenches.

Unless otherwise stated, the limitations in table 10 apply only to the soil material within a depth of about 6 feet. If the trench is deeper, a limitation of slight or moderate may not be valid. Site investigation is needed before a site is selected.

Daily cover for landfill should be soil that is easy to excavate and spread over the compacted fill in wet and dry periods. Soils that are loamy or silty and free of stones or boulders are better than other soils. Clayey soils may be sticky and difficult to spread; sandy soils may be subject to soil blowing.

The soils selected for final cover of landfills should be suitable for growing plants. Of all the horizons, the A horizon in most soils has the best workability, more organic matter, and the best potential for growing plants. Thus, for either the area- or trench-type landfill, stockpiling material from the A horizon for use as the surface layer of the final cover is desirable.

Where it is necessary to bring in soil material for daily or final cover, thickness of suitable soil material available and depth to a seasonal high water table in soils surrounding the sites should be evaluated. Other factors to be evaluated are those that affect reclamation of the borrow areas. These factors include slope, erodibility, and potential for plant growth.

Construction materials

The suitability of each soil as a source of roadfill, sand, gravel, and topsoil is indicated in table 11 by ratings of good, fair, or poor. The texture, thickness, and organic-matter content of each soil horizon are important factors in rating soils for use as construction materials. Each soil is evaluated to the depth observed, generally about 6 feet.

Roadfill is soil material used in embankments for roads. Soils are evaluated as a source of roadfill for low embankments, which generally are less than 6 feet high and less exacting in design than high embankments. The ratings reflect the ease of excavating and working the material and the expected performance of the material where it has been compacted and adequately drained. The performance of soil after it is stabilized with lime or cement is not considered in the ratings, but information about some of the soil properties that influence such performance is given in the descriptions of the soil series.

The ratings apply to the soil material between the A horizon and a depth of 5 to 6 feet. It is assumed that soil horizons will be mixed during excavation and spreading. Many soils have horizons of contrasting suitability within their profile. The estimated engineering properties in table 15 provide specific information about the nature of each horizon. This information can help determine the suitability of each horizon for roadfill.

Soils rated *good* are coarse grained. They have low shrink-swell potential, and few cobbles and stones. They are at least moderately well drained and have slopes of 15 percent or less. Soils rated *fair* have a plasticity index of less than 15 and have other limiting features, such as moderate shrink-swell potential, moderately steep slopes, wetness, or many stones. If the thickness of suitable material is less than 3 feet, the entire soil is rated *poor*.

Sand and *gravel* are used in great quantities in many kinds of construction. The ratings in table 11 provide guidance as to where to look for probable sources and are based on the probability that soils in a given area contain sizable quantities of sand or gravel. A soil rated *good* or *fair* has a layer of suitable material at least 3 feet thick, the top of which is within a depth of 6 feet. Coarse fragments of soft bedrock material, such as shale and siltstone, are not considered to be sand and gravel. Fine-grained soils are not suitable sources of sand and gravel.

The ratings do not take into account depth to the water table or other factors that affect excavation of the material. Descriptions of grain size, kinds of minerals, reaction, and stratification are given in the soil series descriptions and in table 15.

Topsoil is used in areas where vegetation is to be established and maintained. Suitability is affected mainly by the ease of working and spreading the soil material in preparing a seedbed and by the ability of the soil material to support plantlife. Also considered is the damage that can result at the area from which the topsoil is taken.

The ease of excavation is influenced by the thickness of suitable material, wetness, slope, and amount of stones. The ability of the soil to support plantlife is determined by texture, structure, and the amount of soluble salts or toxic substances. Organic matter in the A1 or Ap horizon greatly increases the absorption and retention of moisture and nutrients. Therefore, the soil material from these horizons should be carefully preserved for later use.

Soils rated *good* have at least 16 inches of friable loamy material at their surface. They are free of stones and cobbles, are low in content of gravel, and have gentle slopes. They are low in soluble salts that can limit or prevent plant growth. They are naturally fertile or respond well to fertilizer. They are not so wet that excavation is difficult during most of the year.

Soils rated *fair* are loose sandy soils or firm loamy or clayey soils in which the suitable material is only 8 to 16 inches thick or soils that have appreciable amounts of gravel, stones, or soluble salt.

Soils rated *poor* are very sandy soils and very firm clayey soils; soils with suitable layers less than 8 inches thick; soils having large amounts of gravel, stones, or soluble salt; steep soils; and poorly drained soils.

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter con-

tent. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 12 the degree of soil limitation and soil and site features that affect use are indicated for each kind of soil. This information is significant in planning, installing, and maintaining water control structures.

Soil and site limitations are expressed as slight, moderate, and severe. *Slight* means that the soil properties and site features are generally favorable for the specified use and that any limitation is minor and easily overcome. *Moderate* means that some soil properties or site features are unfavorable for the specified use but can be overcome or modified by special planning and design. *Severe* means that the soil properties and site features are so unfavorable and so difficult to correct or overcome that major soil reclamation, special design, or intensive maintenance is required.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have a low seepage potential, which is determined by permeability and the depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material that is resistant to seepage, erosion, and piping and has favorable stability, shrink-swell potential, shear strength, and compaction characteristics. Large stones and organic matter in a soil downgrade the suitability of a soil for use in embankments, dikes, and levees.

Drainage of soil is affected by such soil properties as permeability; texture; depth to bedrock, hardpan, or other layers that affect the rate of water movement; depth to the water table; slope; stability of ditchbanks; susceptibility to flooding; salinity and alkalinity; and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to intercept runoff. They allow water to soak into the soil or flow slowly to an outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth to bedrock, hardpan, or other unfavorable material; large stones; permeability; ease of establishing vegetation; and resistance to water erosion, soil blowing, soil slipping, and piping.

Grassed waterways are constructed to channel runoff to outlets at a nonerosive velocity. Features that affect the use of soils for waterways are slope, permeability, erodibility, wetness, and suitability for permanent vegetation.

Recreation

The soils of the survey area are rated in table 13 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreational use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreational facilities.

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

The information in table 13 can be supplemented by information in other parts of this survey. Especially helpful are interpretations for septic tank absorption fields, given in table 10, and interpretations for dwellings without basements and for local roads and streets, given in table 9.

Camp areas require such site preparation as shaping and leveling for tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils for this use have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing camping sites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for use as picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes or stones or boulders that will increase the cost

of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is free of stones or boulders, is firm after rains, and is not dusty when dry. If shaping is required to obtain a uniform grade, the depth of the soil over bedrock or hardpan should be enough to allow necessary grading.

Paths and trails for walking, horseback riding, bicycling, and other uses should require little or no cutting and filling. The best soils for this use are those that are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once during the annual period of use. They should have moderate slopes and have few or no stones or boulders on the surface.

Wildlife habitat

Don W. Stephens, biologist, Soil Conservation Service, helped in preparing this section.

The major game species in Lamar and Delta Counties are white-tailed deer, bobwhite quail, mourning dove, swamp and cottontail rabbit, gray and fox squirrel, raccoon, beaver, and many species of waterfowl during migration. There is a wide range of habitats, from open range to hardwood bottoms.

Soils directly affect the kind and amount of vegetation that is available to wildlife as food and cover, and they affect the construction of water impoundments. The kind and abundance of wildlife that populate an area depend largely on the amount and distribution of food, cover, and water. If any one of these elements is missing, is inadequate, or is inaccessible, wildlife either are scarce or do not inhabit the area.

If the soils have the potential, wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by helping the natural establishment of desirable plants.

In table 14, the soils in the survey area are rated according to their potential to support the main kinds of wildlife habitat in the area. This information can be used in planning for parks, wildlife refuges, nature study areas, and other developments for wildlife; selecting areas that are suitable for wildlife; selecting soils that are suitable for creating, improving, or maintaining specific elements of wildlife habitat; and determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* means that the element of wildlife habitat or the kind of habitat is easily created, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected if the soil is used for the designated purpose. A rating of *fair* means that the element of wildlife habitat or kind of habitat can be created, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* means that limitations are severe for the designated element or kind of wildlife habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* means that restrictions for the element of wildlife habitat or kind of wildlife are very severe, and that unsatisfactory results can be expected. Wildlife habitat is impractical or even impossible to create, improve, or maintain on soils having such a rating.

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

Grain and seed crops are seed-producing annuals used by wildlife. The major soil properties that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, wheat, oats, and barley.

Grasses and legumes are domestic perennial grasses and herbaceous legumes that are planted for wildlife food and cover. Major soil properties that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are fescue, lovegrass, lespedeza, clover, and alfalfa.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds, that provide food and cover for wildlife. Major soil properties that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, goldenrod, beggarweed, wildrye, and grama.

Hardwood trees and the associated woody understory provide cover for wildlife and produce nuts or other fruit, buds, catkins, twigs, bark, or foliage that wildlife eat. Major soil properties that affect growth of hardwood trees and shrubs are depth of the root zone, available water capacity, and wetness. Examples of native plants are oak, poplar, cherry, sweetgum, apple, hawthorn, dogwood, hickory, blackberry, and blueberry. Examples of fruit-producing shrubs that are commercially available and suitable for planting on soils rated *good* are Russian-olive, autumn-olive, and crabapple.

Coniferous plants are cone-bearing trees, shrubs, or ground cover plants that furnish habitat or supply food in the form of browse, seeds, or fruitlike cones. Soil properties that have a major effect on the growth of coniferous plants are depth of the root zone, available water capac-

ity, and wetness. Examples of coniferous plants are pine and cedar.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, or foliage used by wildlife or that provide cover and shade for some species of wildlife. Major soil properties that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and moisture. Examples of shrubs are yaupon, hawthorn, plum, and willow.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites, exclusive of submerged or floating aquatics. They produce food or cover for wildlife that use wetland as habitat. Major soil properties affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, rushes, sedges, and reeds.

Shallow water areas are bodies of water that have an average depth of less than 5 feet and that are useful to wildlife. They can be naturally wet areas, or they can be created by dams or levees or by water-control structures in marshes or streams. Major soil properties affecting shallow water areas are depth to bedrock, wetness, surface stoniness, slope, and permeability. The availability of a dependable water supply is important if water areas are to be developed. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

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

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

Woodland habitat consists of areas of hardwoods or conifers, or a mixture of both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include wild turkey, woodcock, thrushes, woodpeckers, swamp rabbit, squirrels, gray fox, raccoon, and deer.

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

Rangeland habitat consists of areas of wild herbaceous plants and shrubs. Wildlife attracted to rangeland include white-tailed deer, jackrabbit, coyote, bobwhite, meadowlark, and dove.

Soil properties

Extensive data about soil properties are summarized on the following pages. The two main sources of these data are the many thousands of soil borings made during the course of the survey and the laboratory analyses of selected soil samples from typical profiles.

In making soil borings during field mapping, soil scientists can identify several important soil properties. They note the seasonal soil moisture condition or the presence of free water and its depth. For each horizon in the profile, they note the thickness and color of the soil material; the texture, or amount of clay, silt, sand, and gravel or other coarse fragments; the structure, or the natural pattern of cracks and pores in the undisturbed soil; and the consistence of the soil material in place under the existing soil moisture conditions. They record the depth of plant roots, determine the pH or reaction of the soil, and identify any free carbonates.

Samples of soil material are analyzed in the laboratory to verify the field estimates of soil properties and to determine all major properties of key soils, especially properties that cannot be estimated accurately by field observation. Laboratory analyses are not conducted for all soil series in the survey area, but laboratory data for many soil series not tested are available from nearby survey areas.

The available field and laboratory data are summarized in tables. The tables give the estimated range of engineering properties, the engineering classifications, and the physical and chemical properties of each major horizon of each soil in the survey area. They also present data about pertinent soil and water features, engineering test data, and data obtained from physical and chemical laboratory analyses of soils.

Engineering properties

Table 15 gives estimates of engineering properties and classifications for the major horizons of each soil in the survey area.

Most soils have, within the upper 5 or 6 feet, horizons of contrasting properties. Table 15 gives information for each of these contrasting horizons in a typical profile. *Depth* to the upper and lower boundaries of each horizon is indicated. More information about the range in depth and about other properties in each horizon is given for each soil series in the section "Soil series and morphology."

Texture is described in table 15 in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the

American Association of State Highway and Transportation Officials (AASHTO) (*1*).

The *Unified* system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter, plasticity index, liquid limit, and organic-matter content. Soils are grouped into 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes have a dual classification symbol, for example, CL-ML.

The *AASHTO* system classifies soils according to those properties that affect their use in highway construction and maintenance. In this system a mineral soil is classified in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines. At the other extreme, in group A-7, are fine-grained soils. Highly organic soils are classified in group A-8 on the basis of visual inspection.

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. The AASHTO classification for soils tested in the survey area is given in table 18. The estimated classification, without group index numbers, is given in table 15.

Also in table 15 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

Percentage of the soil material less than 3 inches in diameter that passes each of four sieves (U.S. standard) is estimated for each major horizon. The estimates are based on tests of soils that were sampled in the survey area and in nearby areas and on field estimates from many borings made during the survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil. These indexes are used in both the Unified and AASHTO soil classification systems. They are also used as indicators in making general predictions of soil behavior. Range in liquid limit and in plasticity index is estimated on the basis of test data from the survey area or from nearby areas and on observations of the many soil borings made during the survey.

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

Physical and chemical properties

Table 16 shows estimated values for several soil characteristics and features that affect behavior of soils in engineering uses. These estimates are given for each major horizon, at the depths indicated, in the typical pedon of each soil. The estimates are based on field observations and on test data for these and similar soils.

Permeability is estimated on the basis of known relationships among the soil characteristics observed in the field—particularly soil structure, porosity, and gradation or texture—that influence the downward movement of water in the soil. The estimates are for vertical water movement when the soil is saturated. Not considered in the estimates is lateral seepage or such transient soil features as plowpans and surface crusts. Permeability of the soil is an important factor to be considered in planning and designing drainage systems, in evaluating the potential of soils for septic tank systems and other waste disposal systems, and in many other aspects of land use and management.

Available water capacity is rated on the basis of soil characteristics that influence the ability of the soil to hold water and make it available to plants. Important characteristics are content of organic matter, soil texture, and soil structure. Shallow-rooted plants are not likely to use the available water from the deeper soil horizons. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design of irrigation systems.

Soil reaction is expressed as a range in pH values. The range in pH of each major horizon is based on many field checks. For many soils, the values have been verified by laboratory analyses. Soil reaction is important in selecting the crops, ornamental plants, or other plants to be grown; in evaluating soil amendments for fertility and stabilization; and in evaluating the corrosivity of soils.

Salinity is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of the nonirrigated soils. The salinity of individual irrigated fields is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of individual fields can differ greatly from the value given in table 16. Salinity affects the suitability of a soil for crop production, its stability when used as a construction material, and its potential to corrode metal and concrete.

Shrink-swell potential depends mainly on the amount and kind of clay in the soil. Laboratory measurements of the swelling of undisturbed clods were made for many soils. For others the swelling was estimated on the basis of the kind and amount of clay in the soil and on measurements of similar soils. The size of the load and the magnitude of the change in soil moisture content also influence the swelling of soils. Shrinking and swelling of some soils can cause damage to building foundations,

basement walls, roads, and other structures unless special designs are used. A high shrink-swell potential indicates that special design and added expense may be required if the planned use of the soil will not tolerate large volume changes.

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

Erosion factors are used to predict the erodibility of a soil and its tolerance to erosion in relation to specific kinds of land use and treatment (*6*). The soil erodibility factor (K) is a measure of the susceptibility of the soil to erosion by water. Soils having the highest K values are the most erodible. K values range from 0.10 to 0.64. To estimate annual soil loss per acre, the K value of a soil is modified by factors representing plant cover, grade and length of slope, management practices, and climate. The soil-loss tolerance factor (T) is the maximum rate of soil erosion, whether from rainfall or soil blowing, that can occur without reducing crop production or environmental quality. The rate is expressed in tons of soil loss per acre per year.

Soil and water features

Table 17 contains information helpful in planning land uses and engineering projects that are likely to be affected by soil and water features.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are placed in one of four groups on the basis of the intake of water after the soils have been wetted and have received precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of deep, well drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils that have a layer that impedes the downward movement of water or soils that have moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clay soils that have a high shrink-swell potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding is the temporary covering of soil with water from overflowing streams, with runoff from adjacent slopes, and by tides. Water standing for short periods after rains or after snow melts is not considered flooding, nor is water in swamps and marshes. Flooding is rated in general terms that describe the frequency and duration of flooding and the time of year when flooding is most likely. The ratings are based on evidence in the soil profile of the effects of flooding, namely thin strata of gravel, sand, silt, or, in places, clay deposited by floodwater; irregular decrease in organic-matter content with increasing depth; and absence of distinctive soil horizons that form in soils of the area that are not subject to flooding. The ratings are also based on local information about floodwater levels in the area and the extent of flooding; and on information that relates the position of each soil on the landscape to historic floods.

The generalized description of flood hazards is of value in land-use planning and provides a valid basis for land-use restrictions. The soil data are less specific, however, than those provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table is the highest level of a saturated zone more than 6 inches thick for a continuous period of more than 2 weeks during most years. The depth to a seasonal high water table applies to undrained soils. Estimates are based mainly on the relationship between grayish colors or mottles in the soil and the depth to free water observed in many borings made during the course of the soil survey. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table, that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. Only saturated zones above a depth of 5 or 6 feet are indicated.

Information about the seasonal high water table helps in assessing the need for specially designed foundations, the need for specific kinds of drainage systems, and the need for footing drains to insure dry basements. Such information is also needed to decide whether or not construction of basements is feasible and to determine how septic tank absorption fields and other underground installations will function. Also, a seasonal high water table affects ease of excavation.

Depth to bedrock is shown for all soils that are underlain by bedrock at a depth of 5 to 6 feet or less. For

many soils, the limited depth to bedrock is a part of the definition of the soil series. The depths shown are based on measurements made in many soil borings and on other observations during the mapping of the soils. The kind of bedrock and its hardness as related to ease of excavation is also shown. Rippable bedrock can be excavated with a single-tooth ripping attachment on a 200-horsepower tractor, but hard bedrock generally requires blasting.

Engineering test data

The results of analyses of engineering properties of several typical soils of the survey area are given in table 18.

The data presented are for soil samples that were collected from carefully selected sites. The soil profiles sampled are typical of the series discussed in the section "Soil series and morphology." The soil samples were analyzed by the Texas Highway Department.

The methods used in obtaining the data are listed by code in the next paragraph. Most of the codes, in parentheses, refer to the methods assigned by the American Association of State Highway and Transportation Officials. The codes for shrinkage and Unified classification are those assigned by the American Society for Testing and Materials.

The methods and codes are AASHTO classification (M-145-66); Unified classification (D-2487-69); mechanical analysis (T88-57); liquid limit (T89-60); plasticity index (T90-56).

Classification of the soils

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Readers interested in further details about the system should refer to "Soil taxonomy" (*7*).

The system of classification has six categories. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. In this system the classification is based on the different soil properties that can be observed in the field or those that can be inferred either from other properties that are observable in the field or from the combined data of soil science and other disciplines. The properties selected for the higher categories are the result of soil genesis or of factors that affect soil genesis. In table 19, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

ORDER. Ten soil orders are recognized as classes in the system. The properties used to differentiate among orders are those that reflect the kind and degree of dominant soil-forming processes that have taken place. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders based primarily on properties that influence soil genesis and are important to plant growth or that are selected to reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Udifluvents (*Ud*, meaning humid, plus *fluvent*, the suborder of Entisols that are stratified and have irregular organic matter content).

SUBGROUP. Each great group may be divided into three subgroups: the central (typic) concept of the great groups, which is not necessarily the most extensive subgroup; the intergrades, or transitional forms to other orders, suborders, or great groups; and the extragrades, which have some properties that are representative of the great groups but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that is thought to typify the great group. An example is Typic Udifluvents.

FAMILY. Families are established within a subgroup on the basis of similar physical and chemical properties that affect management. Among the properties considered in horizons of major biological activity below plow depth are particle-size distribution, mineral content, temperature regime, thickness of the soil penetrable by roots, consistence, moisture equivalent, soil slope, and permanent cracks. A family name consists of the name of a subgroup and a series of adjectives. The adjectives are the class names for the soil properties used as family differentiae. An example is sandy, mixed, thermic Typic Udifluvents.

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition.

Soil series and morphology

In this section, each soil series recognized in the survey area is described in detail. The descriptions are arranged in alphabetic order by series name.

Characteristics of the soil and the material in which it formed are discussed for each series. Then a pedon, a small three-dimensional area of soil that is typical of the soil series in the survey area, is described. The detailed descriptions of each soil horizon follow standards in the Soil Survey Manual (*5*). Unless otherwise noted, colors described are for moist soil.

Following the pedon description is the range of important characteristics of the soil series in this survey area. Phases, or map units, of each soil series are described in the section "Soil maps for detailed planning."

Ambia series

The Ambia series consists of deep, loamy soils on flood plains. These soils formed in clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Ambia clay loam, frequently flooded; from the intersection of U.S. Highway 271 and North Loop 286 in Paris, 6.8 miles north on U.S. Highway 271, 3.9 miles east on Farm Road 2648, 2.6 miles north, 0.5 mile northeast, 2.4 miles south and east on county road, 400 yards east of county road, on Pine Creek flood plain:

A11—0 to 7 inches; very dark grayish brown (10YR 3/2) clay loam; weak fine granular structure; very hard, firm; common fine roots; few fine pores; slightly acid; clear smooth boundary.

A12g—7 to 16 inches; grayish brown (10YR 5/2) clay loam; few fine distinct dark yellowish brown mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm, plastic; common fine roots; few fine pores; few black concretions; very strongly acid; gradual smooth boundary.

IIA11bg—16 to 33 inches; dark grayish brown (10YR 4/2) clay; common medium distinct dark yellowish brown (10YR 4/4) and common medium faint gray (10YR 5/1) mottles; moderate medium subangular blocky structure; extremely hard, very firm, plastic; few fine black concretions; strongly acid; gradual smooth boundary.

IIA12bg—33 to 69 inches; dark gray (10YR 4/1) clay; common medium faint dark grayish brown (10YR 4/2) and few fine distinct dark brown and dark yellowish brown mottles; weak coarse blocky structure parting to moderate medium subangular blocky; extremely hard, very firm, plastic; few slickensides; few fine black concretions; medium acid; diffuse wavy boundary.

IIIA1bg—69 to 80 inches; very dark gray (10YR 3/1) clay; few fine faint dark brown mottles; weak coarse blocky structure; extremely hard, very firm, plastic; common intersecting slickensides; few fine pockets of white neutral salts; few fine black concretions; neutral.

The weighted average clay content of the control section is 40 to 60 percent.

The A horizon is very dark gray, very dark grayish brown, dark grayish brown, grayish brown, dark brown, or brown. Horizons with value of less than 4 moist are less than 7 inches thick. Few or common, fine or medium mottles of very dark grayish brown, dark grayish brown, grayish brown, brown, or dark yellowish brown are present. This horizon is clay loam and is very strongly acid to neutral.

The IIAbg horizon is dark grayish brown or grayish brown and has common fine or medium mottles of dark gray, gray, brown, yellowish brown, dark yellowish brown, or strong brown. This horizon is clay or silty clay. It is generally very strongly acid to slightly acid, but is medium acid or slightly acid in some subhorizons.

The IIIA1bg horizon is very dark gray, dark gray, or dark grayish brown. Few or common, fine or medium, reddish or brownish mottles are present in most pedons. This horizon is clay or silty clay and is strongly acid to neutral.

Annona series

The Annona series consists of deep, loamy soils on uplands. These soils formed in clayey and loamy sediment. Slopes range from 1 to 4 percent.

Typical pedon of Annona loam, 1 to 4 percent slopes; from the intersection of Farm Road 195 and Northeast Loop 286 in Paris, 6.4 miles northeast on Farm Road 195, 1.25 miles south on county road, and 150 feet east of county road in wooded area:

A1—0 to 4 inches; dark grayish brown (10YR 4/2) loam; few medium distinct yellowish brown (10YR 5/4) mottles; weak fine granular structure; slightly hard, very friable; common roots; few wormcasts; slightly acid; clear wavy boundary.

A2—4 to 9 inches; light yellowish brown (10YR 6/4) loam; few fine faint light grayish brown and brownish yellow mottles; weak fine granular structure; slightly hard, very friable; common roots; few fine pores; few wormcasts; strongly acid; abrupt wavy boundary.

B21t—9 to 16 inches; dark red (2.5YR 3/6) clay; many medium prominent gray (10YR 6/1) mottles; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; few roots; few patchy clay films; common pressure faces; very strongly acid; gradual wavy boundary.

B22t—16 to 26 inches; light brownish gray (2.5Y 6/2) clay; common medium prominent dark red (2.5YR 3/6) and common medium faint gray (10YR 6/1) mottles; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; few roots; few clay films mainly along root channels; few black concretions; 1 millimeter to 2 millimeters

in diameter; common pressure faces; very strongly acid; gradual wavy boundary.

B23t—26 to 42 inches; gray (10YR 6/1) clay; common medium prominent dark red (2.5YR 3/6) and common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few roots; few thin clay films mainly along root channels; few black concretions 1 millimeter to 2 millimeters in diameter; common pressure faces; few slickensides 2 to 5 centimeters across; strongly acid; gradual wavy boundary.

B24t—42 to 55 inches; yellowish brown (10YR 5/4) clay; common medium distinct gray (10YR 6/1) and few medium prominent reddish brown (5YR 4/4) mottles; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots mainly on faces of peds; few black concretions 2 to 4 millimeters in diameter; common black stains; few fine pockets of white salts; common slickensides 2 to 5 centimeters across; slightly acid; gradual wavy boundary.

B25t—55 to 75 inches; mottled gray (10YR 6/1) and yellowish brown (10YR 5/6) clay; common coarse distinct dark gray (10YR 4/1) mottles; moderate coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common clay films; few black concretions 2 to 3 millimeters in diameter; mildly alkaline.

The solum ranges from 60 inches to more than 75 inches in thickness.

The A horizon is loam. It is strongly acid to slightly acid. The A1 horizon is very dark grayish brown, dark grayish brown, or brown. The A2 horizon is pale brown or light yellowish brown and has few brownish or yellowish mottles.

The B21t horizon is dark red, red, or yellowish red and has few to many, grayish or brownish mottles. This horizon is very strongly acid. The B22t horizon and B23t horizons are light brownish gray or gray and have common gray, brownish, or reddish mottles. These horizons are very strongly acid to medium acid. The B24t and B25t horizons are yellowish brown or mottled gray, red, yellowish brown, or light olive brown clay or clay loam. These horizons are slightly acid to mildly alkaline.

Austin series

The Austin series consists of moderately deep, clayey soils on uplands. These soils formed in calcareous chalk or chalk interbedded with marl. Slopes range from 1 to 3 percent.

Typical pedon of Austin silty clay, 1 to 3 percent slopes; from the intersection of Farm Road 905 and Southeast Loop 286 in Paris, 2.6 miles southeast on Farm Road 905, 1.1 miles south and 0.9 mile northwest on county road, 500 feet north of county road in pasture:

Ap—0 to 5 inches; very dark brown (10YR 2/2) silty clay; weak very fine granular and subangular blocky structure; hard, friable, sticky and plastic; common roots; common wormcasts; few fine pitted calcium carbonate concretions; few fine black concretions; calcareous; moderately alkaline; clear smooth boundary.

A1—5 to 12 inches; very dark grayish brown (10YR 3/2) silty clay; moderate very fine granular and subangular blocky structure; hard, friable, sticky and plastic; common roots; common wormcasts; few fine pitted calcium carbonate concretions; few fine black concretions; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—12 to 20 inches; brown (10YR 4/3) silty clay; common dark grayish brown (10YR 4/2) coatings on some faces of peds; strong very fine and fine subangular blocky structure; hard, friable, sticky and plastic; few roots; common wormcasts; common fine and medium concretions and soft bodies of calcium carbonate; few fine black concretions; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—20 to 27 inches; brown (10YR 5/3) silty clay; few fine distinct yellowish brown mottles; strong very fine and fine subangular blocky structure; hard, friable, sticky and plastic; few roots; few wormcasts; many concretions and soft bodies of calcium carbonate; few black concretions; calcareous; moderately alkaline; gradual wavy boundary.

B3ca—27 to 37 inches; pale brown (10YR 6/3) silty clay loam; common fine and medium distinct brownish yellow (10YR 6/6) and yellow (10YR 7/6) mottles; strong very fine subangular blocky structure; slightly hard, very friable, sticky and plastic; few roots; few wormcasts; about 30 percent white (10YR 8/2) and very pale brown (10YR 8/3) platy chalk fragments; few lenses and threads of soft calcium carbonate; calcareous; moderately alkaline; gradual irregular boundary.

C—37 to 44 inches; white (10YR 8/2) and very pale brown (10YR 8/3) platy chalk that is softer than 3 (Mohs' scale); few thin tongues of pale brown silty clay loam in crevices between chalk plates; calcareous; moderately alkaline.

The solum is 20 to 40 inches thick. Clay content is 35 to 55 percent. Below a depth of 10 inches, more than one third of the clay fraction is calcium carbonate. Below the A horizon, the soil has 40 to 70 percent calcium carbonate equivalent. Reaction is moderately alkaline.

The A horizon is very dark brown, very dark grayish brown, or dark grayish brown.

The B horizon is pale brown, very pale brown, light yellowish brown, light brownish gray, brown, or grayish brown silty clay or silty clay loam.

The C horizon is platy chalk or chalk interbedded with marl.

Belk series

The Belk series consists of deep, clayey soils on flood plains. These soils formed in calcareous, clayey alluvial sediment deposited over stratified calcareous silt loam. Slope ranges from 0 to 1 percent.

Typical pedon of Belk clay; from the intersection of Farm Road 197 and U.S. Highway 271 in Arthur City, 15.2 miles west on Farm Road 197, 1.0 mile west on county road from Ragtown Community, and 50 feet north of county road in cultivated field:

Ap—0 to 6 inches; reddish brown (5YR 4/3) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, very sticky; few fine roots; calcareous; moderately alkaline; clear smooth boundary.

B2—6 to 26 inches; reddish brown (5YR 4/4) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, very sticky; few fine roots; peds have shiny surfaces; calcareous; moderately alkaline; abrupt wavy boundary.

IIC1—26 to 45 inches; reddish brown (5YR 5/4) silt loam; massive; slightly hard, very friable; few thin strata of yellowish red (5YR 4/6) very fine sandy loam; calcareous; moderately alkaline; clear wavy boundary.

IIC2—45 to 73 inches; yellowish red (5YR 5/6) silt loam; few thin strata of reddish brown (5YR 5/4) very fine sandy loam; few thin strata of reddish brown (5YR 4/4) clay in lower part; massive; slightly hard, very friable; many distinct bedding planes; calcareous; moderately alkaline.

The soil is calcareous and moderately alkaline throughout.

The A horizon is dark reddish brown or reddish brown. Where this horizon has chroma and value of less than 3.5 moist, it is less than 7 inches thick.

The B horizon is reddish brown clay. It ranges from 40 to 60 percent clay.

The IIC horizon is reddish brown or yellowish red. It is silt loam stratified with layers of very fine sandy loam or fine sandy loam. Some pedons contain thin strata of loamy fine sand, loamy very fine sand, silty clay loam, and clay.

Benklin series

The Benklin series consists of deep, loamy soils on uplands. These soils formed in loamy ancient alluvial deposits. They are on low terraces of major streams. Slopes range from 0 to 1 percent.

Typical pedon of Benklin silt loam; from the intersection of Farm Road 38 and Farm Road 128 in Ben Franklin, 0.8 mile east on Farm Road 128, 1.0 mile east on county road, 0.6 mile north, 300 yards west of county road in hay meadow:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silt loam; moderate medium granular structure; hard, friable; many fine roots; few worm channels; neutral; abrupt smooth boundary.

B21t—6 to 18 inches; very dark brown (10YR 2/2) loam; moderate very fine and fine blocky structure; hard, friable; common fine roots; few fine pores; common wormcasts and channels; few patchy clay films; neutral; gradual smooth boundary.

B22t—18 to 33 inches; very dark grayish brown (10YR 3/2) loam; common medium faint dark grayish brown (10YR 4/2) and brown (10YR 4/3) mottles; moderate fine and medium blocky structure; hard, friable; common fine roots; few fine pores; common wormcasts and channels; few black concretions 1 millimeter to 2 millimeters in diameter; many peds have dark brown (10YR 2/2) clay films; neutral; gradual smooth boundary.

B23t—33 to 41 inches; dark grayish brown (10YR 4/2) clay loam; common medium faint brown (10YR 4/3) and yellowish brown (10YR 5/4) mottles; moderate medium prismatic structure parting to moderate fine and medium blocky; hard, friable; few fine roots; common wormcasts and channels; few black concretions 1 millimeter to 2 millimeters in diameter; very dark grayish brown (10YR 3/2) clay flows on faces of prisms; mildly alkaline; gradual smooth boundary.

B24t—41 to 63 inches; mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) clay loam; few medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium blocky; hard, friable; few fine roots; common black concretions 2 to 4 millimeters in diameter; few black nodules; dark grayish brown (10YR 4/2) clay flows on faces of prisms; mildly alkaline.

The solum is more than 60 inches thick. The mollic epipedon is 20 to 45 inches thick.

The A horizon is very dark grayish brown, dark brown, or very dark brown. It is medium acid to neutral.

The B21t horizon is very dark brown loam, silty clay loam, or clay loam. It is slightly acid or neutral. The B22t and B23t horizons are dark grayish brown, very dark grayish brown, very dark brown, or brown. Few to many, faint or distinct mottles of dark grayish brown, grayish brown, brown, yellowish brown, dark yellowish brown, or strong brown are present. This horizon is loam, silty clay loam, or clay loam. It is slightly acid to mildly alkaline. The B24t horizon is mottled grayish brown, dark grayish

brown, brown, brownish yellow, yellowish brown, dark yellowish brown, light olive brown, or yellowish red loam, silty clay loam, or clay loam. It is neutral to moderately alkaline.

Bernaldo series

The Bernaldo series consists of deep, loamy soils on uplands. These soils formed in loamy sediment. Slopes range from 1 to 3 percent.

Typical pedon of Bernaldo fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 195 and Northeast Loop 286 in Paris, 7.6 miles northeast on Farm Road 195, 0.35 mile south on Farm Road 196, 4.9 miles east on Farm Road 1502, and 350 feet north in pasture:

Ap—0 to 9 inches; brown (10YR 5/3) fine sandy loam; weak fine subangular blocky and granular structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

A2—9 to 16 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak fine subangular blocky structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

B21t—16 to 25 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium faint strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; very hard, firm; few fine roots; few fine and very fine pores; few thin clay films; medium acid; gradual smooth boundary.

B22t—25 to 32 inches; yellowish brown (10YR 5/6) sandy clay loam; common medium faint strong brown (7.5YR 5/6) and common medium prominent red (2.5YR 4/6) mottles; weak fine and medium subangular blocky structure; very hard, firm; few fine roots; few very fine pores; few thin clay films; very strongly acid; gradual smooth boundary.

B23t&A'2—32 to 53 inches; yellowish brown (10YR 5/6) sandy clay loam; few medium distinct light brownish gray (10YR 6/2) and common medium prominent red (2.5YR 4/6) mottles; weak medium prismatic structure parting to weak fine subangular blocky; very hard, firm; few fine roots; few very fine pores; few thin clay films; about 5 percent of mass is vertical interfingers 3 to 8 millimeters wide and 8 to 12 centimeters long of uncoated sand grains; very strongly acid; diffuse irregular boundary.

B24t&A'2—53 to 65 inches; yellowish brown (10YR 5/8) sandy clay loam; many large prominent red (2.5YR 4/6) and common medium distinct light brownish gray (10YR 6/2) mottles; weak medium prismatic structure parting to weak fine subangular blocky; very hard, firm; few fine roots; common thick clay films on faces of prisms; about 20 percent of mass is vertical tongues 0.5 centimeter to 3 centimeters wide and 10 to 20 centimeters long of uncoated sand grains; very strongly acid.

The solum is 60 inches to more than 72 inches thick.

The A horizon is fine sandy loam. It is strongly acid to slightly acid except where limed. The A1 or Ap horizon is brown or dark yellowish brown. The A2 horizon is yellowish brown or light yellowish brown.

The B21t and B22t horizons are brown, strong brown, or yellowish brown. Few to common, brownish and reddish mottles are present. These horizons are sandy clay loam, loam, or clay loam. They are very strongly acid to medium acid.

The B23t&A'2 and B24t&A'2 horizons are brown, yellowish brown, or brownish yellow. Few to many, grayish, brownish, or reddish mottles are present, but grayish mottles are only below a depth of 30 inches. Tongues and interfingers of uncoated sand and silt grains are present. These horizons are fine sandy loam, loam, or sandy clay loam. They are very strongly acid.

The Bernaldo soils in this survey area have base saturation of about 28 percent, which is less than that described in the range for the series. This difference does not significantly affect use, management, and behavior of these soils.

Burleson series

The Burleson series consists of deep, clayey soils on uplands. These soils formed in clayey sediment. Slopes range from 0 to 1 percent.

Typical pedon of Burleson clay, 0 to 1 percent slopes; from the intersection of Texas Highway 19 and U.S. Highway 82 in the Square in Paris, 10.0 miles south on Texas Highway 19, 3.8 miles west on Farm Road 1184, 1.2 miles west and 0.8 mile south on county road, 50 feet east of county road in cultivated field in the center of a microdepression:

Ap—0 to 5 inches; very dark gray (10YR 3/1) clay; gray (10YR 5/1) granular hard surface crust about 4 millimeters thick; moderate medium blocky structure parting to moderate fine blocky; extremely hard, very firm, sticky and plastic; common fine and medium roots; neutral; abrupt smooth boundary.

A1—5 to 22 inches; black (10YR 2/1) clay; moderate coarse blocky structure parting to moderate fine and medium blocky; extremely hard, very firm, sticky and plastic; few fine roots; few black concretions 1 millimeter to 2 millimeters in diameter; peds have shiny pressure faces; common grooved intersecting slickensides in lower part of horizon; neutral; diffuse wavy boundary.

AC1—22 to 57 inches; very dark gray (10YR 3/1) clay; many grooved intersecting slickensides border parallelepipeds that part to moderate fine and medium blocky structure; extremely hard, very firm, sticky

and plastic; few fine roots; few black concretions 1 millimeter to 3 millimeters in diameter; few calcium carbonate concretions as much as 2 millimeters across; peds have shiny pressure faces; mildly alkaline; diffuse wavy boundary.

AC2—57 to 69 inches; dark gray (10YR 4/1) clay; common grooved intersecting slickensides border parallelepipeds that part to moderate fine and medium blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few black concretions 1 millimeter to 3 millimeters in diameter; 2 to 3 percent strongly cemented calcium carbonate concretions as much as 2 centimeters across; peds have shiny pressure faces; calcareous; moderately alkaline; diffuse wavy boundary.

AC3—69 to 80 inches; gray (10YR 6/1) clay; many medium faint light brownish gray (2.5Y 6/2), common medium distinct light olive brown (2.5Y 5/4), and few medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse blocky structure parting to moderate fine blocky; extremely hard, very firm, sticky and plastic; few fine roots; few black concretions 1 millimeter to 3 millimeters in diameter; 2 to 3 percent calcium carbonate concretions as much as 5 millimeters across; common intersecting slickensides; peds have shiny pressure faces; calcareous; moderately alkaline.

The solum ranges in thickness from about 60 inches in the microknolls to more than 80 inches in the microdepressions. Intersecting slickensides begin at a depth of 20 to 30 inches. When dry, cracks that are 1 inch to 2 inches wide at a depth of 20 inches form. Cycles of microknolls and microdepressions are repeated each 5 to 15 feet.

The A horizon is black or very dark gray. It is medium acid to moderately alkaline. The matrix is noncalcareous.

The AC horizon is very dark gray, dark gray, or gray clay or silty clay. In some pedons this horizon has few to common, faint to distinct, brownish, olive, and yellowish mottles. The horizon is mildly alkaline or moderately alkaline.

Caspiana series

The Caspiana series consists of deep, loamy soils on uplands. These soils formed in loamy alluvial sediment. Slopes range from 0 to 1 percent.

Typical pedon of Caspiana silt loam; from the intersection of Farm Road 197 and Farm Road 906 in Chicota, 0.3 mile west on Farm Road 197 and county road to Chicota School, 0.25 mile north, 0.25 mile west, 3.3 miles north on county road, 0.5 mile east on field road and spray plane landing strip, 100 feet southeast of field road in cultivated field:

Ap—0 to 10 inches; dark brown (7.5YR 3/2) silt loam; moderate fine granular structure; hard, friable; few roots; slightly acid; abrupt smooth boundary.

B21t—10 to 16 inches; dark reddish brown (5YR 3/2) silt loam; few fine faint dark reddish brown mottles; moderate fine and medium subangular blocky structure; hard, friable; common very fine and fine pores; common roots; common wormcasts; distinct patchy clay films; neutral; gradual smooth boundary.

B22t—16 to 19 inches; dark brown (7.5YR 3/2) silt loam; few fine distinct dark reddish brown mottles; moderate fine and medium subangular blocky structure; hard, friable; common fine pores; common roots; common wormcasts; few distinct patchy clay films; neutral; gradual smooth boundary.

B23t—19 to 48 inches; reddish brown (5YR 4/4) silt loam; common dark reddish brown (5YR 3/3) ped coatings and few fine faint yellowish red mottles; moderate fine and medium subangular blocky structure; hard, friable; common fine pores; few roots; few wormcasts; few black concretions 1 millimeter to 3 millimeters in diameter; distinct patchy clay films; neutral; gradual smooth boundary.

B3—48 to 58 inches; yellowish red (5YR 4/6) silt loam; many fine faint reddish brown mottles; moderate medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; common fine pores; few wormcasts; few patchy clay films on faces of prisms; neutral; gradual smooth boundary.

C—58 to 80 inches; yellowish red (5YR 4/6) silt loam; massive; slightly hard, friable; few soft black bodies 3 to 12 millimeters in diameter; neutral.

The solum is 47 to 60 inches thick.

The A horizon is dark brown, very dark grayish brown, very dark brown, or dark reddish brown. This horizon is slightly acid or neutral.

The B21t and B22t horizons are very dark brown, dark brown, very dark grayish brown, or dark reddish brown. These horizons are silt loam or silty clay loam. They are neutral or mildly alkaline. The B23t horizon is reddish brown, dark reddish brown, yellowish red, brown, or strong brown silt loam or silty clay loam. It is neutral to moderately alkaline. The B3 horizon is yellowish red, strong brown, or reddish brown silt loam or silty clay loam. It is neutral to moderately alkaline.

The C horizon is yellowish red, strong brown, or reddish brown silt loam or very fine sandy loam. It is neutral to moderately alkaline.

Crockett series

The Crockett series consists of deep, loamy soils on uplands. These soils formed in loamy and clayey sediment commonly interbedded with shale. Slopes range from 0 to 3 percent.

Typical pedon of Crockett loam, 1 to 3 percent slopes; from the intersection of Farm Road 905 and Southeast Loop 286 in Paris, 14.5 miles southeast on Farm Road 905, 0.2 mile east on county road, and 75 feet north of county road in pasture:

A1—0 to 8 inches; very dark grayish brown (10YR 3/2) loam; massive; very hard, friable; few roots; few wormcasts; slightly acid; abrupt wavy boundary.

B21t—8 to 17 inches; distinctively mottled brown (10YR 4/3) and reddish brown (5YR 4/4) clay; few fine prominent mottles of dark red; moderate coarse prismatic structure parting to moderate fine and medium blocky; extremely hard, very firm; few roots; few wormcasts; clay films 1/2 unit of chroma darker than soil matrix; few siliceous pebbles 1 centimeter to 2.5 centimeters across; few black concretions 1 millimeter to 3 millimeters in diameter; vertical cracks partly filled with darker, less clayey material; slightly acid; diffuse wavy boundary.

B22t—17 to 29 inches; faintly mottled light olive brown (2.5Y 5/4) and olive (5Y 5/3) clay; common medium prominent reddish brown (5YR 4/4) and common medium faint grayish brown (10YR 5/2) mottles; moderate coarse blocky structure parting to moderate fine and medium blocky; extremely hard, very firm; few roots; few wormcasts; few clay films; few siliceous pebbles as much as 1 centimeter across; few black concretions 1 millimeter to 3 millimeters in diameter; few pressure faces 2 to 5 centimeters across; vertical cracks partly filled with darker, less clayey soils; slightly acid; diffuse wavy boundary.

B23t—29 to 39 inches; olive (5Y 5/3) clay; few medium prominent strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) mottles; weak coarse blocky structure parting to weak fine and medium blocky; extremely hard, very firm; few roots; few clay films; few siliceous pebbles as much as 1 centimeter across; few black concretions 1 millimeter to 3 millimeters in diameter; few pressure faces 2 to 5 centimeters across; neutral; diffuse wavy boundary.

B24t—39 to 51 inches; olive brown (2.5Y 4/4) clay; weak coarse blocky structure; extremely hard, very firm; few roots; few clay films; few siliceous pebbles as much as 1 centimeter across; few black concretions 1 millimeter to 3 millimeters in diameter; common pressure faces 2 to 8 centimeters across; mildly alkaline; clear wavy boundary.

B3ca—51 to 59 inches; light olive brown (2.5Y 5/4) clay loam; common medium distinct grayish brown (2.5Y 5/2) and many fine to coarse faint light olive brown (2.5Y 5/6) mottles; weak coarse blocky structure; extremely hard, very firm; few fine roots; few black concretions 1 millimeter to 4 millimeters in diameter; common black streaks; 10 to 15 percent, by volume, concretions of calcium carbonate; few pressure faces 5 to 8 centimeters across; calcareous; moderately alkaline; clear wavy boundary.

Cca—59 to 73 inches; distinct and coarsely mottled light gray (2.5Y 7/2) and brownish yellow (10YR 6/6) loam; massive; extremely hard, very firm; 15 to 20 percent, by volume, concretions and soft bodies of calcium carbonate; few black streaks; calcareous; moderately alkaline.

The solum is 45 inches to more than 60 inches thick. Secondary carbonates are below a depth of 30 inches.

The A horizon is very dark grayish brown, dark grayish brown, brown, or dark brown loam or silt loam. It is medium acid to neutral.

The B21t horizon is mottled. The degree of mottling varies within a few feet. In some pedons, this horizon is dark brown, brown, olive brown, or light olive brown and has common to many olive, yellowish, brownish, or reddish mottles. In other pedons, it is mottled in shades of red, yellow, brown, or olive. The horizon is medium acid or slightly acid. The rest of the B2t horizon and the B3ca horizon are dark grayish brown, grayish brown, brown, olive brown, light olive brown, olive, or light yellowish brown. Few to common, reddish, olive, yellowish, or brownish mottles are present. These horizons are clay or clay loam and have a clay content of 35 to 50 percent in the control section. They are medium acid to moderately alkaline.

The C horizon is mottled dark gray, light gray, grayish brown, light brownish gray, yellowish brown, light olive brown, or brownish yellow loam or clay loam. In some pedons, it is thinly interbedded with shale. This horizon is mildly alkaline or moderately alkaline.

Deport series

The Deport series consists of deep, clayey soils on uplands. These soils formed in clay, clay stratified with shale, and stratified shale. Slopes range from 0 to 3 percent.

Typical pedon of Deport clay, 1 to 3 percent slopes; from the Post Office in Cunningham, 0.65 mile west on Farm Road 196, 0.7 mile south on field road, and 950 feet east of field road in pasture in the center of a microdepression:

Ap—0 to 8 inches; dark gray (10YR 4/1) clay; moderate medium blocky structure; extremely hard, very firm, very sticky and plastic; few roots; few wormcasts; medium acid; clear smooth boundary.

AC1g—8 to 25 inches; dark gray (10YR 4/1) clay; common medium faint grayish brown (10YR 5/2) and common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium blocky structure parting to moderate fine blocky; extremely hard, very firm, very sticky and plastic; few roots; few grooved intersecting slickensides 5 to 10 centi-

meters across; many pressure faces; few vertical cracks about 1 centimeter wide filled with dark gray (10YR 4/1) soil material; few black concretions 1 millimeter to 3 millimeters in diameter; medium acid; diffuse wavy boundary.

AC2g—25 to 65 inches; gray (10YR 5/1) clay; common fine distinct strong brown and light yellowish brown mottles; moderate coarse angular blocky structure parting to moderate fine and medium blocky; extremely hard, very firm, very sticky and plastic; few fine roots; common grooved intersecting slickensides 5 to 15 centimeters across; cracks about 1 centimeter wide filled with dark gray (10YR 4/1) soil material; few black concretions 1 millimeter to 3 millimeters in diameter; slightly acid; diffuse wavy boundary.

Cg—65 to 70 inches; gray (10YR 6/1) clay; common medium distinct light yellowish brown (2.5Y 6/4) and brownish yellow (10YR 6/6) mottles; massive; common cleavage planes; extremely hard, very firm, very sticky and plastic; few black concretions 1 millimeter to 3 millimeters in diameter; mildly alkaline.

The soil is more than 60 inches thick. Intersecting slickensides begin at a depth of 12 to 16 inches. When dry, cracks that are 1 inch to 2 inches wide at a depth of 20 inches form. Cycles of microdepressions and microknolls are repeated each 4 to 10 feet.

The A horizon is very dark gray, dark gray, or gray. This horizon is medium acid or slightly acid. The AC1g horizon is dark gray. Few or common, fine or medium, grayish or brownish mottles generally are present. The horizon is medium acid to neutral. The AC2g horizon is gray, grayish brown, or olive brown. Few to many, faint or distinct, grayish, olive, and brownish mottles are present. The horizon is slightly acid to moderately alkaline, and is calcareous below a depth of 40 inches in a few pedons.

The Cg horizon is gray, light olive gray, or yellowish brown. Common to many, grayish, brownish, or yellowish mottles are present. The horizon is clay, shaly clay, or stratified shale. It is mildly alkaline or moderately alkaline.

Derly series

The Derly series consists of deep, loamy soils on uplands. These soils formed in clayey sediment. Slopes range from 0 to 1 percent.

Typical pedon of Derly silt loam, in an area of Derly-Raino complex; from the intersection of Northeast Loop 286 and Farm Road 195 in Paris, 1.8 miles northeast on Farm Road 195, 3.0 miles north, 0.1 mile east, 1.8 miles north on county road, 0.7 mile east on county road, 350 feet south of country road in pasture:

A1—0 to 3 inches; grayish brown (10YR 5/2) silt loam; common medium faint dark grayish brown (10YR 4/2) mottles; weak fine subangular blocky structure; slightly hard, friable; common coarse roots; few fine pores; few wormcasts; medium acid; clear smooth boundary.

A2g—3 to 8 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct light yellowish brown (10YR 6/4) mottles; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, friable; common coarse roots; common fine pores; few wormcasts; very strongly acid; clear wavy boundary.

Bg&Ag—8 to 12 inches; light brownish gray (10YR 6/2) clay loam; common medium distinct light olive brown (2.5Y 5/4) mottles in the Bg part of horizon; moderate fine and medium subangular blocky structure; very hard, firm; light brownish gray (10YR 6/2) A2g material occurs as tongues and interfingers and makes up about 25 percent, by volume, of this horizon; common coarse roots; common fine and medium pores; few wormcasts; very strongly acid; clear irregular boundary.

B21tg—12 to 31 inches; grayish brown (10YR 5/2) clay; moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; light brownish gray (10YR 6/2) silt loam interfingers and tongues 1 millimeter to 15 millimeters wide and 3 to 8 inches long make up about 10 percent of the upper part of the horizon and about 3 percent of the lower part; common medium roots; few clay films; few pressure faces 1 centimeter to 2 centimeters across; very strongly acid; gradual wavy boundary.

B22tg—31 to 42 inches; grayish brown (10YR 5/2) clay; moderate coarse blocky structure parting to weak medium blocky; extremely hard, very firm, sticky and plastic; few medium roots mostly confined to surfaces of peds; few clay films; few thin streaks of uncoated sand and silt grains; common slickensides 2 to 4 inches across; very strongly acid; gradual wavy boundary.

B23tg—42 to 50 inches; grayish brown (2.5Y 5/2) clay; few medium distinct yellowish brown (10YR 5/6) mottles; some ped surfaces are dark grayish brown (10YR 4/2); moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; few medium roots mainly confined to surfaces of peds; few clay films; few black concretions 1 millimeter to 4 millimeters in diameter; few white salt spots; common slickensides 3 to 4 inches across; strongly acid; gradual wavy boundary.

B24tg—50 to 74 inches; light brownish gray (2.5Y 6/2) clay; few medium distinct light olive brown (2.5Y 5/4) mottles; moderate coarse blocky structure; extremely hard, very firm, sticky and plastic; few

medium roots mainly confined to surfaces of peds; many clay films; few black concretions 1 millimeter to 4 millimeters in diameter; few pressure faces 1 centimeter to 2 centimeters across; slightly acid; diffuse wavy boundary.

B3g—74 to 80 inches; mottled light gray (2.5Y 7/2) and light brownish gray (2.5Y 6/2) clay; common medium distinct brownish yellow (10YR 6/6) mottles; weak medium prismatic structure; extremely hard, very firm, sticky and plastic; few fine roots; few clay films and gray (10YR 5/1) clay flows; few black concretions 2 to 4 millimeters in diameter; few masses of white crystals; neutral.

The solum is more than 72 inches thick.

The A1 horizon is very dark grayish brown, dark grayish brown, brown, or grayish brown. Few to common mottles of these colors and light brownish gray are in most pedons. The horizon is very strongly acid through medium acid. The A2 horizon is grayish brown, light brownish gray, or light gray. This horizon has few or common yellowish brown, light yellowish brown, or brownish yellow mottles. It is very strongly acid or strongly acid.

The Bg&Ag horizon is dark grayish brown, grayish brown, or light brownish gray. Mottles are few or common, fine or medium, distinct or prominent, dark red, red, yellowish red, dark yellowish brown, yellowish brown, or light olive brown. The horizon is clay loam, clay, or silty clay. Tongues and interfingers of A2g material make up 15 to 40 percent of this horizon. Reaction is very strongly acid or strongly acid. The B21tg horizon is dark gray, dark grayish brown, or grayish brown. Few or common, fine or medium, reddish or brownish mottles are present in many places. The horizon is clay or silty clay. It is very strongly acid or strongly acid. Interfingers make up 3 to 15 percent of the horizon. Clay content of the control section averages 35 to 50 percent. The B22tg and B23tg horizons are dark grayish brown or grayish brown. In some places, peds are coated with very dark grayish brown or dark grayish brown. Few or common, fine or medium, reddish or brownish mottles commonly are present. These horizons are clay or silty clay and range from very strongly acid to medium acid. Common to many slickensides and a few silt and sand coatings are present. The B24tg horizon is gray, grayish brown, or light brownish gray. Few to common, reddish or brownish mottles are in some places. The horizon is clay or silty clay, and ranges from medium acid to neutral. The B3g horizon is mottled light brownish gray and light gray. Reddish, yellowish, and brownish mottles are in some pedons. The horizon is clay or silty clay, and ranges from medium acid to neutral.

Desha series

The Desha series consists of deep, clayey soils on flood plains. These soils formed in clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Desha clay; from the intersection of U.S. Highway 271 and Farm Road 906 north of Powderly, 7.8 miles east on Farm Road 906, 1.2 miles south on county road, and 400 yards east of county road in cultivated field:

Ap—0 to 7 inches; dark reddish brown (5YR 3/2) clay; moderate fine and medium subangular blocky structure; very hard, very firm, very sticky and plastic; few roots; few wormcasts; mildly alkaline; abrupt smooth boundary.

A1—7 to 26 inches; dark reddish brown (5YR 2/2) clay; few fine faint reddish brown mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm, very sticky and plastic; few roots; few reddish brown wormcasts; common pressure faces; mildly alkaline; gradual wavy boundary.

B21—26 to 41 inches; reddish brown (5YR 4/3) clay; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few wormcasts; common black and very dark brown clayey material in vertical cracks about 2 centimeters wide at upper part that taper out in lower part of horizon; common large slickensides; 1 to 3 percent, by volume, calcium carbonate concretions in lower part of horizon; few fine black concretions; calcareous; moderately alkaline; gradual wavy boundary.

B22—41 to 70 inches; reddish brown (5YR 4/3) clay; weak fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; 2 to 4 percent, by volume, concretions and soft bodies of calcium carbonate; few black concretions 1 millimeter to 3 millimeters in diameter; few slickensides; calcareous; moderately alkaline.

The solum is more than 60 inches thick.

The A horizon is dark reddish brown or dark brown. It is neutral or mildly alkaline.

The B horizon is dark reddish brown or reddish brown. It is mildly alkaline or moderately alkaline. A few calcium carbonate concretions are present. Some pedons have a buried horizon that is dark reddish gray, brown, or very dark grayish brown.

Some pedons have a reddish brown C horizon. This horizon is clay or clay loam and has lenses of coarser textured material. It is moderately alkaline.

The Desha soils in this survey area have a calcareous B2 horizon, which is not described in the range for the series. This difference does not significantly affect the use, management, or behavior of these soils.

Eddy series

The Eddy series consists of very shallow to shallow, loamy soils on uplands. These soils formed in platy chalk. Slopes range from 2 to 5 percent.

Typical pedon of Eddy gravelly clay loam, in an area of Stephen-Eddy complex, 2 to 5 percent slopes (fig. 9); from the intersection of Farm Road 1509 and Farm Road 137 in Petty, 1.5 miles east on Farm Road 1509, 0.4 mile south on county road, and 85 feet east in cultivated field:

Ap—0 to 6 inches; brown (10YR 4/3) gravelly clay loam; moderate fine subangular blocky structure parting to moderate very fine subangular blocky and granular; hard, firm; common fine roots; about 30 percent angular and platy chalk fragments as much as 3 centimeters across the long axis; calcareous; moderately alkaline; abrupt irregular boundary.

C&A—6 to 10 inches; grayish and whitish angular and platy chalk fragments and chalk in place and brown (10YR 4/3) clay loam; few fine roots; chalk content grades from 50 percent at top of horizon to 95 percent at bottom; calcareous; moderately alkaline; abrupt wavy boundary.

C—10 to 28 inches; white (2.5Y 8/2) platy chalk that is softer than 3 (Mohs' scale); few thin tongues of brown clay loam in crevices between some chalk plates in upper part.

The soil ranges from 3 to 15 inches thick over chalk that is softer than 3 (Mohs' scale). The soil is 35 to 60 percent chalk fragments. Calcium carbonate equivalent ranges from 50 to 90 percent. The soil is moderately alkaline.

The A horizon is grayish brown, dark grayish brown, pale brown, or brown. Texture of soil without chalk fragments is loam or clay loam, and the clay content is 18 to 35 percent.

Elbon series

The Elbon series consists of deep, loamy soils on flood plains. These soils formed in loamy and clayey, stratified alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Elbon silty clay loam, frequently flooded; from the intersection of Farm Road 38 and Farm Road 137 in Roxton, 2.3 miles southwest on Farm Road 38, 100 feet south of Farm Road in the flood plain of Rowdy Creek:

A11—0 to 10 inches; very dark grayish brown (2.5Y 3/2) silty clay loam; moderate fine and medium subangular blocky structure; very hard, firm; common fine roots; common wormcasts; calcareous; moderately alkaline; clear smooth boundary.

A12—10 to 21 inches; very dark grayish brown (2.5Y 3/2) silty clay loam; moderate fine and medium subangular blocky structure; very hard, firm; common fine roots; common wormcasts; few pockets and strata of very fine sandy loam 1 millimeter to 2 millimeters thick; calcareous; moderately alkaline; clear smooth boundary.

C1—21 to 39 inches; dark grayish brown (2.5Y 4/2) silty clay loam; massive; very hard, firm; few fine roots; common wormcasts; few strata as much as 2 centimeters thick of very dark grayish brown (2.5Y 3/2) silty clay loam; common grayish brown (2.5Y 5/2) and brown (10YR 5/3) very fine sandy loam strata 1 millimeter to 2 millimeters thick; evident bedding planes; few fine distinct dark yellowish brown mottles between bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C2—39 to 64 inches; very dark grayish brown (2.5Y 3/2) silty clay loam; massive; very hard, firm; few fine roots; few wormcasts; few strata as much as 2 centimeters thick of dark grayish brown (2.5Y 4/2); common strata of grayish brown (2.5Y 5/2) and brown (10YR 5/3) very fine sandy loam 1 millimeter to 2 millimeters thick; evident bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

Bb—64 to 80 inches; dark grayish brown (2.5Y 4/2) silty clay loam; weak fine and medium subangular blocky structure; very hard, firm; few fine roots; few wormcasts; few shell fragments; few grayish brown (2.5Y 5/2) and brown (10YR 5/3) very fine sandy loam pockets and strata 1 millimeter to 2 millimeters thick; calcareous; moderately alkaline.

The mollic epipedon ranges from 10 to 24 inches in thickness. Reaction is mildly alkaline or moderately alkaline throughout.

The A horizon is very dark grayish brown or very dark brown.

The C horizon is very dark grayish brown, dark brown, dark grayish brown, grayish brown, brown, light brownish gray, or pale brown. Thin strata of black or very dark gray are present in some pedons. This horizon is silty clay loam, silty clay, or clay loam, but thin strata of coarser or finer texture are present.

A buried horizon is common below a depth of 40 inches. This horizon is black, very dark gray, very dark brown, very dark grayish brown, or dark grayish brown silty clay loam, clay loam, or clay. Carbonates in the form of films and threads are common.

Ferris series

The Ferris series consists of deep, clayey soils on uplands. These soils formed in calcareous; stratified, weathered shale or shaly clay. Slopes range from 3 to 12 percent.

Typical pedon of Ferris clay, 5 to 12 percent slopes, eroded; from the intersection of Farm Road 137 and Farm Road 1184 in Howland, 1.5 miles west on Farm Road 137, 0.5 mile north on county road, 450 feet east of county road in pasture:

A1—0 to 4 inches; dark grayish brown (2.5Y 4/2) clay; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; common fine roots; few wormcasts; few fine black concretions; few fine calcium carbonate concretions; calcareous; moderately alkaline; clear wavy boundary.

AC1—4 to 9 inches; light olive brown (2.5Y 5/4) clay; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; few fine black concretions; common fine and medium calcium carbonate concretions; common vertical cracks filled with very dark grayish brown clayey material; common pressure faces; calcareous; moderately alkaline; gradual wavy boundary.

AC2—9 to 43 inches; olive (5Y 5/3) clay; common medium faint light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/4) mottles; moderate fine angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine black concretions; common concretions and powdery bodies of calcium carbonate; common intersecting slickensides and wedge-shaped parallelepipeds having long axis tilted 30 to 45 degrees from the horizontal; calcareous; moderately alkaline; gradual wavy boundary.

C—43 to 55 inches; pale olive (5Y 6/3) weakly stratified shale; common medium faint pale brown (10YR 6/3) mottles; extremely hard, very firm; few fine roots; powdery calcium carbonate bodies; calcareous; moderately alkaline.

The soil is 30 to 60 inches thick. Intersecting slickensides begin at a depth of 8 to 20 inches. When dry, cracks that are 1 to 2 inches wide at a depth of 20 inches form. Cycles of microdepressions and microknolls are repeated each 6 to 20 feet across the slope. The soil is calcareous and moderately alkaline.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, or light olive brown. The AC horizon is olive, light olive brown, light yellowish brown, or pale olive, with or without grayish, brownish, or yellowish mottles. Few to many concretions of calcium carbonate are present.

The C horizon is stratified light gray, light brownish gray, light olive brown, pale yellow, pale olive, or yellow. In many pedons this horizon is coarsely and prominently mottled. It is weathered shale or shaly clay.

Freestone series

The Freestone series consists of deep, loamy soils on uplands. These soils formed in loamy and clayey sediment. Slopes range from 0 to 3 percent.

Typical pedon of Freestone fine sandy loam, in an area of Freestone-Hicota complex, 0 to 3 percent slopes; from the intersection of Farm Road 197 and U.S. Highway 271 in Arthur City, 2.6 miles south on U.S. Highway 271, 1.3 miles east on county road, 1,080 feet south of county road in pasture:

A1—0 to 6 inches; brown (10YR 5/3) fine sandy loam; few fine faint yellowish brown mottles; moderate medium granular structure; slightly hard, very friable; common fine and medium roots; common wormcasts; slightly acid; clear smooth boundary.

A2—6 to 16 inches; light yellowish brown (10YR 6/4) fine sandy loam; weak fine subangular blocky structure; hard, friable; common fine and medium roots; common wormcasts; few fine pores; medium acid; clear wavy boundary.

B21t—16 to 23 inches; yellowish brown (10YR 5/6) loam; common medium faint yellowish brown (10YR 5/4) and few fine faint strong brown mottles; weak medium subangular blocky structure; very hard, firm; few fine roots; many fine and medium pores; common wormcasts; few patchy clay films; strongly acid; gradual wavy boundary.

B22t—23 to 33 inches; yellowish brown (10YR 5/6) clay loam; common medium prominent red (2.5YR 4/6) and common medium distinct grayish brown (2.5Y 5/2) mottles; moderate medium subangular blocky structure; very hard, firm; few roots along faces of peds; common wormcasts; common fine pores; common clay films 1/2 unit of chroma darker than soil matrix; few uncoated fine sand and silt grains along faces of few peds; strongly acid; gradual wavy boundary.

B23tg&A'2—33 to 44 inches; light gray (10YR 6/1) clay loam; common medium prominent dark red (2.5YR 3/6) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots along faces of peds; few fine pores; about 10 percent of the horizon is composed of uncoated sand and silt grains in the form of vertical streaks and pockets 2 to 5 millimeters wide on faces of prisms; very strongly acid; diffuse wavy boundary.

B24tg—44 to 59 inches; light brownish gray (2.5Y 6/2) clay; common medium prominent dark red (2.5YR 3/6) and common medium distinct yellowish brown (10YR 5/4) mottles; moderate medium blocky structure parting to moderate fine and medium subangular blocky; extremely hard, very firm; few fine roots along faces of peds; common clay films and gray

clay flows on faces of peds; common pressure faces and slickensides as much as 3 centimeters across; medium acid; gradual wavy boundary.

B25t—59 to 80 inches; light brownish gray (2.5Y 6/2) clay loam; common medium distinct olive yellow (2.5Y 6/6) and yellowish brown (10YR 5/6) and few medium prominent dark red (2.5YR 3/6) mottles; moderate coarse blocky structure; extremely hard, very firm, sticky; few fine roots confined to faces of peds; few gray clay flows; common pressure faces and slickensides as much as 5 centimeters across tilted at a 25 degree angle; medium acid.

The solum is more than 72 inches thick.

The A1 horizon is dark grayish brown or brown. This horizon is strongly acid to neutral. The A2 horizion is grayish brown, light brownish gray, pale brown, brown, light brown, light yellowish brown, or yellowish brown fine sandy loam. This horizon is strongly acid to neutral.

The B21t and B22t horizons are strong brown, yellowish brown, brownish yellow, or yellow, and they have reddish or grayish mottles in some places. There are mottles with chroma of 2 or less above a depth of 30 inches. The horizon is sandy clay loam, clay loam, or loam. It is very strongly acid to medium acid. The B23tg&A'2 horizon is yellowish brown, light gray, gray, or light brownish gray. This horizon has common to many brownish, grayish, and reddish mottles. Streaks and pockets of uncoated sand and silt grains make up 5 to 20 percent of the horizon. The horizon is clay or clay loam. It is very strongly acid to medium acid. The B24tg and B25t horizons are gray, light gray, or light brownish gray and have brownish, yellowish, and reddish mottles. These horizons are clay loam or clay. They are strongly acid or medium acid above a depth of 60 inches and are medium acid or slightly acid below that depth.

Guyton series

The Guyton series consists of deep, loamy soils on flood plains. These soils formed in loamy alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Guyton silt loam, frequently flooded; from the intersection of U.S. Highway 271 and Farm Road 197 in Arthur City, 1.6 miles south on U.S. Highway 271, 2.5 miles east on Farm Road 906, 1.5 miles south, 1.1 miles northeast, and 1.9 miles east on county road, and 270 feet south of county road in pasture:

A1—0 to 5 inches; grayish brown (10YR 5/2) silt loam; common medium distinct strong brown (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, friable; many roots; few worm channels; few fine black concretions; medium acid; clear smooth boundary.

A2g—5 to 16 inches; light brownish gray (2.5Y 6/2) silt loam; common medium distinct yellowish brown (10YR 5/4, 5/6) mottles; weak fine and medium subangular blocky structure; hard, friable; common fine roots; few wormcasts; common fine pores; few fine black concretions; medium acid; clear irregular boundary.

B21tg&A2—16 to 20 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) and few fine distinct strong brown (7.5YR 5/6) mottles; weak fine and medium subangular blocky structure; very hard, firm; common roots; common fine pores and few medium pores; about 15 percent of peds are covered by uncoated sand and silt grains; medium acid; gradual irregular boundary.

B22tg&A2—20 to 36 inches; light brownish gray (10YR 6/2) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to weak fine and medium subangular blocky; very hard, firm; few fine roots; few fine and medium pores; common 3 to 8 millimeters black concretions and bodies; 30 percent of the horizon is light gray (10YR 7/2) silt loam tongues 4 to 20 millimeters wide; many peds surrounded by pockets of uncoated sand and silt grains; strongly acid; gradual irregular boundary.

B23tg&A2—36 to 44 inches; grayish brown (10YR 5/2) silty clay loam; common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium prismatic structure parting to weak fine and medium subangular blocky; very hard, firm; few fine roots; few fine and medium pores; few clay films on faces of peds and in pores; few dark gray (10YR 4/1) clay films in old channels; few black concretions 2 to 6 millimeters across; 15 percent of the horizon is light gray (10YR 7/2) silt loam tongues 3 to 10 millimeters wide; strongly acid; gradual irregular boundary.

B24tg—44 to 72 inches; gray (10YR 5/1) silty clay loam; few fine distinct strong brown mottles; moderate coarse prismatic structure parting to weak medium and coarse blocky; very hard, firm; few fine roots; few fine and medium pores; few black concretions 2 to 6 millimeters across; common clay films on faces of peds; few thick dark gray (10YR 4/1) clay films in old channels and on prism faces; common vertical streaks and pockets of light gray (10YR 7/2) silt loam on many faces of prisms; slightly acid.

The solum is more than 60 inches thick. Black concretions and few or common, fine or medium mottles of yellowish brown or strong brown are present in all horizons.

The A1 horizon is dark grayish brown, grayish brown, or brown. This horizon is medium acid. The A2 horizon is gray, light gray, or light brownish gray very fine sandy loam or silt loam and is very strongly acid to medium acid. Tongues of A2 material extend into the Bt horizon.

The B21tg&A2 and B22tg&A2 horizons are grayish brown or light brownish gray silty clay loam, clay loam, or silt loam. The A2 material is light gray or white silt loam and uncoated sand and silt grains. The horizons are very strongly acid to medium acid.

The B23tg&A2 and B24tg horizons are gray, grayish brown, or light brownish gray. Pockets and streaks of light gray and white silt loam and uncoated sand and silt grains are common in most horizons. The horizons are silty clay loam or clay loam, and are strongly acid to slightly acid.

Harjo series

The Harjo series consists of deep, clayey soils on flood plains. These soils formed in loamy and clayey, calcareous, stratified alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Harjo clay, frequently flooded; from the intersection of Farm Road 197 and U.S. Highway 271 in Arthur City, 3.25 miles west on Farm Road 197, 0.1 mile north, 0.25 mile west, 0.1 mile north, 0.05 mile east, 1.8 miles north on county road, 4,400 feet north of county road in idle cropland:

A1—0 to 13 inches; dark reddish gray (5YR 4/2) clay; strong coarse subangular blocky structure parting to moderate medium subangular blocky; very hard, very firm, plastic; few roots; few wormcasts; calcareous; moderately alkaline; clear smooth boundary.

C1—13 to 24 inches; reddish brown (5YR 4/3) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, plastic; few roots; few wormcasts; few shell fragments; few pressure faces; few thin lenses of reddish brown loamy material; calcareous; moderately alkaline; gradual smooth boundary.

C2—24 to 58 inches; reddish brown (5YR 4/3) clay; few fine distinct gray mottles; weak fine and medium subangular blocky structure; extremely hard, very firm, plastic; common pressure faces; few shell fragements; few very fine calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

C3—58 to 80 inches; reddish brown (5YR 4/4) clay; common fine and medium distinct gray (5Y 5/1) mottles; massive; except for parallelepiped structure; extremely hard, very firm, plastic; few fine concretions of calcium carbonate; intersecting slickensides; calcareous; moderately alkaline.

The soil is calcareous and moderately alkaline throughout. Buried soils are in some pedons.

The A horizon is dark reddish gray or reddish brown clay.

The C horizon is weak red, reddish brown, or red. Few to common fine or medium gray mottles are present in most pedons. This horizon is clay or clay loam, and stratification is common in many places. Silt loam or very fine sandy loam is below a depth of 40 inches in some pedons.

Heiden series

The Heiden series consists of deep, clayey soils on uplands. These soils formed in calcareous shale stratified with clay. Slopes range from 2 to 5 percent.

Typical pedon of Heiden clay, 2 to 5 percent slopes; from the intersection of Farm Road 1497 and South Loop 286 in Paris, 1.7 miles south on Farm Road 1497, 0.7 mile east, 0.3 mile south on county road, 900 feet east of county road in pasture in the center of a microdepression:

Ap—0 to 5 inches; very dark grayish brown (2.5Y 3/2) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, very sticky and plastic; granular mulch about 6 millimeters thick on surface; few wormcasts; few black concretions 2 to 5 millimeters in diameter; few fine siliceous pebbles; calcareous; moderately alkaline; abrupt smooth boundary.

A1—5 to 26 inches; very dark grayish brown (2.5Y 3/2) clay; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few wormcasts; few black concretions 2 to 5 millimeters in diameter; few fine siliceous pebbles; many shiny ped faces; common grooved intersecting slickensides in lower part of horizon that form parallelepipeds as much as 8 centimeters long; calcareous; moderately alkaline; diffuse wavy boundary.

AC1—26 to 48 inches; olive gray (5Y 4/2) clay; coarse tilted grooved intersecting slickensides parting to moderate fine angular blocky structure; parallelepipeds as much as 8 centimeters long with axis tilted; extremely hard, very firm, very sticky and plastic; few wormcasts; peds have shiny surfaces; few black concretions 2 to 5 millimeters in diameter; few fine siliceous pebbles; vertical cracks 2 to 5 centimeters wide are filled with material similar to that of the Ap and A1 horizons; few concretions of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

AC2—48 to 62 inches; prominently and coarsely mottled dark grayish brown (2.5Y 4/2), light olive brown (2.5Y 5/4, 5/6), and brownish yellow (10YR 6/8) clay; weak coarse angular blocky structure; common grooved intersecting slickensides in upper part; extremely hard, very firm, sticky and plastic; few vertical cracks filled with material the same color as that of the horizons above; few calcium carbonate concretions; few black concretions; calcareous; moderately alkaline; diffuse wavy boundary.

C—62 to 80 inches; prominently and coarsely mottled brownish yellow (10YR 6/6), light olive brown (2.5Y 5/4), and light olive gray (5Y 6/2) stratified platy shale; extremely hard, very firm; calcareous; moderately alkaline.

The solum ranges in thickness from 40 inches in the microknolls to 65 inches in the microdepressions. Intersecting slickensides begin at a depth of 16 to 24 inches. When dry, cracks that are 1 inch to 2 inches wide at a depth of 20 inches form. Cycles of microdepressions and microknolls are repeated every 4 to 12 feet across the slope. The soil is dominantly calcareous and moderately alkaline, but in places the upper 12 inches is noncalcareous and mildly alkaline or moderately alkaline.

The A horizon is very dark grayish brown, very dark brown, very dark gray, dark olive gray, or black. Where chroma is less than 1.5, the surface layer is less than 12 inches thick in more than one-half of the pedon.

The AC horizon is dark grayish brown, grayish brown, light olive brown, light yellowish brown, olive gray, or olive. This horizon has yellowish or olive mottles in places. Weakly to strongly cemented calcium carbonate concretions make up less than 2 percent of the AC horizon.

The C horizon is weathered, calcareous, stratified shaly clay or shale.

Hicota series

The Hicota series consists of deep, loamy soils on uplands. These soils formed in loamy and clayey sediment. Slopes range from 0 to 3 percent.

Typical pedon of Hicota very fine sandy loam, in an area of Freestone-Hicota complex, 0 to 3 percent slopes; from the intersection of U.S. Highway 271 and Farm Road 197 in Arthur City, 2.6 miles south on U.S. Highway 271, 1.3 miles east on county road, 1,050 feet south of county road in pasture at the middle of the side of a mound:

A1—0 to 4 inches; brown (10YR 4/3) very fine sandy loam; weak fine granular structure; slightly hard, very friable; common fine roots; slightly acid; clear smooth boundary.

A2—4 to 14 inches; light yellowish brown (10YR 6/4) very fine sandy loam; weak fine granular structure; slightly hard, very friable; common fine roots; medium acid; gradual wavy boundary.

A&B—14 to 32 inches; light yellowish brown (10YR 6/4) very fine sandy loam; massive; soft, very friable; about 25 percent of the horizon consists of bodies 5 to 20 millimeters across of brown (7.5YR 5/4) loam; weak fine granular structure; slightly hard, very friable; brown bodies have common fine and medium pores and bridged sand grains; few fine roots; medium acid; clear irregular boundary.

B21t&A2—32 to 44 inches; yellowish brown (10YR 5/6) loam; common medium distinct strong brown (7.5YR 5/6) mottles and few fine distinct mottles of grayish brown in the lower part; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine roots; common fine and medium pores; patchy clay films; about 20 percent of the horizon is uncoated sand and silt in tongues 2 to 20 millimeters wide and 5 to 10 centimeters long and as pockets of uncoated sand and silt in the peds; very strongly acid; gradual smooth boundary.

B22t—44 to 54 inches; yellowish brown (10YR 5/6) clay loam; common medium distinct light brownish gray (10YR 6/2) and common medium prominent red (2.5YR 4/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine roots between peds; common fine and medium pores; about 5 percent of horizon is white (10YR 8/1) sand and silt on faces of prisms; thick clay films; very strongly acid; gradual smooth boundary.

B23t—54 to 67 inches; gray (10YR 6/1) clay loam; common medium prominent dark red (2.5YR 3/6) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots between peds; many clay films and a few gray (10YR 5/1) clay flows; few streaks of uncoated sand and silt; very strongly acid; gradual smooth boundary.

B24t—67 to 80 inches; light brownish gray (2.5Y 6/2) clay; common medium prominent dark red (2.5YR 3/6) and common medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse angular blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky; few fine roots; few gray (10YR 5/1) clay flows; common tilted slickensides as much as 2 inches across, some of which intersect; many shiny pressure faces; few streaks of uncoated sand and silt; very strongly acid.

The solum is more than 72 inches thick.

The A1 horizon is dark grayish brown, brown, or yellowish brown and is medium acid or slightly acid. The A2 horizon is pale brown, light yellowish brown, yellowish brown, or strong brown and is strongly acid to slightly acid.

The A material of the A&B horizon is very pale brown, light yellowish brown, yellowish brown, light brown, or brown. The isolated bodies of B material make up 20 to 50 percent of the horizon and are brown, strong brown, or yellowish brown. These bodies are fine sandy loam, very fine sandy loam, or loam. The horizon is strongly acid or medium acid.

The B21t&A2 and B22t horizons are brown, yellowish brown, strong brown, brownish yellow, or reddish yellow. Few to common mottles of red and yellowish red, and below a depth of 30 inches, gray, light gray, grayish

brown, and light brownish gray, are present. Tongues and vertical streaks of uncoated sand and silt grains make up about 15 to 40 percent of these horizons. These horizons are very fine sandy loam, loam, or clay loam. The average clay content of the upper 20 inches of the Bt horizon ranges from 6 to 18 percent. The horizons are very strongly acid to medium acid. The B23t and B24t horizons are mottled in colors and shades of gray, yellow, brown, and red. A few, thin streaks and pockets of uncoated sand and silt grains are common. The horizons are clay loam, sandy clay loam, or clay. They are very strongly acid to medium acid.

Houston Black series

The Houston Black series consists of deep, clayey soils on uplands. These soils formed in calcareous shaly clay. Slopes range from 0 to 3 percent.

Typical pedon of Houston Black clay, 1 to 3 percent slopes; from the intersection of Farm Road 38 and Farm Road 1506 in Brookston, 0.8 mile north on Farm Road 38, 450 feet west of Farm Road in idle cropland in the center of a microdepression:

Ap—0 to 5 inches; very dark gray (10YR 3/1) clay; moderate fine subangular blocky structure; extremely hard, very firm, very sticky and plastic; many fine roots; common wormcasts; few snail fragments; few black concretions; few fine strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

A11—5 to 23 inches; black (10YR 2/1) clay; moderate fine and very fine angular blocky structure; common fine roots; few wormcasts; few snail fragments; shiny ped faces; few black concretions; few fine strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A12—23 to 38 inches; very dark gray (10YR 3/1) clay; moderate fine and very fine angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; shiny ped faces; few black concretions; few fine strongly cemented concretions of calcium carbonate; common coarse grooved intersecting slickensides that form parallelepipeds; calcareous; moderately alkaline; diffuse wavy boundary.

AC1—38 to 51 inches; olive gray (5Y 4/2) clay; common medium distinct light olive brown (2.5Y 5/4) and common medium distinct gray (10YR 5/1) mottles; common vertical streaks of dark gray (10YR 4/1) clayey material; moderate fine and very fine angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; shiny ped faces; common black concretions; common strongly cemented concretions of calcium carbonate as much as 8 millimeters across; common coarse grooved intersecting slickensides that form parallelepipeds; calcareous; moderately alkaline; gradual wavy boundary.

AC2—51 to 69 inches; light olive brown (2.5Y 5/4) clay; common medium distinct yellow (10YR 8/6) and common medium distinct gray (10YR 6/1) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; shiny ped faces; few fine black concretions and soft masses; common concretions of calcium carbonate; common coarse grooved intersecting slickensides that form parallelepipeds; calcareous; moderately alkaline; diffuse wavy boundary.

AC3—69 to 77 inches; grayish brown (10YR 5/2) clay; many coarse distinct brownish yellow (10YR 6/6) mottles; moderate coarse angular blocky structure; extremely hard, very firm, very sticky and plastic; shiny ped faces; common black and brown concretions; few fine concretions of calcium carbonate; many coarse grooved intersecting slickensides that form parallelepipeds; calcareous; moderately alkaline; gradual irregular boundary.

C—77 to 80 inches; stratified brownish yellow (10YR 6/6) and light brownish gray (2.5Y 6/2) shaly clay; massive rock structure; extremely hard, very firm; few soft bodies of calcium carbonate; few soft black masses; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Intersecting slickensides begin at a depth of 16 to 24 inches. When dry, cracks that are 1 inch to 2 inches wide at a depth of 20 inches form. Cycles of microdepressions and microknolls are repeated every 10 to 24 feet. The soil is dominantly calcareous and moderately alkaline, but the upper 12 inches of some pedons is mildly alkaline or moderately alkaline.

The A horizon is black or very dark gray.

The AC horizon is dark grayish brown, grayish brown, light brownish gray, pale yellow, light yellowish brown, light olive brown, olive gray, olive, or pale olive. Few to common, grayish, brownish, or yellowish mottles are in most places.

The C horizon is grayish brown, light brownish gray, light gray, gray, pale yellow, brownish yellow, or yellow. This horizon is clay, shale, or shaly clay and is calcareous and moderately alkaline.

Karma series

The Karma series consists of deep, loamy soils on uplands. These soils formed in sandy and loamy, ancient alluvial sediment. Slopes range from 0 to 1 percent.

Typical pedon of Karma fine sandy loam, 0 to 1 percent slopes; from the intersection of Northeast Loop 286 and Farm Road 195 in Paris, 12.0 miles northeast on Farm Road 195, 2.4 miles northeast on Farm Road 906,

1.7 miles north, 0.3 mile west on county road, 150 feet north of county road in pasture:

Ap—0 to 6 inches; brown (7.5YR 4/2) fine sandy loam; weak medium granular structure; hard, friable; common fine roots; common wormcasts; slightly acid; abrupt smooth boundary.

A1—6 to 12 inches; brown (7.5YR 5/4) fine sandy loam; weak medium granular structure; hard, friable; few fine roots; few fine pores; common wormcasts; slightly acid; clear smooth boundary.

B21t—12 to 27 inches; yellowish red (5YR 4/6) sandy clay loam; moderate medium subangular blocky structure; few fine roots; few fine pores; few wormcasts; many clay films 1/2 unit of chroma darker than matrix; common bridging of sand grains; slightly acid; gradual smooth boundary.

B22t—27 to 34 inches; yellowish red (5YR 4/8) sandy clay loam; moderate medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; common clay films 1/2 unit of chroma darker than matrix; common bridging of sand grains; few black concretions; slightly acid; gradual smooth boundary.

B23t—34 to 46 inches; reddish brown (5YR 4/4) sandy clay loam; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; few patchy clay films 1/2 unit of chroma darker than matrix; common bridging of sand grains; few soft black masses 1 millimeter to 10 millimeters in diameter; slightly acid; diffuse smooth boundary.

B3—46 to 73 inches; yellowish red (5YR 5/6) fine sandy loam; weak medium subangular blocky structure; slightly hard, very friable; few fine roots; thin patchy clay films on faces of peds; common bridging of sand grains; few soft black masses; 2 to 4 percent, by volume, pockets of uncoated sand grains; slightly acid.

The solum is 60 inches to more than 80 inches thick. Reaction is medium acid to neutral.

The Ap and A1 horizons are brown or dark brown. The B2t horizon is reddish brown, yellowish red, or red sandy clay loam or clay loam. The B3 horizon is yellowish red or red loam, fine sandy loam, or sandy clay loam. Pockets of uncoated sand grains make up about 1 to 4 percent of the volume.

Kaufman series

The Kaufman series consists of deep, clayey soils on flood plains. These soils formed in clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Kaufman clay; from the intersection of Farm Road 895 and county road in Charleston, 8.5 miles north and east on Farm Road 895 to its junction with county road in Kensing (end of pavement), 1.4 miles east on county road, 1.45 miles south on private road, 50 feet east in pasture:

A11—0 to 6 inches; black (10YR 2/1) clay; weak and moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; many fine roots; common very fine pores; few wormcasts; peds have shiny faces; slightly acid; diffuse smooth boundary.

A12—6 to 19 inches; black (10YR 2/1) clay; moderate fine and medium blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; common very fine pores; few slickensides 1 inch to 2 inches wide; peds have shiny faces; slightly acid; diffuse wavy boundary.

A13—19 to 35 inches; black (10YR 2/1) clay; few fine distinct brown mottles; moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; few fine roots; few very fine pores; few black concretions 2 to 4 millimeters in diameter; few grooved intersecting slickensides 1 inch to 3 inches wide; slightly acid; diffuse wavy boundary.

AC1g—35 to 50 inches; very dark gray (10YR 3/1) clay; common fine distinct olive brown and few fine distinct brown mottles; moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; few fine roots mostly confined to surfaces of slickensides; few very fine pores; common grooved intersecting slickensides 3 to 6 inches across; few black concretions 2 to 4 millimeters in diameter; slightly acid; diffuse wavy boundary.

AC2g—50 to 69 inches; very dark gray (10YR 3/1) clay; few fine distinct dark yellowish brown mottles; moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; few fine roots mostly on faces of slickensides; few very fine pores; many grooved intersecting slickensides 2 to 10 inches wide tilted at a 45- to 60-degree angle; few black concretions 1 millimeter to 4 millimeters in diameter; slightly acid; diffuse wavy boundary.

AC3g—69 to 80 inches; very dark gray (10YR 3/1) clay; moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm, sticky and plastic; many grooved intersecting slickensides 2 to 10 inches wide tilted 25 to 45 degrees from horizontal; few black concretions 1 millimeter to 3 millimeters in diameter; mildly alkaline.

The soil is more than 60 inches thick. Clay content of the solum ranges from 60 to 80 percent. Intersecting slickensides begin at a depth of 16 to 32 inches. When dry, cracks that are 1 inch to 2 inches wide at a depth of 20 inches form. The soil is medium acid to mildly alkaline.

The A horizon is black or very dark gray. In some pedons, the A horizon is free of mottles; in others, some part of the A horizon has few to common, fine and medium, yellowish and brownish mottles. The mollic epipedon is more than 20 inches thick.

The ACg horizon is very dark gray, dark gray, or gray. In some pedons, this horizon has few to common concretions of calcium carbonate and yellowish, brownish, and olive mottles.

Kiomatia series

The Kiomatia series consists of deep, sandy soils on flood plains. These soils formed in sandy, calcareous, stratified alluvium. Slopes range from 0 to 5 percent.

Typical pedon of Kiomatia loamy fine sand, in an area of Severn-Kiomatia complex, frequently flooded; from the intersection of Farm Road 197 and Farm Road 906 in Chicota, 0.3 mile west on Farm Road 197 and county road to Chicota School, 0.25 mile north, 0.25 mile west, 3.3 miles north, 0.9 mile west on county road, 3,750 feet west of county road corner in wooded area:

A1—0 to 4 inches; brown (7.5YR 4/4) loamy fine sand; single grained; soft, very friable; few fine roots; common thin reddish brown strata in lower part; calcareous; moderately alkaline; clear smooth boundary.

C1—4 to 18 inches; reddish brown (5YR 5/4) loamy fine sand; single grained; loose; few fine roots; few thin strata of pink fine sand; calcareous; moderately alkaline; abrupt smooth boundary.

C2—18 to 60 inches; light brown (7.5YR 6/4) fine sand; single grained; loose; few fine roots; many bedding planes; few reddish brown silty clay loam strata as much as 6 millimeters thick in lower part; calcareous; moderately alkaline.

The soil is calcareous and moderately alkaline throughout. The average texture of the 10- to 40-inch control section is fine sand or loamy fine sand stratified with loamy very fine sand or finer textured material.

The A horizon is brown, light brown, pink, reddish brown, or dark reddish gray.

The C horizon is reddish brown, light brown, light reddish brown, pink, or strong brown.

Lamar series

The Lamar series consists of deep, loamy soils on uplands. These soils formed in loamy, calcareous sediment. Slopes range from 5 to 8 percent.

Typical pedon of Lamar clay loam, 5 to 8 percent slopes; from the intersection of Farm Road 38 and Farm Road 128 in Ben Franklin, 0.8 mile east on Farm Road 128, 0.95 mile east on county road, 50 feet north of county road in pasture:

A1—0 to 6 inches; dark grayish brown (2.5Y 4/2) clay loam; moderate fine and medium subangular blocky and strong fine granular structure; hard, friable; many fine roots; few fine pores; common wormcasts and channels; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21—6 to 24 inches; light olive brown (2.5Y 5/4) silty clay loam; moderate fine subangular blocky structure; hard, friable; common fine roots; many fine pores; few wormcasts and channels; 8 to 10 percent, by volume, concretions and soft bodies of calcium carbonate; few small shell fragments; calcareous; moderately alkaline; clear smooth boundary.

B22—24 to 44 inches; light olive brown (2.5Y 5/4) silty clay loam; common medium faint olive yellow (2.5Y 6/6) mottles; moderate fine subangular blocky structure; hard, friable; few fine roots; common fine pores; few wormcasts and channels; 10 to 15 percent, by volume, concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline; diffuse wavy boundary.

C—44 to 65 inches; mottled light yellowish brown (2.5Y 6/4), light brownish gray (2.5Y 6/2), and olive yellow (2.5Y 6/6) silty clay loam; massive; few angular cleavage planes; hard, firm; few fine roots; few fine pores; few worm channels; 5 to 10 percent, by volume, soft bodies of calcium carbonate; few marine shells; calcareous; moderately alkaline.

The solum is 26 to 50 inches thick. The soil is calcareous and moderately alkaline throughout.

The A horizon is dark grayish brown, grayish brown, light brownish gray, or brown.

The B horizon is grayish brown, yellowish brown, light yellowish brown, brownish yellow, light olive brown, or olive yellow. This horizon is silty clay loam, loam, or clay loam. Films, threads, and concretions of calcium carbonate make up 5 to 20 percent, by volume, of the B horizon.

The C horizon has the same color and texture as the B horizon. Bands of shaly material containing marine fossils are common. Soft bodies of powdery lime and concretions of calcium carbonate make up 3 to 15 percent of the C horizon.

Lassiter series

The Lassiter series consists of deep, loamy soils on flood plains. These soils formed in loamy, stratified alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Lassiter silt loam, frequently flooded; from the intersection of Farm Road 79 and North Loop 286 in Paris, 3.2 miles northwest on Farm Road 79, 3.5 miles west on Farm Road 2820, 1.3 miles north on county road, and 50 feet west of county road in wooded area of Little Pine Creek flood plain:

A1—0 to 5 inches; very dark grayish brown (10YR 3/2) silt loam; few fine strata less than 1 centimeter thick of brown (10YR 4/3) very fine sandy loam; weak fine subangular blocky structure; hard, friable; common fine and medium roots; common fine pores; common wormcasts and tubular channels; neutral; clear smooth boundary.

C1—5 to 28 inches; brown (10YR 4/3) silt loam; few to common medium faint dark grayish brown (10YR 4/2) and grayish brown (10YR 5/2) mottles; massive but parts along bedding planes into platy fragments; hard, friable; few fine roots; common fine pores; few wormcasts and tubular channels; weakly to prominently stratified with layers 1 millimeter to 3 millimeters thick that are pale brown (10YR 6/3) very fine sandy loam; few fine distinct yellowish brown mottles along bedding planes; neutral; gradual smooth boundary.

Ab—28 to 42 inches; very dark grayish brown (10YR 3/2) silt loam; common medium faint dark grayish brown (10YR 4/2) and few fine distinct yellowish brown mottles; moderate medium subangular blocky structure; hard, friable; few fine roots; common fine pores; few wormcasts and tubular channels; few thin lenses of brown (10YR 5/3) very fine sandy loam; few fragments of charcoal; slightly acid; gradual smooth boundary.

B2tb—42 to 72 inches; dark grayish brown (10YR 4/2) clay loam; common medium distinct yellowish brown (10YR 5/6) and strong brown (7.5YR 5/6) mottles and common medium faint gray (10YR 5/1) and grayish brown (10YR 5/2) mottles; weak medium subangular blocky structure; hard, friable; few fine roots; few fine pores; few wormcasts and tubular channels; few thin patchy clay films mainly in pores and old root channels; few pockets of uncoated sand grains; slightly acid.

Depth to buried horizons ranges from 22 to 55 inches.

The A horizon is very dark grayish brown, dark grayish brown, or brown. Where the value is less than 3.5 moist, the horizon is less than 7 inches thick. The horizon is slightly acid or neutral.

The C horizon is dark grayish brown, light gray, light brownish gray, brown, or pale brown. Few or common mottles of grayish brown and yellowish brown are present. The horizon is silt loam, loam, or silty clay loam. The 10- to 40-inch control section ranges from 18 to 30 percent clay and is less than 15 percent sand coarser than very fine. Bedding planes range from few to many. The horizon is medium acid to neutral.

The Ab horizon, where present, is 1 or 2 units in value lower than the overlying material. This horizon has few to common mottles of gray, grayish brown, or yellowish brown and is silt loam or loam. It is medium acid to neutral.

The B2tb horizon is common and is below a depth of 40 inches. This horizon is very dark grayish brown, dark grayish brown, grayish brown, or brown, and it has common fine and medium mottles of gray, brown, and yellow. The horizon is clay loam, loam, or silty clay loam. It is strongly acid to neutral.

Leson series

The Leson series consists of deep, clayey soils on uplands. These soils formed in shaly clay. Slopes range from 1 to 3 percent.

Typical pedon of Leson clay, 1 to 3 percent slopes; from the intersection of Farm Road 1335 and Farm Road 198 in Lake Creek, 1.1 miles east on Farm Road 198, 0.75 mile south on county road, 100 feet west in pasture in the center of a microdepression:

Ap—0 to 6 inches; black (10YR 2/1) clay; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; many fine roots; common wormcasts; few fine black concretions; few rounded siliceous pebbles; slightly acid; clear smooth boundary.

A1—6 to 20 inches; black (10YR 2/1) clay; few fine distinct yellowish brown (10YR 5/4) mottles; weak coarse blocky structure parting to moderate fine blocky; extremely hard, very firm, very sticky and plastic; common fine roots; few wormcasts; few fine black concretions; common shiny pressure faces; few intersecting slickensides; slightly acid; gradual wavy boundary.

A12—20 to 39 inches; very dark gray (10YR 3/1) clay; few fine distinct yellowish brown mottles; moderate coarse angular blocky structure parting to moderate fine angular blocky; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; few fine black concretions; common shiny pressure faces; many grooved intersecting slickensides and wedge-shaped aggregates having long axis tilted 30 to 45 degrees from the horizontal; neutral; gradual wavy boundary.

AC1—39 to 57 inches; dark grayish brown (2.5Y 4/2) clay; common medium faint olive (5Y 5/3) mottles; common vertical dark gray (10YR 4/1) clay streaks as much as 2 centimeters wide extending through horizon; moderate coarse angular blocky structure parting to moderate fine angular blocky; extremely hard, very firm, very sticky and plastic; few fine roots; few fine concretions of calcium carbonate; common shiny ped faces; many grooved intersecting slickensides and wedge-shaped aggregates having long axis tilted 30 to 45 degrees from the horizontal; matrix noncalcareous; mildly alkaline; gradual wavy boundary.

AC2—57 to 66 inches; olive (5Y 5/3) clay; common medium distinct dark grayish brown (2.5Y 4/2) and

light olive brown (2.5Y 5/6) mottles; moderate fine and medium angular blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; few fine and medium black concretions; few soft bodies of calcium carbonate; common shiny pressure faces; few tilted grooved intersecting slickensides; common shale fragments in lower part; calcareous; moderately alkaline; gradual wavy boundary.

C—66 to 75 inches; stratified light brownish gray (2.5Y 6/2) and pale olive (5Y 6/3) shaly clay; massive; extremely hard, very firm; few fine soft bodies of calcium carbonate; common black masses; calcareous; moderately alkaline.

The solum is 40 to 80 inches thick. When dry, cracks that are 1 inch to 3 inches wide at a depth of 20 inches form. Common to many intersecting slickensides are below a depth of 10 inches. Distance between the microknolls and microdepressions is 4 to 16 feet.

The A horizon is black, very dark gray, or dark gray. In some pedons, a few brownish and olive mottles are in the lower part of this horizon. The horizon is slightly acid to mildly alkaline. The AC horizon is very dark grayish brown, dark grayish brown, grayish brown, olive gray, olive, or pale olive and has few to many, grayish, brownish, and yellowish mottles. This horizon is neutral to moderately alkaline.

The C horizon is grayish brown, light brownish gray, light olive brown, light yellowish brown, light olive gray, olive, or pale olive. In many places, this horizon has common to many brownish, grayish, olive, or yellowish mottles. It is shale, shaly clay, or clay and is mildly alkaline or moderately alkaline.

Mabank series

The Mabank series consists of deep, loamy soils on uplands. These soils formed in clayey marine sediment. Slopes range from 0 to 1 percent.

Typical pedon of Mabank silt loam, in an area of Mabank-Crockett complex, 0 to 1 percent slopes (fig. 7); from the intersection of Farm Road 2352 and Farm Road 38 in Tigertown, 1.9 miles west on Farm Road 2352, 0.3 mile west on county road, 0.25 miles south, 0.1 mile west, 75 feet north of county road in cultivated field:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silt loam; weak very fine subangular blocky and fine granular structure; very hard, friable; common roots; few fine black concretions; slightly acid; abrupt wavy boundary.

B21tg—8 to 34 inches; very dark gray (10YR 3/1) clay; moderate medium and coarse blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common clay films; few fine black concretions; common pressure faces; many cracks filled with material from Ap horizon; slightly acid; gradual wavy boundary.

B22tg—34 to 47 inches; dark grayish brown (2.5Y 4/2) clay; few medium distinct light olive brown (2.5Y 5/4) mottles; extremely hard, very firm, very sticky and plastic; few fine roots; common clay films; few white salt spots; few black concretions; few pressure faces; neutral; diffuse wavy boundary.

B23tg—47 to 61 inches; grayish brown (2.5Y 5/2) clay; common medium distinct light olive brown (2.5Y 5/4) and gray (10YR 6/1) mottles; moderate fine and medium blocky structure; extremely hard, very firm, very sticky and plastic; few fine roots; common clay films; few white salt spots; few black concretions; few pressure faces; mildly alkaline; diffuse wavy boundary.

B3—61 to 72 inches; light brownish gray (2.5Y 6/2) clay; common medium faint gray (10YR 6/1) and common medium distinct yellowish brown (10YR 5/6) mottles; weak medium blocky structure; extremely hard, very firm, very sticky and plastic; few clay films; few hard pitted concretions of calcium carbonate as much as 1 centimeter across; few white salt spots; few black concretions; few pressure faces; mildly alkaline.

The solum is 60 inches to more than 80 inches thick.

The A horizon is dark grayish brown, grayish brown, or light grayish brown. This horizon is medium acid or slightly acid.

The B21tg horizon is dark gray or very dark gray. This horizon is medium acid to neutral. The B22tg and B23tg horizons are dark grayish brown, grayish brown, or gray. In places, these horizons have a few mottles of light olive brown, light yellowish brown, or reddish brown. They are clay or clay loam, and they are neutral to moderately alkaline. The B3 horizon is light brownish gray or light gray and has mottles in shades of yellow and brown. This horizon is mildly alkaline or moderately alkaline. Hard pitted concretions of calcium carbonate and crystals of gypsum are below a depth of 40 inches.

Muldrow series

The Muldrow series consists of deep, loamy soils on flood plains. These soils formed in loamy and clayey alluvial sediment. Slopes range from 0 to 1 percent.

Typical pedon of Muldrow clay loam; from the intersection of Farm Road 906 and Farm Road 197 in Chicota, 0.1 mile east on Farm Road 197, 0.1 mile north, 0.25 mile east, and 1.1 miles north on county road, 1,500 feet west of county road in idle field:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam; moderate fine subangular blocky structure; very hard, very firm; common fine roots; few

wormcasts and tubular channels; slightly acid; clear smooth boundary.

A1—6 to 16 inches; very dark brown (10YR 2/2) clay loam; moderate medium subangular blocky structure; very hard, firm; few fine roots; few wormcasts and tubular channels; neutral; gradual smooth boundary.

B21tg—16 to 37 inches; very dark brown (10YR 2/2) clay; few fine and medium prominent reddish brown (5YR 4/3) mottles; moderate coarse blocky structure; extremely hard, very firm; few fine roots; few clay films; common pressure faces; few black concretions 1 millimeter to 2 millimeters in diameter; mildly alkaline; gradual smooth boundary.

B22tg—37 to 48 inches; very dark grayish brown (10YR 3/2) clay; common medium prominent reddish brown (5YR 4/4) and common medium faint dark gray (10YR 4/1) mottles; moderate coarse blocky structure; extremely hard, very firm; few fine roots; clay films 1/2 unit of chroma darker than ped interiors; few black concretions 1 millimeter to 3 millimeters in diameter; few siliceous pebbles as much as 5 millimeters across; few fine concretions of calcium carbonate in lower part; mildly alkaline; gradual smooth boundary.

B23tg—48 to 67 inches; gray (10YR 5/1) silty clay loam; common medium distinct yellowish brown (10YR 5/6), common medium faint light gray (10YR 7/1), and few fine prominent dark reddish brown mottles; moderate medium prismatic structure parting to weak coarse blocky; extremely hard, very firm; few fine roots mainly along faces of peds; dark gray clay flows on faces of prisms; common black concretions 1 millimeter to 3 millimeters in diameter; few concretions of calcium carbonate as much as 3 centimeters in diameter; calcareous in pockets; moderately alkaline; diffuse smooth boundary.

B3g—67 to 80 inches; gray (10YR 6/1) silty clay loam; common coarse distinct strong brown (7.5YR 5/6) and yellowish brown (10YR 5/6) mottles; weak coarse prismatic structure; very hard, firm; few fine roots; gray and dark gray clay flows between faces of prisms; few black concretions 1 millimeter to 3 millimeters in diameter; noncalcareous; moderately alkaline.

The solum is more than 60 inches thick.

The A horizon is very dark gray, very dark grayish brown, very dark brown, or dark brown.

The B21tg and B22tg horizons are very dark gray, very dark grayish brown, or very dark brown. Few to common mottles of yellowish brown, dark gray, strong brown, or reddish brown are present. The horizons are clay, silty clay, or silty clay loam. They are slightly acid to mildly alkaline. The B23tg and the B3 horizons, where present, are dark brown, dark grayish brown, dark gray, gray, or grayish brown. Few to common mottles of yellowish brown, strong brown, reddish brown, light gray, or gray are present. The horizons are silty clay loam, silty clay, or clay. They are neutral to moderately alkaline.

The Muldrow soils in this survey area have higher pH than described in the range for the series, but this difference does not significantly affect the use, management, or behavior of these soils.

Normangee series

The Normangee series consists of deep, loamy soils on uplands. These soils formed in shale or shaly clay. Slopes range from 1 to 6 percent.

Typical pedon of Normangee clay loam, 1 to 3 percent slopes; from the intersection of West Loop 286 and U.S. Highway 82 in Paris, 8.9 miles west on U.S. Highway 82, 75 feet north in idle field:

Ap—0 to 7 inches; dark brown (10YR 3/3) clay loam; moderate fine granular structure; hard, friable; common fine roots; few fine wormcasts; few coarse tubular worm channels; slightly acid; clear wavy boundary.

B21t—7 to 16 inches; brown (10YR 4/3) clay; common fine prominent red and reddish brown mottles and a few medium faint dark grayish brown (10YR 4/2) mottles; moderate medium blocky structure parting to moderate fine subangular blocky; extremely hard, very firm, sticky and plastic; few fine roots; few clay films 1/2 unit of chroma darker than matrix; few black concretions 1 millimeter to 3 millimeters in diameter; few angular and rounded limonitic masses 3 to 8 millimeters across; medium acid; gradual wavy boundary.

B22t—16 to 28 inches; yellowish brown (10YR 5/4) clay; common medium distinct grayish brown (10YR 5/2) and dark brown (7.5YR 4/4) mottles and few fine prominent reddish brown and yellowish red mottles; moderate coarse blocky structure parting to moderate fine blocky; extremely hard, very firm, sticky and plastic; few black concretions 1 millimeter to 3 millimeters in diameter; few angular and rounded limonitic masses as much as 1 centimeter across; few slickensides 3 to 8 centimeters wide; few vertical cracks filled with very dark grayish brown soil material; neutral; diffuse wavy boundary.

B23t—28 to 38 inches; mottled grayish brown (10YR 5/2) and light olive brown (2.5Y 5/4) clay; moderate coarse blocky structure parting to moderate fine blocky; extremely hard, very firm, sticky and plastic; few fine roots; few black concretions 1 millimeter to 4 millimieters in diameter; few angular and rounded limonitic fragments as much as 1 centimeter across; few slickensides as much as 8 centimeters wide; few vertical cracks filled with dark grayish brown soil material that has common fine prominent reddish

brown mottles; mildly alkaline; gradual wavy boundary.

B24t—38 to 48 inches; light olive brown (2.5Y 5/4) clay; common fine faint grayish brown mottles; moderate coarse blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few black concretions 1 millimeter to 4 millimeters across; few angular and rounded limonitic fragments as much as 1 centimeter across; 2 to 3 percent concretions of calcium carbonate as much as 6 millimeters in diameter; common slickensides 5 to 8 centimeters wide tilted at a 15 to 20 degree angle; few vertical cracks about 1 centimeter wide filled with dark grayish brown soil material that has common fine prominent dark reddish brown mottles; noncalcareous; moderately alkaline; gradual wavy boundary.

B3—48 to 57 inches; distinctly mottled olive (5Y 5/3), light olive brown (2.5Y 5/4) and yellowish brown (10YR 5/6) clay; moderate coarse blocky structure parting to moderate fine blocky; extremely hard, very firm, sticky and plastic; few fine roots; 2 to 4 percent, by volume, concretions of calcium carbonate 2 to 10 millimeters across; few shale fragments in lower part of horizon; few slickensides 5 to 8 centimeters wide; few vertical cracks filled with gray and dark grayish brown soil material that has reddish brown mottles; noncalcareous; moderately alkaline; gradual wavy boundary.

C—57 to 65 inches; light olive gray (5Y 6/2) weathered shale; common fine distinct light olive brown and few fine distinct yellowish brown mottles; massive; common cleavage planes; extremely hard, very firm; few fine roots; few black masses; few concretions of calcium carbonate as much as 1 centimeter across; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. The B horizon contains a few limonitic fragments. The depth to secondary carbonates is more than 30 inches.

The A horizon is dark brown, dark grayish brown, or brown. This horizon is medium acid to neutral. The boundary is abrupt in the microknolls and irregular in the microdepressions.

The B21t horizon is brown or yellowish brown. Few to common, reddish and brownish mottles are present. The horizon is medium acid or slightly acid. The B22t, B23t, B24t, and B3 horizons are dark grayish brown, grayish brown, brown, olive, dark yellowish brown, olive brown, yellowish brown, light olive brown, or light yellowish brown. Few to common, reddish, yellowish, brownish, and olive mottles are present. The B22t and B23t horizons are slightly acid to mildly alkaline. The B24t and B3 horizons are neutral to moderately alkaline and concretions of calcium carbonate and gypsum crystals are common.

The C horizon is mottled or stratified in shades of gray, yellow, or brown. This horizon is shale or shaly clay. It is neutral to moderately alkaline. Concretions of calcium carbonate and gypsum crystals are in most pedons.

Norwood series

The Norwood series consists of deep, loamy soils on flood plains. These soils developed in loamy, calcareous, stratified alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Norwood silt loam; from the intersection of Farm Road 79 and Farm Road 197 in East Direct, 0.65 mile north and west on Farm Road 79, 0.85 mile north on a county road, 4,470 feet north of road in a cultivated field:

Ap—0 to 8 inches; reddish brown (5YR 4/3) silt loam; weak fine granular and blocky structure; hard, friable; common roots; common very fine pores; common wormcasts; few fragments of snail shells; calcareous; moderately alkaline; abrupt smooth boundary.

B2—8 to 16 inches; reddish brown (5YR 4/4) silt loam; weak fine blocky structure; hard, friable; common roots; common fine and very fine pores; common wormcasts; common thin discontinuous strata of reddish brown very fine sandy loam; calcareous; moderately alkaline; gradual smooth boundary.

C1—16 to 38 inches; stratified reddish yellow (5YR 6/6) and reddish brown (5YR 4/4) silt loam; massive but parts along bedding planes to platy fragments; hard, friable; few fine roots; common very fine pores; common wormcasts; few fragments of snail shells; common thin strata of very fine sandy loam and silty clay loam; calcareous; moderately alkaline; gradual smooth boundary.

C2—38 to 65 inches; stratified reddish brown (5YR 5/4, 4/4), and yellowish red (5YR 5/6) silt loam; massive; hard, friable; few fine roots; few very fine pores; commom wormcasts; common bedding planes; silt loam is in layers 5 to 10 centimeters thick separated by common strata of very fine sandy loam and silty clay loam 2 to 8 millimeters thick; calcareous; moderately alkaline.

The soil is calcareous and moderately alkaline throughout.

The A horizon is reddish brown or yellowish red.

The B2 horizon, where present, is reddish brown or yellowish red silt loam or silty clay loam.

The C horizon is stratified reddish brown, yellowish red, or reddish yellow. Individual strata are fine sandy loam, silt loam, very fine sandy loam, or silty clay loam. Bedding planes are evident throughout the C horizon.

Parisian series

The Parisian series consists of deep, loamy soils on uplands. These soils formed in interbedded clay and shale. Slopes range from 1 to 3 percent.

Typical pedon of Parisian silt loam, 1 to 3 percent slopes; from the intersection of West Loop 286 and U.S. Highway 82 in Paris, 0.7 mile north on West Loop 286, 3.6 miles west, 0.1 mile north, 0.7 mile west on county road, 50 feet north of county road in native prairie:

A1—0 to 11 inches; very dark grayish brown (10YR 3/2) silt loam; moderate very fine subangular blocky structure; hard, friable; many fine roots; common wormcasts; medium acid; clear wavy boundary.

B21t—11 to 17 inches; very dark grayish brown (10YR 3/2) silty clay loam; common fine faint dark grayish brown and brown mottles; moderate fine subangular blocky structure; very hard, firm; many fine roots; few fine pores; common wormcasts; common patchy clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—17 to 21 inches; dark grayish brown (10YR 4/2) clay; common medium prominent dark red (2.5YR 3/6) and reddish brown (5YR 4/4) mottles; moderate fine and medium blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; few wormcasts; continuous clay films on faces of peds; medium acid; gradual wavy boundary.

B23t—21 to 27 inches; brown (10YR 4/3) clay; common medium faint dark grayish brown (2.5Y 4/2), common medium prominent reddish brown (5YR 4/4), and few medium distinct yellowish brown (10YR 5/6) mottles; moderate coarse blocky structure parting to moderate fine and medium blocky; extremely hard, very firm, sticky and plastic; few fine roots; few clay films mainly on vertical faces of peds; few shiny pressure faces 2 to 3 centimeters across; slightly acid; gradual wavy boundary.

B24t—27 to 39 inches; light olive brown (2.5YR 5/4) clay; common medium faint brown (10YR 4/3), few medium faint dark grayish brown (2.5Y 4/2), and few medium prominent reddish brown (5YR 4/4) mottles; moderate coarse blocky structure parting to moderate fine and medium blocky; extremely hard, very firm, sticky and plastic; few fine roots; few clay films mainly on vertical faces of peds; few shiny pressure faces 2 to 3 centimeters across; few black concretions 1 millimeter to 3 millimeters in diameter; neutral; gradual wavy boundary.

B25t—39 to 56 inches; dark yellowish brown (10YR 4/4) clay; common medium faint brown (7.5YR 4/4) and few medium distinct grayish brown (2.5Y 5/2) mottles; moderate coarse blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few clay films mainly on vertical faces of peds; few pressure faces 2 to 4 centimeters across; few black and brownish concretions 1 millimeter to 3 millimeters in diameter; neutral; diffuse wavy boundary.

B3—56 to 68 inches; mottled yellowish brown (10YR 5/4) and grayish brown (10YR 5/2) silty clay loam; common medium distinct light brownish gray (2.5Y 6/2) and yellowish brown (10YR 5/6) mottles; moderate coarse prismatic structure; extremely hard, very firm, sticky and plastic; few fine roots; thick gray (10YR 5/1) clay flows; few black concretions 1 millimeter to 4 millimeters in diameter; common black masses 2 to 8 millimeters across; few white salt spots in lower part; mildly alkaline; diffuse wavy boundary.

C—68 to 80 inches; mottled yellowish brown (10YR 5/6), light brownish gray (2.5Y 6/2), and pale olive (5Y 6/3) clay; massive; extremely hard, very firm, sticky and plastic; few fine roots; few subrounded soft shale fragments; few white salt spots; few black concretions 1 millimeter to 4 millimeters in diameter; common black masses; neutral.

The solum ranges from 60 inches to more than 80 inches in thickness. Pitted concretions of calcium carbonate and white salt crystals are in the lower part of the B2t and C horizons in some pedons.

The A horizon is very dark grayish brown, very dark brown, or dark brown. In some pedons, a few dark grayish brown or brown mottles are present in the lower part. The horizon is medium acid to neutral.

The B21t horizon is very dark grayish brown, dark grayish brown, brown, or dark brown. This horizon has common to many, fine and medium, red and brown mottles. It is clay loam, clay, or silty clay loam. The horizon ranges from strongly acid to slightly acid. The B22t and B23t horizons are dark grayish brown, grayish brown, brown, light olive brown, or olive brown. These horizons have common to many, fine and medium, brown and red mottles. They range from strongly acid to slightly acid. The B24t and B25t horizons are very dark grayish brown, dark grayish brown, grayish brown, light grayish brown, brown, yellowish brown, dark yellowish brown, light olive brown, or olive brown. These horizons have few to common, fine and medium, red and brown mottles. They are clay, clay loam, or silty clay loam. The horizons range from slightly acid to moderately alkaline.

The C horizon is mottled dark gray, gray, light gray, pale olive, light brownish gray, pale brown, yellowish brown, or brownish yellow. This horizon is clay or clay interbedded with shale. It ranges from neutral to moderately alkaline.

Porum series

The Porum series consists of deep, loamy soils on uplands. These soils formed in loamy and clayey, ancient, alluvial sediment. Slopes range from 8 to 20 percent.

Typical pedon of Porum fine sandy loam, in an area of Whakana-Porum complex, 8 to 20 percent slopes; from the intersection of Farm Road 197 and U.S. Highway 271 in Arthur City, 1.9 miles south on U.S. Highway 271, 0.8 mile west on Farm Road 906, 1.0 mile southwest on Sanders Cove Road, 0.2 mile southwest on poor motor road, 50 feet west in wooded area:

A1—0 to 3 inches; dark grayish brown (10YR 4/2) fine sandy loam; weak fine subangular blocky structure; hard, friable; many roots; common wormcasts; medium acid; clear smooth boundary.

A2—3 to 7 inches; pale brown (10YR 6/3) fine sandy loam; common medium faint brown (10YR 5/3) mottles; weak fine subangular blocky structure; hard, friable; many roots; common wormcasts; medium acid; clear wavy boundary.

B21t—7 to 17 inches; red (2.5YR 4/6) clay; common fine and medium distinct strong brown (7.5YR 5/6) mottles; moderate fine and medium blocky structure; extremely hard, very firm; few roots; few fine black concretions; common clay films on ped faces; very strongly acid; gradual wavy boundary.

B22t—17 to 31 inches; yellowish red (5YR 4/6) clay; many coarse distinct strong brown (7.5YR 5/6) and common medium distinct light gray (10YR 7/1) mottles; moderate fine and medium blocky structure; extremely hard, very firm; few roots; few fine black concretions; common clay films on ped faces; very strongly acid; gradual wavy boundary.

B23t—31 to 42 inches; yellowish red (5YR 5/6) sandy clay loam; common medium distinct gray (10YR 6/1), strong brown (7.5YR 5/6), and red (2.5YR 4/6) mottles; moderate medium blocky structure; very hard, firm; few roots; few fine pores; few fine black concretions; common clay films; about 3 percent, by volume, uncoated sand grains on some vertical faces of peds; strongly acid; diffuse wavy boundary.

B24t&A'2—42 to 65 inches; strong brown (7.5YR 5/6) sandy clay loam; common coarse distinct light gray (10YR 7/2) and common medium faint yellowish red (5YR 5/6) mottles; moderate coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few roots; clay films on faces of peds; about 8 percent, by volume, uncoated sand grains in pockets and on faces of peds; medium acid.

The solum is more than 60 inches thick. Depth to mottles with chroma of 2 or less ranges from 16 to 28 inches.

The A1 horizon is dark grayish brown, brown, or dark brown. This horizon is very strongly acid to medium acid, except where limed. The A2 horizon is pale brown, brown, or yellowish brown. This horizon is very strongly acid to medium acid, except where limed.

The B21t and B22t horizons are yellowish red or red. These horizons have common to many brownish, reddish, and grayish mottles. They are clay, clay loam, or silty clay loam. The horizons are very strongly acid or strongly acid. The B23t horizon is yellowish red, red, or strong brown. Common to many, brownish, grayish, or reddish mottles are present. The horizon is clay loam or sandy clay loam. It is very strongly acid or strongly acid.

The B24t&A'2 horizon is yellowish red or strong brown. This horizon has common to many reddish, brownish, yellowish, and grayish mottles. It is very strongly acid to medium acid. The A'2 material is uncoated sand and silt grains. It makes up 5 to 15 percent of the volume.

Raino series

The Raino series consists of deep, loamy soils on uplands. These soils formed in clayey sediment. Slopes range from 0 to 5 percent.

Typical pedon of Raino fine sandy loam, in an area of Derly-Raino complex; from the intersection of Farm Road 79 and Northwest Loop 286 in Paris, 2.0 miles northwest on Farm Road 79, 8.0 miles north on county road, about 75 feet northwest in wooded area at the middle of the side of a mound:

A1—0 to 4 inches; brown (10YR 4/3) fine sandy loam; moderate fine granular and subangular blocky structure; hard, very friable; many roots; medium acid; clear smooth boundary.

B1—4 to 25 inches; strong brown (7.5YR 5/6) loam; moderate fine and medium subangular blocky structure; hard, very friable; few roots; common fine pores; few black concretions; few uncoated sand grains in the lower part; very strongly acid; diffuse irregular boundary.

B21t&A'2—25 to 36 inches; light yellowish brown (10YR 6/4) loam; common coarse distinct light brownish gray (10YR 6/2), strong brown (7.5YR 5/6), and red (2.5YR 4/6) mottles; moderate medium prismatic structure parting to moderate fine and medium subangular blocky; very hard, friable; few roots; common fine pores; few black concretions; few patchy clay films; about 20 percent uncoated sand in pockets and on faces of peds 3 to 8 millimeters wide; very strongly acid; gradual wavy boundary.

B22t&A'2—36 to 42 inches; light brownish gray (10YR 6/2) clay; many coarse distinct yellowish brown (10YR 5/6) and few medium prominent red (2.5YR 4/6) mottles; moderate medium blocky structure; extremely hard, very firm; few roots; few black concretions; common light brownish gray (2.5Y 6/2) clay films on ped surfaces; about 15 percent, by volume, uncoated sand and silt on surfaces of peds, mainly in the upper part of horizon; very strongly acid; gradual wavy boundary.

B23t—42 to 59 inches; light brownish gray (2.5Y 6/2) clay; common coarse distinct yellowish brown (10YR 5/6) and few medium distinct yellowish red (5YR 5/

6) mottles; moderate medium blocky structure; extremely hard, very firm; few roots; few black concretions; few pressure faces; common clay films; few thin streaks of uncoated sand; strongly acid; gradual wavy boundary.

B24t—59 to 63 inches; distinctly and coarsely mottled yellowish brown (10YR 5/6) and light brownish gray (2.5Y 6/2) clay; common coarse distinct yellowish red (5YR 4/6) mottles; moderate coarse blocky structure; extremely hard, very firm; few roots; few black concretions; few pressure faces; common thick clay films; medium acid.

The solum is more than 72 inches thick.

The A horizon is brown or yellowish brown. This horizon is strongly acid to slightly acid.

The B1 horizon is light yellowish brown, yellowish brown, strong brown, light brown, or reddish yellow fine sandy loam or loam. This horizon is very strongly acid or strongly acid. The B21t&A'2 horizon is yellowish brown, strong brown, brownish yellow, reddish yellow, yellowish red, red, light yellowish brown, or pale brown and has mottles of these colors and of grayish brown and light brownish gray. This horizon is loam, sandy clay loam, or clay loam. It is very strongly acid or strongly acid. The B22t&A'2 horizon is light brownish gray and has few to many brownish and reddish mottles, or it is mottled gray, grayish brown, light brownish gray, yellowish brown, red, or dark red. The A'2 material is uncoated sand and silt. The horizon is very strongly acid or strongly acid. The B23t and B24t horizons are light brownish gray or gray and have few to many grayish, brownish, reddish, and yellowish mottles, or they are mottled yellowish brown and light brownish gray and have few to many, yellowish or reddish mottles. These horizons are mainly very strongly acid to medium acid. Some pedons are slightly acid below a depth of 60 inches.

Redlake series

The Redlake series consists of deep, clayey soils on flood plains. These soils formed in clayey, calcareous, stratified alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Redlake clay; from the intersection of Farm Road 197 and Farm Road 906 in Chicota, 2.8 miles west on Farm Road 197, 2.6 miles north on county road, 0.8 mile west on private road, 50 feet south in pecan orchard:

Ap—0 to 6 inches; dark reddish brown (5YR 3/3) clay; moderate fine and medium subangular blocky structure; very hard, firm, sticky; many fine roots; few wormcasts; calcareous; moderately alkaline; clear smooth boundary.

B21—6 to 24 inches; reddish brown (5YR 4/3) clay; moderate medium subangular blocky structure; very hard, firm, sticky; few fine roots; common shiny ped faces; few slickensides 1 centimeter to 2 centimeters across; calcareous; moderately alkaline; gradual wavy boundary.

B22—24 to 45 inches; reddish brown (2.5YR 4/4) clay; moderate medium subangular blocky structure; very hard, firm, sticky; few fine roots; few shiny ped faces; few slickensides 1 centimeter to 2 centimeters across; few wormcasts; calcareous; moderately alkaline; gradual smooth boundary.

IIC—45 to 72 inches; reddish brown (2.5YR 4/4) clay loam; massive; hard, firm; common bedding planes and strata of friable yellowish red (5YR 4/6) and reddish brown (5YR 4/4) silt loam, few strata of dark red (2.5YR 3/6) clay as much as 2 centimeters thick; few tubular worm channels; calcareous; moderately alkaline.

The solum is 35 to 60 inches thick. The soil is calcareous and moderately alkaline throughout.

The A horizon is dark reddish brown or reddish brown.

The B2 horizon is reddish brown.

The C horizon is stratified. Strata are reddish brown, dark red, or yellowish red. Individual strata are silt loam, clay loam, or clay. Bedding planes are common.

Roxton series

The Roxton series consists of deep, clayey soils on flood plains. These soils formed in clayey alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Roxton clay, frequently flooded; from the intersection of Farm Road 79 and Northwest Loop 286 in Paris, 13.7 miles northwest on Farm Road 79 and 200 feet north of road in Sanders Creek flood plain:

A11—0 to 13 inches; very dark gray (10YR 3/1) clay; moderate fine and medium subangular blocky structure; extremely hard, very firm, very sticky and plastic; few fine and medium roots; few wormcasts; mildly alkaline; clear smooth boundary.

A12—13 to 18 inches; very dark gray (10YR 3/1) clay; few medium distinct dark yellowish brown (10YR 3/4) mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm, very sticky and plastic; few fine and medium roots; few wormcasts; few discontinuous dark grayish brown loamy strata 1 millimeter to 3 millimeters thick; mildly alkaline; gradual smooth boundary.

B21g—18 to 29 inches; dark gray (10YR 4/1) clay; common medium distinct strong brown (7.5YR 5/6) and dark yellowish brown (10YR 3/4) mottles; moderate fine and medium blocky structure; extremely hard, very firm, sticky and plastic; common medium and large roots; few black concretions 1 millimeter to 3 millimeters in diameter; few pressure faces 1 centimeter across; neutral; gradual smooth boundary.

B22g—29 to 43 inches; mottled dark gray (10YR 4/1) and dark grayish brown (10YR 4/2) silty clay; common medium distinct dark yellowish brown (10YR 4/4) mottles; weak medium blocky structure parting to weak fine blocky; extremely hard, very firm, sticky and plastic; common fine, medium, and large roots; few black concretions 1 millimeter to 3 millimeters in diameter; few black organic matter fragments; few thin lenses of brown loamy material; slightly acid; gradual smooth boundary.

Abg—43 to 64 inches; very dark gray (10YR 3/1) clay loam; few fine distinct dark yellowish brown mottles; moderate medium blocky structure parting to weak fine blocky; extremely hard, very firm, sticky and plastic; common fine and medium roots; few black organic matter fragments; few black concretions 1 millimeter to 2 millimeters in diameter; few pressure faces 1 centimeter to 4 centimeters across; strongly acid.

The solum is more than 60 inches thick.

The A horizon is black, very dark gray, or very dark grayish brown. The lower part of this horizon commonly has distinct or prominent mottles of dark reddish brown, yellowish brown, or dark yellowish brown. The horizon is neutral to moderatly alkaline. The upper 10 inches of the horizon is calcareous in some pedons.

The B2g horizon is dark gray, gray, dark grayish brown, grayish brown, or light grayish brown and has common to many grayish, brownish, and yellowish mottles. This horizon is clay, silty clay, or clay loam. It is strongly acid to mildly alkaline.

A buried A horizon is common below a depth of 30 inches. These horizons are dark gray or very dark gray and have brownish mottles. They are clay loam, clay, or silty clay, and they range from strongly acid to slightly acid.

Severn series

The Severn series consists of deep, loamy soils on flood plains. These soils formed in loamy, calcareous, stratified alluvium. Slopes range from 0 to 5 percent.

Typical pedon of Severn very fine sandy loam; from the intersection of Farm Road 197 and U.S. Highway 271 in Arthur City, 1.9 miles south on U.S. Highway 271, 9.9 miles east on Farm Road 906, and 200 feet north of road in pasture:

A1—0 to 4 inches; reddish brown (5YR 4/4) very fine sandy loam; weak fine granular structure; slightly hard, very friable; common fine roots; few wormcasts; common organic matter stains; calcareous; moderately alkaline; clear smooth boundary.

C1—4 to 28 inches; reddish brown (5YR 5/4) very fine sandy loam; massive; slightly hard, very friable; common fine roots; few very fine pores; few wormcasts; many bedding planes; few thin strata of silt loam; calcareous; moderately alkaline; clear smooth boundary.

C2—28 to 37 inches; stratified reddish brown (5YR 5/4) very fine sandy loam and reddish brown (5YR 4/4) loam; massive; slightly hard, very friable; common fine roots; few very fine pores; few wormcasts; few thin light reddish brown fine sandy loam strata; common bedding planes; calcareous; moderately alkaline; gradual smooth boundary.

C3—37 to 63 inches; reddish brown (5YR 5/4) very fine sandy loam; massive; slightly hard, very friable; few fine roots; common reddish yellow (5YR 6/6) loamy very fine sand strata 0.5 millimeter to 77 millimeters thick; many bedding planes; calcareous; moderately alkaline.

The soil is calcareous and moderately alkaline throughout.

The A horizon is dark reddish brown or reddish brown.

The C horizon is strong brown, reddish brown, yellowish red, or reddish yellow. This horizon is stratified very fine sandy loam, silt loam, or loamy very fine sand. It has thin strata of coarser or finer textured material. Bedding planes are common to many.

Stephen series

The Stephen series consists of very shallow to shallow, clayey soils on uplands. These soils formed in platy chalk. Slopes range from 1 to 5 percent.

Typical pedon of Stephen silty clay, 1 to 3 percent slopes (fig. 8); from the intersection of Farm Road 38 and Farm Road 137 in Roxton, 2.5 miles north on Farm Road 38, and 300 feet west in cultivated field:

Ap—0 to 7 inches; very dark brown (10YR 2/2) silty clay; moderate fine and very fine subangular blocky structure; very hard, firm, sticky and plastic; common roots; few fine chalk fragments; calcareous; moderately alkaline; abrupt wavy boundary.

C1&A—7 to 13 inches; about 60 percent platy chalk fragments and platy chalk in place and about 40 percent very dark grayish brown (10YR 3/2) silty clay in the horizontal and vertical crevices and between the loose chalk fragments; few roots; calcareous; moderately alkaline; abrupt irregular boundary.

C2—13 to 28 inches; white (10YR 8/2) and very pale brown (10YR 8/3) platy chalk that is softer than 3 (Mohs' scale); few thin tongues of very dark grayish brown silty clay in crevices between some chalk plates; calcareous; moderately alkaline.

Chalk or soft limestone is at a depth of 7 to 20 inches.

The A horizon is very dark brown, dark brown, or very dark grayish brown. Chalk fragments range from a few to 35 percent.

The C horizon is chalk, chalk interbedded with limy earth, or soft limestone and chalk. When moist, the C horizon material can be cut with a spade.

Trinity series

The Trinity series consists of deep, clayey soils on flood plains. These soils formed in clayey, calcareous alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Trinity clay; from the intersection of Farm Road 38 and Farm Road 128 in Ben Franklin, 1.4 miles south on Farm Road 38, 200 feet east of road in cultivated field:

Ap—0 to 7 inches; very dark gray (10YR 3/1) clay; moderate fine and medium blocky structure; when dry, surface is mulch 5 millimeters thick of hard very fine aggregates; extremely hard, firm, very sticky and plastic; few fine roots; few wormcasts; calcareous; moderately alkaline; abrupt smooth boundary.

A11—7 to 16 inches; very dark gray (10YR 3/1) clay; moderate medium blocky structure parting to moderate fine and very fine subangular blocky; extremely hard, firm, very sticky and plastic; few fine roots; few very fine pores; few wormcasts; peds have shiny faces; common pressure faces; calcareous; moderately alkaline; gradual wavy boundary.

A12—16 to 29 inches; very dark gray (10YR 3/1) clay; moderate coarse angular blocky structure parting to moderate fine and medium angular and subangular blocky; extremely hard, very firm, very sticky and plastic; few fine roots; few wormcasts; many pressure faces; common grooved intersecting slickensides; few very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

A13—29 to 72 inches; black (10YR 2/1) clay; few fine distinct dark grayish brown mottles; moderate coarse angular blocky structure parting to moderate fine and medium angular and subangular blocky; extremely hard, firm, very sticky and plastic; few fine roots; many pressure faces; many grooved intersecting slickensides; few black concretions; common very fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 60 inches thick. Clay content of the solum ranges from 60 to 80 percent. Intersecting slickensides are at a depth of less than 24 inches. When dry, cracks that are 1 inch to 3 inches wide at a depth of 20 inches form. The soil is calcareous and mildly alkaline or moderately alkaline throughout.

The A horizon is black or very dark gray. Few to common brownish, yellowish, or olive mottles are below a depth of 10 inches in some places.

Varro series

The Varro series consists of deep, loamy soils on flood plains. These soils formed in loamy, calcareous, stratified alluvium. Slopes range from 0 to 1 percent.

Typical pedon of Varro clay loam, frequently flooded; from the intersection of Farm Road 196 and county road in Cunningham, 1.9 miles south and 1.8 miles east on county road, 1.5 miles southeast in wooded area:

C1—0 to 60 inches; stratified dark grayish brown (10YR 4/2; 2.5Y 4/2), grayish brown (2.5Y 5/2), light brownish gray (2.5Y 6/2), and very dark grayish brown (10YR 3/2) clay loam; most strata are less than 6 millimeters thick; massive; hard, friable, slightly sticky and slightly plastic; few medium roots; few fine pores; few decaying leaves and twigs between bedding planes; few thin very dark gray silty clay strata; calcareous; moderately alkaline.

The soil is calcareous and moderately alkaline. Bedding planes are present throughout the soil. Strata are light brownish gray, grayish brown, dark grayish brown, very dark grayish brown, pale brown, or brown. Thin strata of black or very dark gray are in some pedons. Strata are loam, very fine sandy loam, silty clay loam, silty clay, or clay loam.

Whakana series

The Whakana series consists of deep, loamy soils on uplands. These soils formed in loamy ancient alluvial sediment. Slopes range from 1 to 20 percent.

Typical pedon of Whakana fine sandy loam, 1 to 5 percent slopes; from the intersection of Farm Road 906 and Farm Road 197 in Chicota, 2.8 miles west on Farm Road 197, 2.0 miles north on county road, 160 feet west of county road in pasture:

A1—0 to 5 inches; brown (7.5YR 4/2) fine sandy loam; moderate fine granular structure; slightly hard, very friable; common fine roots; few fine siliceous pebbles; medium acid; clear smooth boundary.

A2—5 to 15 inches; brown (7.5YR 5/4) fine sandy loam; weak fine granular structure; slightly hard, very friable; common fine roots; few fine siliceous pebbles; medium acid; clear smooth boundary.

B21t—15 to 25 inches; red (2.5YR 4/6) clay loam; moderate medium subangular blocky structure; very hard, friable; few fine roots; few fine black concretions; few fine siliceous pebbles; few medium strong brown pockets of loamy sand; thick reddish brown (2.5YR 4/4) clay films on exterior of peds; very strongly acid; gradual wavy boundary.

B22t—25 to 42 inches; yellowish red (5YR 5/6) clay loam; weak medium subangular blocky structure; very hard, firm; few fine roots; few fine pores; few black masses; few fine siliceous pebbles; few patchy

clay films 1/2 unit of chroma darker than ped interiors on surface of peds; about 5 percent vertical streaks 2 to 4 millimeters wide of uncoated sand grains on faces of peds; very strongly acid; diffuse wavy boundary.

B23t&A'2—42 to 65 inches; red (2.5YR 4/6) sandy clay loam; weak coarse prismatic structure parting to weak medium blocky; hard, slightly brittle; few fine roots; few fine pores; few patchy clay films; few fine siliceous pebbles; about 15 percent vertical streaks and tongues of loamy fine sand, tongues are 2 to 5 centimeters wide and expand with depth; very strongly acid; gradual irregular boundary.

B24t&A'2—65 to 80 inches; yellowish red (5YR 4/6) sandy clay loam; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, slightly brittle; common clay films; few fine siliceous pebbles; about 15 to 20 percent streaks and tongues of loamy fine sand, tongues are 2 to 10 centimeters wide and taper or end in lower part of horizon; very strongly acid.

The solum is more than 72 inches thick.

The A horizon is 9 to 20 inches thick. The A1 horizon is dark grayish brown or brown. This horizon is medium acid or slightly acid. The A2 horizon is brown, light yellowish brown, light brown, or strong brown. This horizon is medium acid or slightly acid.

The B2t horizon is yellowish red, red, reddish brown, dark reddish brown, or dark red. Few or common mottles of these same colors are in most pedons. This horizon is loam, sandy clay loam, or clay loam. It is very strongly acid to medium acid. The B2t&A'2 horizons are reddish brown, red, or yellowish red. Few to many reddish mottles are present in places. The horizons are loam or sandy clay loam. They are very strongly acid to medium acid. Silt coats, pockets, and tongues of light gray (10YR 7/1) and white (10YR 8/1) A'2 material make up 5 to 30 percent of the horizon.

Wilson series

The Wilson series consists of deep, loamy soils on uplands. These soils formed in clayey sediment. Slopes range from 0 to 2 percent.

Typical pedon of Wilson silt loam, 0 to 2 percent slopes; from the intersection of Texas Highway 24 and Business Highway 24 in Cooper, 2.55 miles northeast on Texas Highway 24, 0.5 mile south and 0.2 mile east on county road, 100 feet north of county road in cultivated field:

Ap—0 to 6 inches; very dark gray (10YR 3/1) silt loam; weak medium granular structure; very hard, firm; few fine roots; light gray crust 6 millimeters thick on surface; slightly acid; abrupt smooth boundary.

B21tg—6 to 9 inches; very dark gray (10YR 3/1) clay loam; moderate medium blocky structure; very hard, firm; few fine roots; few patchy clay films on faces of peds; vertical cracks 5 to 8 centimeters wide filled with silt loam soil material; medium acid; clear wavy boundary.

B22tg—9 to 28 inches; very dark gray (10YR 3/1) clay; moderate coarse blocky structure parting to moderate medium blocky; extremely hard, very firm; few fine roots; few fine pores; few large pressure faces; vertical cracks 2 to 5 centimeters wide filled with silt loam soil material; common clay films 1/2 unit of value darker than ped interiors; slightly acid; diffuse wavy boundary.

B23tg—28 to 39 inches; dark gray (10YR 4/1) clay; moderate coarse blocky structure; extremely hard, very firm; few fine roots; few fine pores; common large pressure faces; vertical cracks 2 to 5 centimeters wide are filled with silt loam soil material; common clay films 1/2 unit of value darker than ped interiors; few black concretions 1 millimeter to 3 millimeters in diameter; neutral; diffuse wavy boundary.

B24tg—39 to 61 inches; grayish brown (2.5Y 5/2) clay; few medium distinct light olive brown (2.5Y 5/4) mottles; moderate medium blocky structure; extremely hard, very firm; few fine roots; common large pressure faces; few black concretions 1 millimeter to 3 millimeters in diameter; few fine calcium carbonate concretions; vertical cracks 2 to 4 centimeters wide tapering out in lower part of horizon filled with silt loam; common clay films 1/2 unit of value daker than ped interiors; mildly alkaline; diffuse wavy boundary.

B25tg—61 to 80 inches; grayish brown (2.5Y 5/2) clay; common medium distinct light olive brown (2.5Y 5/4) and olive yellow (2.5Y 6/6) mottles; weak coarse blocky structure; extremely hard, very firm; few large pressure faces; few siliceous pebbles; few concretions of calcium carbonate; few black concretions; few clay films; mildly alkaline.

The solum is 55 to 80 inches thick. When dry, cracks that are 1 to 2 inches wide at a depth of 20 inches form.

The A horizon is very dark gray, dark grayish brown, or very dark grayish brown. This horizon is medium acid or slightly acid.

The B21tg horizon is dark gray or very dark gray. Few to common fine and medium mottles of dark yellowish brown, light yellowish brown, or brown are in some pedons. The horizon is silty clay loam or clay loam. It is medium acid or slightly acid. The B22tg and B23tg horizons are very dark gray or dark gray. Few to common brownish or yellowish mottles are in some places. The horizons are clay or silty clay. They are medium acid to neutral. The B24tg and B25tg horizons are dark gray, gray, grayish brown, or light brownish gray. Olive, brown-

ish, or yellowish mottles are in most pedons. The horizons are clay. Gypsum crystals and concretions of calcium carbonate are in most pedons. The horizon is neutral to moderately alkaline.

Woodtell series

The Woodtell series consists of deep, loamy soils on uplands. These soils formed in stratified loamy, clayey, and shaly sediment. Slopes range from 5 to 12 percent.

Typical pedon of Woodtell loam, 5 to 12 percent slopes; from the intersection of Farm Road 195 and U.S. Highway 82 in Paris, 5.4 miles northeast on Farm Road 195 and 100 feet northwest of road in pasture:

Ap—0 to 4 inches; very dark grayish brown (10YR 3/2) loam; moderate fine subangular blocky structure; hard, friable; few roots; few wormcasts; slightly acid; abrupt wavy boundary.

B21t—4 to 12 inches; yellowish red (5YR 4/6) clay; common fine distinct light olive brown and few fine distinct light brownish gray mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few roots; few wormcasts; few clay films; peds have shiny surfaces; very strongly acid; gradual wavy boundary.

B22t—12 to 26 inches; red (2.5YR 4/6) clay; many medium prominent light brownish gray (10YR 6/2) and few fine distinct light olive brown mottles; moderate fine and medium subangular blocky structure; extremely hard, very firm, sticky and plastic; few roots; peds have shiny surfaces; common pressure faces; very strongly acid; gradual wavy boundary.

B23t—26 to 41 inches; distinctly and coarsely mottled red (2.5YR 5/6) and light gray (10YR 7/1) clay; few fine distinct light olive brown mottles; moderate medium blocky structure; extremely hard, very firm, sticky and plastic; few roots; common pressure faces; few slickensides 2 to 5 centimeters across; peds have shiny surfaces; very strongly acid; gradual wavy boundary.

B3—41 to 51 inches; light brownish gray (2.5Y 6/2) clay; many coarse distinct light yellowish brown (2.5Y 6/4) and many medium distinct light olive brown (2.5Y 5/4) mottles; weak medium subangular blocky structure; extremely hard, very firm; few roots; common pressure faces; few slickensides 2 to 5 centimeters across; fragments of shale as much as 1 centimeter across in lower part of horizon; very strongly acid; gradual smooth boundary.

C—51 to 63 inches; stratified grayish brown (2.5Y 5/2) partially weathered shale and clay; common medium prominent yellowish brown (10YR 5/6) mottles; very hard, firm; few roots; medium acid.

The solum is 42 to 60 inches thick.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, or dark brown. This horizon is very strongly acid to slightly acid. A thin A2 horizon is present in some undisturbed areas.

The B21t and B22t horizons are red, reddish brown, or yellowish red and have few to common gray, light brownish gray, yellowish brown, light olive brown, light yellowish brown, or yellowish red mottles. The amount of gray increases with depth. The horizons are very strongly acid or strongly acid. The B23t and B3 horizons are mottled in shades of gray, yellowish brown, red, and grayish brown. These horizons are clay mixed with shale, clay, clay loam, or sandy clay loam. They are very strongly acid to medium acid.

The C horizon is mottled in shades of gray, yellow, and brown. This horizon is shale, shaly clay, clay loam, or sandy clay loam, and it is strongly acid to neutral.

Formation of the soils

This section discusses the five major factors of soil formation, relates them to the formation of the soils in the survey area, and explains the processes of soil formation.

Parent material

A soil forms in parent material. Parent material is one of the most influential factors in soil formation in Lamar and Delta Counties. It determines the chemical and mineralogical composition of the soil and influences the rate of soil development. The parent materials of the soils of Lamar and Delta Counties are Cretaceous to Recent in age (*3*).

The oldest bedrock in the area is the Woodbine Formation, which is exposed in the northeast corner of Lamar County. It consists chiefly of shale and clay. The most common soils that formed in this material are the acid Annona and Woodtell soils.

The Eagle Ford Formation is exposed in the northern part of Lamar County. This formation consists mainly of bituminous shale and a few thin beds of sandstone. In eastern Lamar County it grades to mostly quartz sand with some conglomerate at the base in places. Acid soils such as Annona, Freestone, and Woodtell soils formed in this material.

The Bonham Formation extends across northern Lamar County. This unit consists of a sandy and glauconitic marl and a glauconitic calcareous clay. In the eastern part of Lamar County acid soils such as Annona, Freestone, and Woodtell soils developed. In the western part loamy, claypan, prairie soils such as Mabank, Crockett, and Parisian soils developed.

The Blossom Sand extends west to east through the center of Lamar County. In the western part of the county this unit is composed of shale and is ferruginous

with thin clay interbeds. The eastern part has quartz sands that in places are glauconitic and ferruginous with thin clay interbeds. Normangee soils formed in the western part, and Annona, Bernaldo, Derly, Freestone, and Woodtell soils formed in the eastern part.

The Brownstown Marl crops out in a narrow belt extending across Lamar County south of Paris. The upper part is calcareous marl and clay in which Heiden and Houston Black soils formed.

The Gober Chalk extends from the west almost to the eastern part of Lamar County, where it tapers out. The chalk is argillaceous and fine-grained. Austin, Eddy, and Stephen soils formed in the steeper areas, and Deport, Leson, and Houston Black soils formed in the less steep areas.

The Roxton Limestone crops out in a narrow band south of the Gober Chalk. The Roxton Limestone is a sandy, glauconitic, soft, tough, red limestone that forms a resistant cap at the top. This cap forms a ledge in outcropped areas. The same soils formed in this rock as in the Gober Chalk.

The Ozan Formation crops out in a belt in the southwestern part of Lamar County extending eastward into Red River County. The unit consists of calcareous clay that contains some fine quartz sand in places. Deep prairie soils such as Deport, Heiden, Leson, and Houston Black soils formed on the Ozan Formation. In the eastern part, Crockett and Wilson soils also formed.

The Wolfe City Formation crops out in the northwestern part of Delta County and angles toward Deport in Lamar County. This unit consists of fine calcareous sand and sandy marl. In this formation Crockett, Lamar, and Wilson soils formed.

The Pecan Gap Chalk crops out in northwestern Delta County and extends eastward through Deport in Lamar County. This unit consists primarily of chalk that is locally argillaceous, sandy, slightly bituminous, and glauconitic. The same soils formed in Pecan Gap Chalk as in Gober Chalk.

The Marlbrook Marl passes through northern Delta County and southeastern Lamar County. This formation is a uniform marl except for the upper part, which is slightly glauconitic. In Delta County Deport, Heiden, Houston Black, and Leson soils formed. In Lamar County these soils and Crockett and Wilson soils formed in this rock.

The Neylandville Formation occurs in southwestern Delta County. It consists of sandy, calcareous clay. Crockett and Wilson soils formed in this formation.

The undivided Navarro Group is exposed in southern Delta County and southeastern Lamar County. This rock is mostly clayey and contains quartz sand. Annona, Crockett, Wilson, and Woodtell soils formed in this rock.

Pleistocene fluvial terraces are common in the northern part of Lamar County. These terraces are 17 to 160 feet above the modern flood plains. On these terraces Caspiana, Karma, Porum, and Whakana soils formed.

The parent material of the soils on the flood plains of the rivers and drainageways of the survey area is alluvial deposits of recent age. Many of these deposits have been reworked from time to time, and new sediment has been added. Sandy, loamy, and clayey alkaline sediment along the Red River is mostly from sources to the west. Belk, Desha, Kiomatia, Norwood, Redlake, and Severn soils formed in these deposits. Other alluvial sediment consists of loamy and clayey sediment from local streams. In this recent sediment Elbon, Lassiter, Kaufman, and Trinity soils formed.

All of the soils that formed in Cretaceous and Pleistocene material have a well developed profile except Austin, Eddy, and Stephen soils, which formed in chalk. Soils that formed in alluvium, except the Guyton soil, have slight profile development.

Climate

Lamar and Delta Counties have a warm, moist, humid, subtropical climate that is characterized by strong rains. Summer is hot, and the humidity is generally high. Winter is mild but well defined. Seasonal changes are gradual.

The climate that existed while the soils formed greatly influenced their development. High humidity and surplus rainfall caused most of the loamy soils on terraces to be strongly weathered, leached, and acid. Most of the soils in the survey area are deep.

Differences in normal soils cannot be attributed to climate, because the climate is uniform throughout the survey area.

Plant and animal life

Plants, burrowing animals, earthworms, micro-organisms, and recently man, have directly influenced the formation of soils. The trees and native grasses have different effects on the losses and gains of organic matter and plant nutrients and on soil structure and porosity.

Soils that formed under forest accumulated organic matter in the upper few inches. This is quickly destroyed when the soils are cultivated, as has happened in the Freestone-Hicota complex, 0 to 3 percent slopes. Soils that formed under grass accumulated organic matter to greater depths. Grass roots also slowed leaching of essential bases, as in Houston Black clay.

Earthworms, crayfish, and burrowing rodents help in mixing the material within the soil. Earthworms are more numerous in prairie soils. They enhance the movement of air, water, and plant nutrients in these soils. Crayfish are most numerous in soils that have clayey layers and slow runoff. They deposit parent material on the soil surface. Burrowing animals such as gophers help mix and aerate loamy soils such as Whakana and Bernaldo soils.

In the past 130 years, man has affected soil formation by removing the native vegetation over most of the area.

Lack of adequate conservation measures on soils that have lost their native vegetation has resulted in sheet and gully erosion, as on Normangee soils, 2 to 6 percent slopes, eroded. Tillage has reduced organic-matter content and compacted clayey soils, reducing aeration, infiltration, and permeability. All of these changes are reflected in present soil productivity and future development of the soils.

Relief

Relief affects the formation of soils by influencing drainage, plant cover, and infiltration. Most of the survey area is nearly level to gently sloping. Relief strongly influences how much water percolates through the soil. The sloping to strongly sloping Ferris soils have a thinner solum than the nearby, nearly level to gently sloping Houston Black soils. Because water runs off faster from the steeper soils, less moisture infiltrates into soil, and the plant cover is thinner. The steeper soils generally have a thinner surface layer, and if they have been cleared, they are more eroded than gently sloping soils. The effect of relief toward shallow soil development is not pronounced in Lamar and Delta Counties. Abundant rainfall and long warm periods overcome most of its effects, and nearly all soils are deeply developed.

Relief influences soil drainage. Soils on nearly level uplands have poor drainage. Derly and Mabank soils formed in such area.

Time

The length of time that climate, living organisms, and relief act upon parent material affects the kind of soil that develops. The effects of time are modified by the other four factors of soil formation. Soils with no definite horizons are young, or immature. Soils that have well defined horizons are mature, or old.

In Lamar and Delta Counties the soils range from young to old. Elbon, Lassiter, Severn, and Kiomatia soils are on flood plains and show faint horizons or none. Whakana, Freestone, and Hicota soils on the uplands are old, mature soils. Although Caspiana and Karma soils are younger, they have well expressed horizons. Eddy and Stephen soils are considered young even though they have had sufficient time to develop well expressed horizons. Since these soils are gently sloping geological erosion took away soil material as fast or almost as fast as it formed.

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Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

Base saturation. The degree to which material having base exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bottom land. The normal flood plain of a stream, subject to frequent flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid. A soil having measurable amounts of calcium carbonate or magnesium carbonate.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity, but is more precise in meaning.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Compressible. Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is 40 or 80 inches (1 or 2 meters).

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave. Unstable walls of cuts made by earth-moving equipment. The soil sloughs easily.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. A delay in grazing until range plants have reached a specified stage of growth. Grazing is deferred in order to increase the vigor of forage and to allow desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Depth to rock. Bedrock at a depth that adversely affects the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients, as for example in "hillpeats" and "climatic moors."

Drainage, surface. Runoff, or surface flow of water, from an area.

Erosion. The wearing away of the land surface by running water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes a bare surface.

Excess fines. Excess silt and clay. The soil does not provide a source of gravel or sand for construction purposes.

Excess lime. Excess carbonates. Excessive carbonates, or lime, restrict the growth of some plants.

Fast intake. The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Flooding. The temporary covering of soil with water from overflowing streams, runoff from adjacent slopes, and tides. Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; *November-May*, for example, means that flooding can occur during the period November through May. Water standing for short periods after rainfall or commonly covering swamps and marshes is not considered flooding.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forage. Plant material used as feed by domestic animals. Forage can be grazed or cut for hay.

Forb. Any herbaceous plant not a grass or a sedge.

Gilgai. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope.

Gleyed soil. A soil having one or more neutral gray horizons as a result of waterlogging and lack of oxygen. The term "gleyed" also designates gray horizons and horizons having yellow and gray mottles as a result of intermittent waterlogging.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as pro-

tection against erosion. Conducts surface water away from cropland.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

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. Inadequate strength for supporting loads.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderate-*

ly rapid (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to 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.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The health or productivity of forage plants on a given range, in terms of the potential productivity under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or assumed climax vegetation on a site, as compared to what has been observed to grow on it when well managed.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind and amount of native vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Runoff. The precipitation discharged in stream channels from a drainage area. The water that flows off the land surface without sinking in is called surface runoff; that which enters the ground before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Seepage. The rapid movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils, formed from a particular type of parent material, having horizons that, except for the texture of the A or surface horizon, are similar in all profile characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineralogical and chemical composition.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake. The slow movement of water into the soil.

Small stones. Rock fragments 3 to 10 inches (7.5 to 25 centimeters) in diameter. Small stones adversely affect the specified use.

Soil. A natural, three-dimensional body at the earth's surface that is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *very coarse sand* (2.0 millimeters to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand*

(0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

Stratified. Arranged in strata, or layers. The term refers to geologic material. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates that are separated from adjoining aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use or management.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea. A stream terrace is frequently called a second bottom, in contrast with a flood plain, and is seldom subject to overflow. A marine terrace, generally wide, was deposited by the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Thin layer. Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The condition of the soil, especially the soil structure, as related to the growth of plants. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.
Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.
Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.
Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Well graded. Refers to a soil or soil material consisting of particles well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

ILLUSTRATIONS

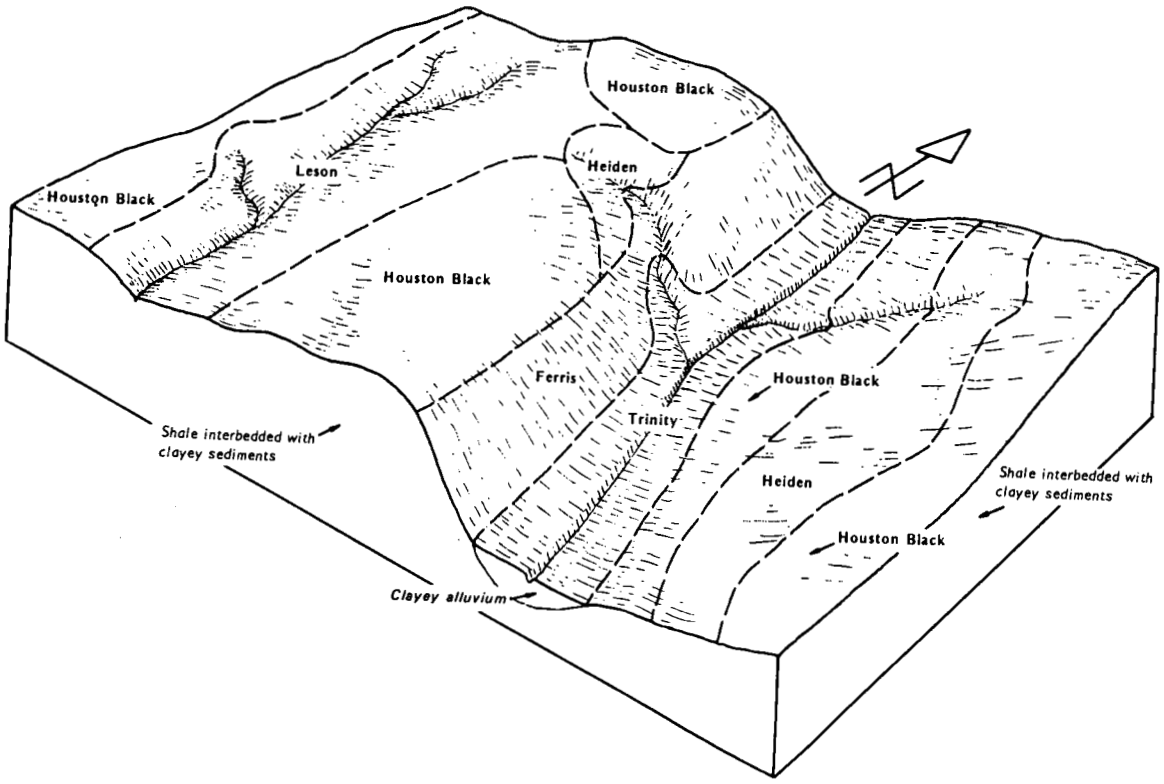

Figure 1.—Relationship of soils, topography, and underlying material in the Houston Black-Leson-Heiden map unit.

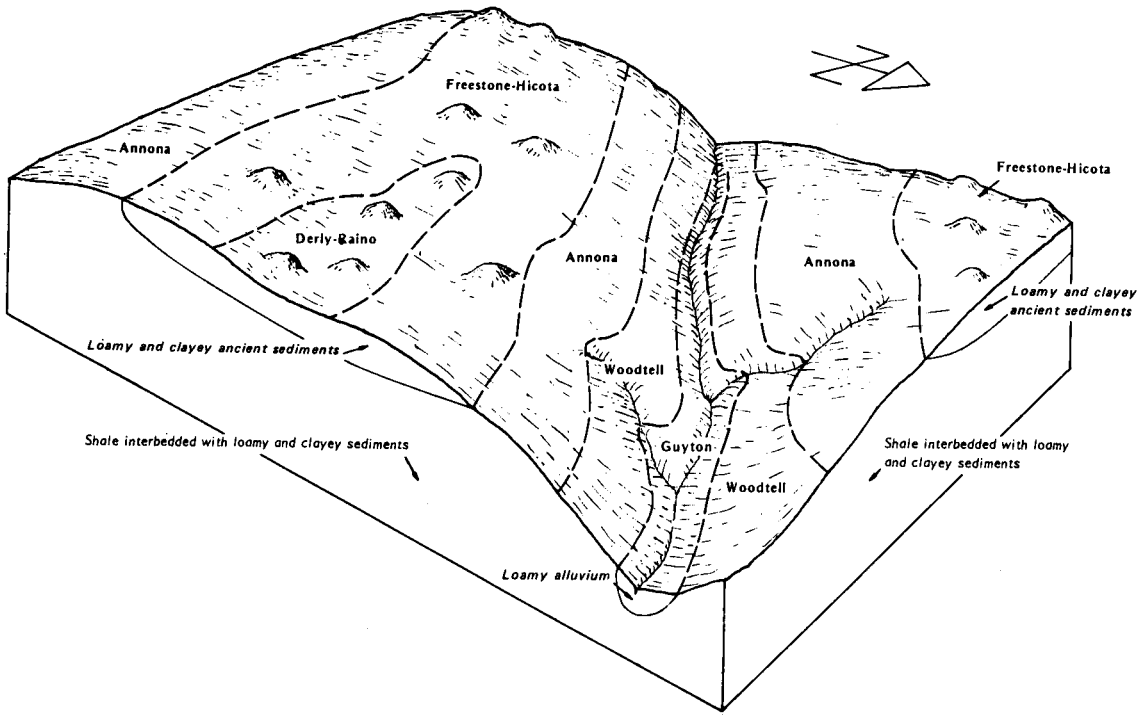

Figure 2.—Relationship of soils, topography, and underlying material in the Annona-Freestone-Woodtell map unit.

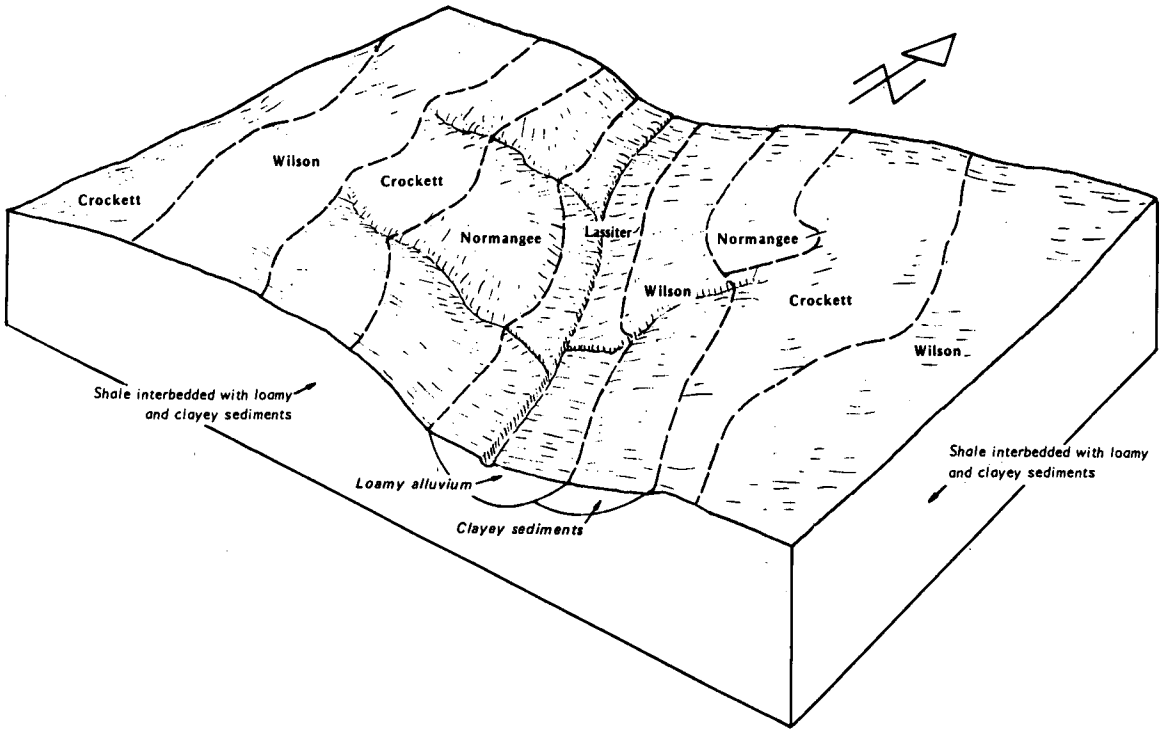

Figure 3.—Relationship of soils, topography, and underlying material in the Wilson-Normangee-Crockett map unit.

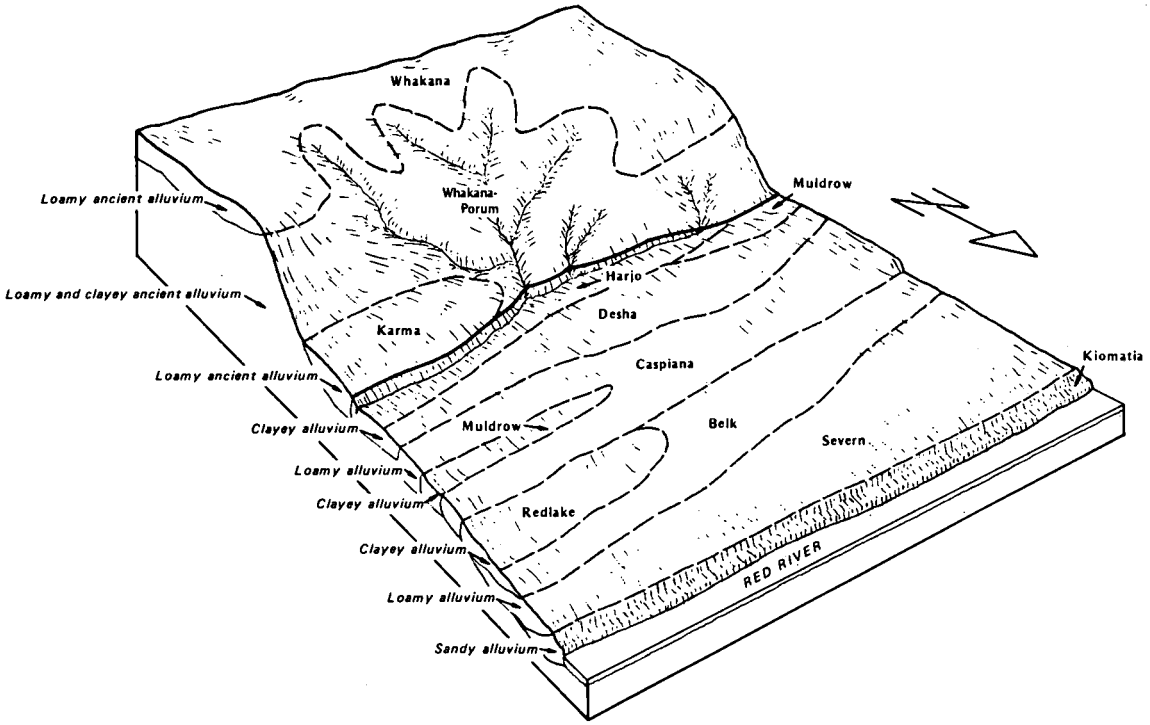

Figure 4.—Relationship of soils, topography, and underlying material in the Whakana-Porum and Severn-Caspiana-Desha map units.

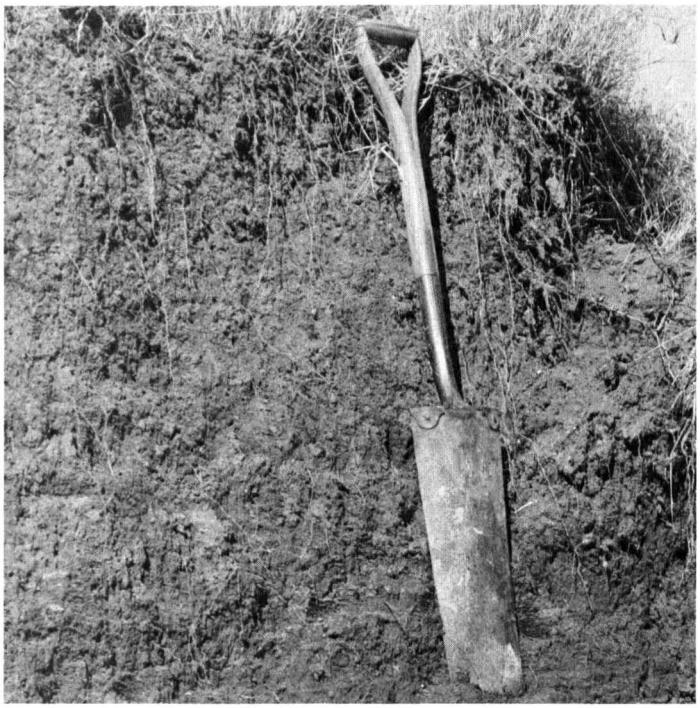

Figure 5.—Profile of Elbon silty clay loam. This soil is deep.

Figure 6.—Cattle grazing on Freestone-Hicota complex, 0 to 3 percent slopes. Gulf Coast ryegrass was overseeded into coastal bermudagrass the previous fall.

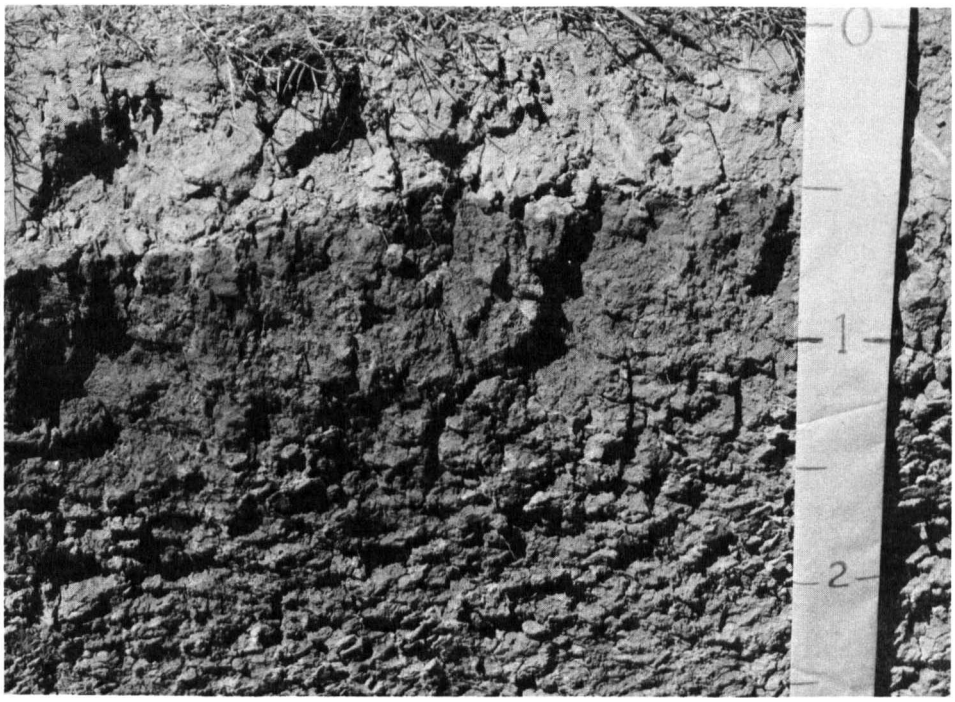

Figure 7.—Profile of Mabank silt loam showing abrupt boundary and blocky structure.

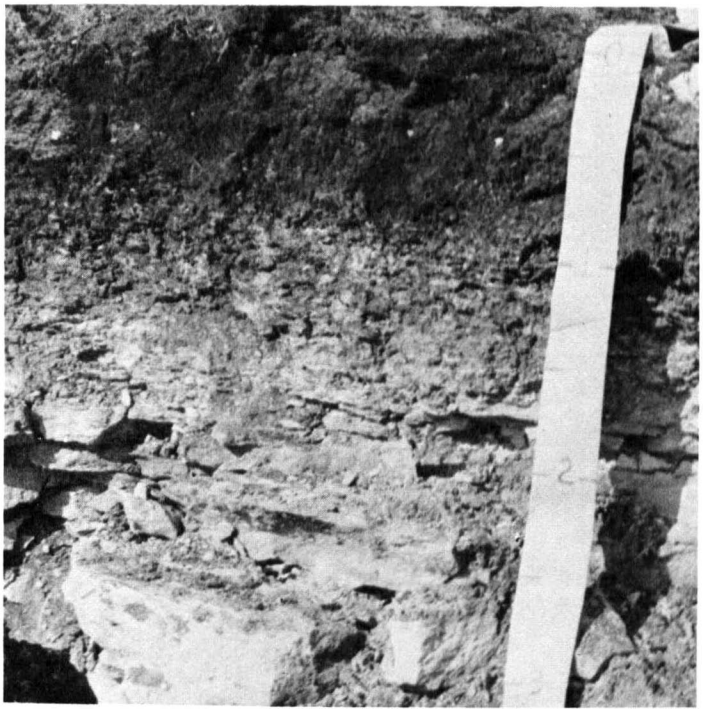

Figure 8.—Profile of Stephen silty clay, 1 to 3 percent slopes, showing chalk bedrock at a depth of 11 inches.

Figure 9.—Profile of Eddy gravelly clay loam. Chalk is at a depth of 6 inches.

Figure 10.—Deteriorated road on Woodtell loam, 5 to 12 percent slopes. This soil has high shrink-swell potential.

Figure 11.—Shortleaf pine and understory vegetation on Annona loam, 1 to 4 percent slopes.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION DATA

[Station at Paris, for period 1938-67]

Month	Temperature*						Average precipitation*	Average number of days with--**		
	Average daily high	Average daily low	Record highest	Year	Record lowest	Year		Precipitation of 0.1 inch or more	Maximum temperature of 90° F or above	Minimum temperature of 32° F or below
	°F	°F	°F		°F		In			
January	52.3	30.7	83	1943	0	1949	2.57	4	0	21
February	56.7	34.7	85	1954	-1	1951	3.52	5	0	13
March	64.6	41.0	92	1946	7	1943	3.49	5	0	6
April	74.0	52.0	91	1960	29	1940	5.59	7	***	***
May	81.1	60.6	96	1958	36	1954	5.42	6	4	0
June	88.9	68.7	103	1953	50	1955	4.46	6	15	0
July	93.6	72.0	111	1954	58	1949	3.76	5	25	0
August	94.4	71.0	110	1939	55	1967	3.05	5	24	0
September	87.5	63.9	109	1939	34	1942	3.68	4	11	0
October	78.7	53.5	99	1953	26	1957	3.10	4	2	***
November	64.9	41.4	88	1955	16	1940	3.62	4	0	5
December	55.4	37.2	82	1955	6	1963	3.06	5	0	15
Year	74.3	52.2	111	1954	-1	1951	45.32	60	81	60

* Length of record, 30 years.

** Length of record, 12 years.

*** Less than one-half.

TABLE 2.--POTENTIALS AND LIMITATIONS OF GENERAL SOIL MAP UNITS FOR SPECIFIED USES

Map unit	Extent of area	Cultivated farm crops	Pasture and hay	Range	Woodland	Woodland grazing	Urban uses	Recreation
	Pct							
1. Houston Black-Leson-Heiden.	32	High	High	High	Low: too clayey, percs slowly.		Low: shrink-swell, low strength, corrosive.	Low: too clayey, percs slowly.
2. Annona-Freestone-Woodtell.	23	Medium: low fertility, wetness, slope.	Medium: low fertility.		Medium: low fertility.	Medium: low fertility.	Medium: shrink-swell, low strength, wetness, slope.	Medium: wetness, slope, percs slowly.
3. Wilson-Normangee-Crockett.	22	Medium: droughty, erodes easily.	High	Medium: percs slowly.	Low: percs slowly.		Medium: shrink-swell, low strength.	Medium: percs slowly.
4. Trinity-Kaufman.	10	Medium: floods.	High		High	High	Low: floods, wetness.	Low: floods, too clayey, wetness.
5. Whakana-Porum.	9	Medium: slope, erodes easily.	Medium: slope.		Medium: low fertility.	Medium: low fertility.	Medium: slope.	Medium: slope.
6. Severn-Caspiana-Desha.	4	High	High		High	High	Low: floods.	Low: floods, too clayey.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Lamar County	Delta County	Total-- Area	Total-- Extent
				Acres	Pct
1	Ambia clay loam, frequently flooded	11,080	0	11,080	1.5
2	Annona loam, 1 to 4 percent slopes	45,980	7,450	53,430	7.1
3	Annona-Urban land complex, 1 to 4 percent slopes	1,710	0	1,710	0.2
4	Austin silty clay, 1 to 3 percent slopes	5,720	830	6,550	0.9
5	Belk clay	2,340	0	2,340	0.3
6	Benklin silt loam	580	3,040	3,620	0.5
7	Bernaldo fine sandy loam, 1 to 3 percent slopes	3,030	0	3,030	0.4
8	Burleson clay, 0 to 1 percent slopes	3,810	1,390	5,200	0.7
9	Caspiana silt loam	5,150	0	5,150	0.7
10	Crockett loam, 1 to 3 percent slopes	23,460	10,070	33,530	4.4
11	Deport clay, 0 to 1 percent slopes	4,680	0	4,680	0.6
12	Deport clay, 1 to 3 percent slopes	7,200	5,660	12,860	1.7
13	Deport-Urban land complex, 0 to 2 percent slopes	360	0	360	(1)
14	Derly silt loam, 0 to 1 percent slopes	8,470	820	9,290	1.2
15	Derly-Raino complex	14,830	1,000	15,830	2.1
16	Desha clay	4,910	0	4,910	0.6
17	Elbon silty clay loam	1,250	320	1,570	0.2
18	Elbon silty clay loam, frequently flooded	4,820	170	4,990	0.7
19	Ferris clay, 5 to 12 percent slopes, eroded	13,190	2,130	15,320	2.0
20	Freestone-Hicota complex, 0 to 3 percent slopes	58,630	2,170	60,800	8.0
21	Freestone-Urban land complex, 0 to 3 percent slopes	1,960	0	1,960	0.3
22	Guyton silt loam, frequently flooded	9,090	670	9,760	1.3
23	Harjo clay, frequently flooded	1,810	0	1,810	0.2
24	Heiden clay, 2 to 5 percent slopes	17,350	5,470	22,820	3.0
25	Heiden-Ferris complex, 3 to 5 percent slopes	11,730	2,040	13,770	1.8
26	Houston Black clay, 0 to 1 percent slopes	8,900	450	9,350	1.2
27	Houston Black clay, 1 to 3 percent slopes	46,080	23,670	69,750	9.2
28	Karma fine sandy loam, 0 to 1 percent slopes	2,670	0	2,670	0.4
29	Kaufman clay	220	8,310	8,530	1.1
30	Kaufman clay, frequently flooded	3,090	16,320	19,410	2.6
31	Lamar clay loam, 5 to 8 percent slopes	2,000	3,140	5,140	0.7
32	Lassiter silt loam, frequently flooded	6,660	1,040	7,700	1.0
33	Leson clay, 1 to 3 percent slopes	17,850	26,580	44,430	5.9
34	Mabank-Crockett complex, 0 to 1 percent slopes	10,330	0	10,330	1.4
35	Muldrow clay loam	2,270	0	2,270	0.3
36	Normangee clay loam, 1 to 3 percent slopes	23,610	0	23,610	3.1
37	Normangee clay loam, 2 to 6 percent slopes, eroded	21,130	4,170	25,300	3.3
38	Norwood silt loam	1,940	0	1,940	0.3
39	Parisian silt loam, 1 to 3 percent slopes	10,530	0	10,530	1.4
40	Redlake clay	2,530	0	2,530	0.3
41	Roxton clay, frequently flooded	4,340	0	4,340	0.6
42	Severn very fine loam	4,600	0	4,600	0.6
43	Severn silty clay loam, overwash	3,280	0	3,280	0.4
44	Severn-Kiomatia complex, frequently flooded	2,400	0	2,400	0.3
45	Stephen silty clay, 1 to 3 percent slopes	2,690	80	2,770	0.4
46	Stephen-Eddy complex, 2 to 5 percent slopes	3,690	330	4,020	0.5
47	Trinity clay	16,300	13,450	29,750	3.9
48	Trinity clay, frequently flooded	12,950	6,530	19,480	2.6
49	Urban land	170	0	170	(1)
50	Varro clay loam, frequently flooded	2,340	1,010	3,350	0.4
51	Whakana fine sandy loam, 1 to 5 percent slopes	16,540	0	16,540	2.2
52	Whakana fine sandy loam, 5 to 12 percent slopes	3,100	0	3,100	0.4
53	Whakana-Porum complex, 8 to 20 percent slopes	22,090	0	22,090	2.9
54	Wilson silt loam, 0 to 2 percent slopes	33,040	26,120	59,160	7.8
55	Woodtell loam, 5 to 12 percent slopes	22,670	2,170	24,840	3.3
	Water	8,610	40	8,650	1.1
	Total	581,760	176,640	758,400	100.0

[1]Less than 0.1 percent.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE

[Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Corn	Cotton lint	Grain sorghum	Soybeans	Improved bermuda-grass	Tall fescue	Alfalfa hay
	Bu	Lb	Bu	Bu	AUM[1]	AUM[1]	Ton
Ambia:							
1	---	---	---	---	7.0	7.5	---
Annona:							
2, [2]3	45	---	---	35	7.0	6.0	---
Austin:							
4	50	350	75	30	6.5	---	---
Belk:							
5	70	500	80	40	8.0	8.0	5.5
Benklin:							
6	85	650	90	45	10.0	8.0	5.0
Bernaldo:							
7	65	---	---	35	9.0	6.5	---
Burleson:							
8	50	450	85	40	7.0	7.5	---
Caspiana:							
9	90	875	90	40	15.0	8.0	5.5
Crockett:							
10	40	350	54	30	7.5	---	---
Deport:							
11	60	500	70	35	6.5	6.5	---
12, [2]13	55	500	65	30	6.5	6.0	---
Derly:							
14	35	260	50	25	6.0	5.5	---
[2]15	35	---	---	25	6.5	5.5	---
Desha:							
[3]16	70	575	90	40	9.0	9.0	4.5
Elbon:							
17	85	625	95	40	9.0	8.0	4.8
18	---	---	---	---	9.0	7.5	---
Ferris:							
19	---	---	---	---	4.0	---	---
Freestone:							
[2]20	60	---	---	35	10.0	7.0	---
[2]21	---	---	---	---	---	---	---
Guyton:							
22	---	---	---	---	6.5	6.5	---
Harjo:							
23	---	---	---	---	5.5	4.5	---
Heiden:							
24	50	400	55	30	6.0	6.0	---
[2]25	40	300	45	20	5.5	---	---
Houston Black:							
26	60	500	90	40	8.0	7.5	---

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Cotton lint	Grain sorghum	Soybeans	Improved bermuda-grass	Tall fescue	Alfalfa hay
	Bu	Lb	Bu	Bu	AUM[1]	AUM[1]	Ton
Houston Black:							
27	55	450	85	35	8.0	7.0	---
Karma:							
28	65	450	65	40	8.5	7.0	---
Kaufman:							
29	75	525	105	40	9.0	8.0	4.5
30	---	---	---	---	8.5	7.5	---
Lamar:							
31	---	---	---	---	6.0	---	---
Lassiter:							
32	---	---	---	---	8.5	7.0	---
Leson:							
33	45	450	80	35	8.0	7.0	---
Mabank:							
2 34	40	350	57	30	7.0	5.5	---
Muldrow:							
35	50	525	60	35	10.0	7.5	5.0
Normangee:							
36	40	350	50	25	8.0	---	---
37	---	---	40	---	6.0	---	---
Norwood:							
38	90	875	90	40	13.0	8.0	6.0
Parisian:							
39	45	375	65	30	8.0	---	---
Redlake:							
40	70	550	80	40	8.0	7.0	5.5
Roxton:							
41	---	---	---	---	8.0	8.0	---
Severn:							
42, 43	65	650	65	35	9.0	6.0	5.5
2 44	---	---	---	---	8.0	5.5	---
Stephen:							
45	35	250	55	20	4.5	---	---
2 46	---	---	---	---	3.5	---	---
Trinity:							
3 47	70	450	100	40	9.0	8.0	4.5
48	---	---	---	---	8.0	7.5	---
Urban land:							
49.							
Varro:							
50	---	---	---	---	8.0	7.0	---
Whakana:							
51	60	---	---	35	8.5	6.5	---
52	50	---	---	---	6.5	---	---
2 53	---	---	---	---	5.5	---	---

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Corn	Cotton lint	Grain sorghum	Soybeans	Improved bermuda-grass	Tall fescue	Alfalfa hay
	Bu	Lb	Bu	Bu	AUM[1]	AUM[1]	Ton
Wilson:							
54	45	375	60	30	7.5	6.0	---
Woodtell:							
55	---	---	---	---	6.0	---	---

[1]Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for a period of 30 days.

[2]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban components that are not rated.

[3]Yields are for areas protected from flooding.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES
[Miscellaneous areas excluded. Absence of an entry means no acreage]

Class		Total acreage	Major management concerns (subclass)		
			Erosion (e)	Wetness (w)	Soil problem (s)
			Acres	Acres	Acres
I	(Lamar)	17,640	---	---	---
	(Delta)	---	---	---	---
II	(Lamar)	185,990	79,960	91,960	14,070
	(Delta)	71,070	49,730	20,820	520
III	(Lamar)	216,860	135,730	73,590	7,540
	(Delta)	68,870	32,620	36,020	230
IV	(Lamar)	30,380	30,380	---	---
	(Delta)	6,480	6,480	---	---
V	(Lamar)	56,770	---	56,770	---
	(Delta)	25,740	---	25,740	---
VI	(Lamar)	59,500	59,500	---	---
	(Delta)	4,440	4,440	---	---
VII	(Lamar)	1,810	---	1,810	---
	(Delta)	---	---	---	---

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Soils not listed do not support rangeland vegetation suited to grazing]

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Austin					
4	Clay Loam	Favorable	6,500	Little bluestem	40
		Normal	5,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	15
				Sideoats grama	5
				Switchgrass	5
				Silver bluestem	5
				Texas needlegrass	5
Burleson					
8	Blackland	Favorable	7,000	Little bluestem	40
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Sideoats grama	5
				Texas needlegrass	5
				Silver bluestem	5
				Tall dropseed	5
Crockett					
10	Claypan Prairie	Favorable	6,000	Little bluestem	10
		Normal	5,000	Indiangrass	10
		Unfavorable	3,000	Virginia wildrye	10
				Florida paspalum	10
				Sideoats grama	10
				Texas needlegrass	10
				Silver bluestem	10
				Paspalum	10
				Big bluestem	5
Deport					
11, 12	Blackland	Favorable	5,000	Sedge	15
		Normal	4,000	Panicum	15
		Unfavorable	2,500	Paspalum	15
				Little bluestem	10
				Virginia wildrye	10
				Indiangrass	5
				Purpletop	5
				Big bluestem	5
Ferris					
19	Eroded Blackland	Favorable	7,000	Little bluestem	30
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Switchgrass	5
				Florida paspalum	5
				Eastern gamagrass	5
				Virginia wildrye	5
				Sideoats grama	5
				Texas needlegrass	5
				Meadow dropseed	5
Heiden					
24	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10
[1]25:					
Heiden part	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Big bluestem	15
		Unfavorable	3,500	Indiangrass	10

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
[1]25:					
Ferris part	Eroded Blackland	Favorable	7,000	Little bluestem	30
		Normal	5,500	Indiangrass	15
		Unfavorable	4,000	Big bluestem	15
				Switchgrass	5
				Florida paspalum	5
				Eastern gamagrass	5
				Virginia wildrye	5
				Sideoats grama	5
				Texas needlegrass	5
				Meadow dropseed	5
Houston Black					
26, 27	Blackland	Favorable	7,000	Little bluestem	50
		Normal	6,000	Indiangrass	25
		Unfavorable	3,500	Switchgrass	5
				Sideoats grama	5
				Vine-mesquite	5
Lamar					
31	Clay Loam	Favorable	6,000	Little bluestem	35
		Normal	4,500	Big bluestem	20
		Unfavorable	3,000	Indiangrass	15
				Switchgrass	5
				Virginia wildrye	5
				Florida paspalum	5
				Texas needlegrass	5
				Silver bluestem	5
Leson					
33	Blackland	Favorable	8,500	Indiangrass	15
		Normal	7,000	Big bluestem	15
		Unfavorable	5,000	Eastern gamagrass	15
				Little bluestem	10
				Switchgrass	10
				Virginia wildrye	5
				Florida paspalum	5
				Sideoats grama	5
				Texas needlegrass	5
				Dropseed	5
[1]34:					
Mabank part	Claypan Prairie	Favorable	6,000	Little bluestem	30
		Normal	5,000	Big bluestem	15
		Unfavorable	3,000	Indiangrass	15
				Switchgrass	10
				Virginia wildrye	5
				Texas needlegrass	5
				Silver bluestem	5
				Meadow dropseed	5
Crockett part	Claypan Prairie	Favorable	6,000	Little bluestem	10
		Normal	5,000	Indiangrass	10
		Unfavorable	3,000	Virginia wildrye	10
				Florida paspalum	10
				Sideoats grama	10
				Texas needlegrass	10
				Silver bluestem	10
				Paspalum	10
				Big bluestem	5
Normangee					
36, 37	Claypan Prairie	Favorable	5,500	Little bluestem	45
		Normal	4,000	Indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Switchgrass	10
				Florida paspalum	5
				Sideoats grama	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Parisian					
39	Loamy Prairie	Favorable	7,000	Little bluestem	40
		Normal	5,500	Indiangrass	10
		Unfavorable	3,500	Switchgrass	10
				Eastern gamagrass	5
				Big bluestem	5
				Texas needlegrass	5
				Meadow dropseed	5
				Vine-mesquite	5
Stephen					
45	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5
[1]46:					
Stephen part	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5
Eddy part	Chalky Ridge	Favorable	4,500	Little bluestem	30
		Normal	3,500	Indiangrass	15
		Unfavorable	2,000	Big bluestem	10
				Sideoats grama	10
				Texas needlegrass	5
				Silver bluestem	5
				Hairy grama	5
Wilson					
54	Claypan Prairie	Favorable	6,000	Little bluestem	45
		Normal	4,500	Indiangrass	10
		Unfavorable	3,000	Big bluestem	10
				Virginia wildrye	5
				Vine-mesquite	5
				Florida paspalum	5
				Sideoats grama	5
				Texas needlegrass	5
				Silver bluestem	5

[1] See map unit description for the composition and behavior of the map unit. Map units 3, 13, and 21 have urban components that are not rated.

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed in this table. Absence of an entry in a column means the information was not available. Site index is calculated at age 30 for Eastern cottonwood and at age 50 for all other species]

Soil name and map symbol	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
Ambia								
1	2w	Slight	Moderate	Moderate	Severe	Water oak	90	Sweetgum, green ash.
						Willow oak	90	
						Green ash	---	
Annona								
2	4c	Slight	Moderate	Slight	Slight	Loblolly pine	74	Loblolly pine, slash pine.
						Shortleaf pine	65	
						Southern red oak	65	
Belk								
5	2c	Slight	Moderate	Moderate	Moderate	Sweetgum	90	Eastern cottonwood, sweetgum, green ash, pecan.
						Water oak	90	
						Eastern cottonwood	100	
Benklin								
6	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood	100	Pecan, black walnut, eastern cottonwood, green ash, sweetgum.
						Green ash	90	
						Sweetgum	90	
Bernaldo								
7	2o	Slight	Slight	Slight	Slight	Loblolly pine	90	Loblolly pine, slash pine, sweetgum.
						Shortleaf pine	80	
						Sweetgum	---	
						Southern red oak	---	
Caspiana								
9	2o	Slight	Slight	Slight	---	Green ash	75	Eastern cottonwood, sweetgum, American sycamore.
						Eastern cottonwood	105	
						Cherrybark oak	100	
						Pecan	---	
						Sweetgum	100	
						American sycamore	---	
Derly								
14	4w	Slight	Severe	Moderate	Severe	Water oak	70	Water oak, sweetgum, willow oak.
						Willow oak	70	
[1]15:								
Derly part	4w	Slight	Severe	Moderate	Severe	Water oak	70	Water oak, sweetgum, willow oak.
						Willow oak	70	
Raino part	3w	Slight	Moderate	Slight	Moderate	Loblolly pine	80	Loblolly pine, shortleaf pine.
						Shortleaf pine	70	
Desha								
16	2w	Slight	Severe	Moderate	---	Green ash	85	Green ash, eastern cottonwood, cherrybark oak, Nuttall oak, water oak, willow oak, sweetgum, Shumard oak.
						Eastern cottonwood	100	
						Cherrybark oak	90	
						Nuttall oak	90	
						Water oak	90	
						Willow oak	90	
						Sweetgum	90	
Elbon								
17, 18	2c	Slight	Moderate	Moderate	Moderate	Green ash	80	Pecan, green ash.
						Common hackberry	---	
						Pecan	---	

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	
[1]20:								
Freestone part-----	3w	Slight	Moderate	Slight	Moderate	Loblolly pine------- Shortleaf pine------ Sweetgum-----------	80 70 80	Loblolly pine, slash pine, shortleaf pine.
Hicota part--------	4o	Slight	Slight	Slight	Slight	Shortleaf pine------	59	Loblolly pine.
Guyton								
22-----------------	2w	Slight	Severe	Moderate	--------	Loblolly pine------- Slash pine---------- Sweetgum---------- Green ash---------- Southern red oak---- Water oak----------	90 90 --- --- --- ---	Loblolly pine, sweetgum.
Harjo								
23-----------------	4w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Green ash---------- Bur oak----------	80 --- ---	Eastern cottonwood, green ash, bur oak.
Karma								
28-----------------	3o	Slight	Slight	Slight	Slight	Eastern cottonwood-- Pecan---------- Green ash---------- Black walnut--------	90 --- --- ---	Eastern cottonwood, black walnut, Shumard oak, pecan, green ash, American sycamore.
Kaufman								
29, 30-------------	1w	Slight	Moderate	Moderate	Severe	Eastern cottonwood-- Sweetgum---------- Water oak---------- Green ash----------	110 100 --- ---	Eastern cottonwood, green ash, pecan, sweetgum.
Lassiter								
32-----------------	2w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Green ash---------- Pecan---------- Black walnut--------	100 --- --- ---	Eastern cottonwood, green ash.
Muldrow								
35-----------------	2w	Slight	Moderate	Moderate	Slight	Green ash---------- Pecan---------- Willow oak---------- Water oak---------- Common hackberry----	90 80 --- --- ---	Green ash, American sycamore, eastern cottonwood, sweetgum.
Norwood								
38-----------------	2o	Slight	Slight	Slight	Slight	Eastern cottonwood--	100	Eastern cottonwood.
Redlake								
40-----------------	3w	Slight	Severe	Moderate	Moderate	Eastern cottonwood-- Pecan---------- Black walnut-------- Green ash----------	90 --- --- ---	Eastern cottonwood, pecan, American sycamore, green ash.
Roxton								
41-----------------	3w	Slight	Severe	Severe	Severe	Water oak---------- Green ash---------- Eastern cottonwood--	80 --- 90	Pecan, green ash, eastern cottonwood.
Severn								
42, 43------------	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood-- Pecan---------- Common hackberry----	100 76 76	Eastern cottonwood, American sycamore, pecan, black walnut, sweetgum.

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	
[1]44:								
Severn part	2o	Slight	Slight	Slight	Moderate	Eastern cottonwood	100	Eastern cottonwood, American sycamore, pecan, black walnut, sweetgum.
						Pecan	76	
						Common hackberry	76	
Kiomatia part	2w	Slight	Moderate	Moderate	Moderate	Eastern cottonwood	100	Eastern cottonwood, sweetgum, black walnut, American sycamore.
						Sweetgum	95	
Trinity 47, 48	1w	Slight	Severe	Moderate	Severe	Eastern cottonwood	106	Eastern cottonwood, green ash, pecan, sweetgum.
						Pin oak	---	
						Green ash	---	
Varro 50	1w	Slight	Severe	Moderate	Severe	Eastern cottonwood	110	Eastern cottonwood, water oak.
						Water oak	100	
						Willow oak	---	
Whakana 51, 52	3o	Slight	Slight	Slight	Moderate	Loblolly pine	80	Loblolly pine, slash pine, sweetgum, southern red oak.
						Shortleaf pine	70	
						Sweetgum	80	
						Southern red oak	70	
[1]53:								
Whakana part	3o	Slight	Slight	Slight	Moderate	Loblolly pine	80	Loblolly pine, slash pine, sweetgum, southern red oak.
						Shortleaf pine	70	
						Sweetgum	80	
						Southern red oak	70	
Porum part	4c	Slight	Moderate	Moderate	Moderate	Shortleaf pine	60	Shortleaf pine, loblolly pine.
						Southern red oak	60	
Woodtell 55	4c	Slight	Moderate	Moderate	Moderate	Loblolly pine	70	Slash pine, loblolly pine.
						Shortleaf pine	60	

[1] See map unit description for the composition and behavior of the map unit. Map units 3, 13, and 21 have an urban component that is not rated.

TABLE 8.--WOODLAND UNDERSTORY VEGETATION

[Only the soils suitable for production of commercial trees are listed in this table]

Soil name and map symbol	Total production		Characteristic vegetation	Composition
	Kind of year	Dry weight		
		Lb/acre		Pct
Ambia				
1	Favorable	6,000	Panicum	20
	Normal	3,500	Beaked panicum	15
	Unfavorable	1,500	Sedge	15
			Paspalum	15
			Virginia wildrye	10
Annona				
2	Favorable	2,500	Little bluestem	15
	Normal	2,000	Brownseed paspalum	15
	Unfavorable	1,000	Panicum	15
			Indiangrass	10
			Longleaf uniola	10
			Purpletop	5
Belk				
5	Favorable	5,000	Broomsedge bluestem	15
	Normal	3,500	Purpletop	15
	Unfavorable	2,000	Sedge	15
			Little bluestem	10
			Panicum	10
			Beaked panicum	10
			Switchcane	5
Benklin				
6	Favorable	4,000	Beaked panicum	10
	Normal	3,000	Sedge	10
	Unfavorable	2,000	Longleaf uniola	10
			Common greenbrier	10
			Virginia wildrye	5
			Switchcane	5
Bernaldo				
7	Favorable	2,500	Pinehill bluestem	20
	Normal	2,000	Beaked panicum	20
	Unfavorable	1,500	Longleaf uniola	20
			Panicum	10
			Purpletop	5
Caspiana				
9	Favorable	8,000	Virginia wildrye	15
	Normal	6,500	Beaked panicum	10
	Unfavorable	5,000	Indiangrass	10
			Little bluestem	10
			Switchgrass	10
			Sedge	10
			Switchcane	10
Derly				
14	Favorable	6,500	Florida paspalum	15
	Normal	4,500	Virginia wildrye	15
	Unfavorable	3,000	Little bluestem	10
			Beaked panicum	10
			Giant cane	10
			Panicum	10
			Redtop panicum	10
			Carolina jointtail	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
[1]15:				
Derly part	Favorable	6,500	Florida paspalum	15
	Normal	4,500	Virginia wildrye	15
	Unfavorable	3,000	Little bluestem	10
			Beaked panicum	10
			Giant cane	10
			Panicum	10
			Redtop panicum	10
			Carolina jointtail	5
Raino part	Favorable	2,500	Little bluestem	15
	Normal	1,750	Beaked panicum	15
	Unfavorable	1,000	Longleaf uniola	15
			Purpletop	10
			Panicum	10
Desha				
16	Favorable	3,000	Virginia wildrye	15
	Normal	2,500	Switchgrass	15
	Unfavorable	2,000	Sedge	15
			Beaked panicum	10
			Uniola	5
			Redtop panicum	5
			Peppervine	5
Elbon				
17, 18	Favorable	6,000	Sedge	15
	Normal	5,000	Virginia wildrye	10
	Unfavorable	3,500	Beaked panicum	10
			Panicum	10
			Switchcane	5
			Purpletop	5
			Little bluestem	5
			Mississippi dropseed	5
			Florida paspalum	5
[1]20:				
Freestone part	Favorable	2,500	Little bluestem	15
	Normal	1,750	Beaked panicum	15
	Unfavorable	1,000	Longleaf uniola	15
			Purpletop	10
			Panicum	10
Hicota part	Favorable	5,000	Broomsedge bluestem	15
	Normal	3,000	Beaked panicum	10
	Unfavorable	1,000	Longleaf uniola	10
			Panicum	10
			Sedge	10
			Paspalum	10
			Purpletop	5
Guyton				
22	Favorable	---	Sedge	50
	Normal	1,800	Broomsedge bluestem	15
	Unfavorable	---	Florida paspalum	15
Harjo				
23	Favorable	4,500	Bushy bluestem	20
	Normal	3,600	Willow	15
	Unfavorable	3,000	Eastern cottonwood	15
			Switchgrass	10
			Indiangrass	5
			Big bluestem	5
			Little bluestem	5
			Beaked panicum	5
			Sedge	5
			Cattail	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
Karma				
28	Favorable	5,500	Big bluestem	25
	Normal	3,800	Indiangrass	15
	Unfavorable	2,600	Little bluestem	10
			Switchgrass	5
			Beaked panicum	5
Kaufman				
29, 30	Favorable	7,500	Virginia wildrye	15
	Normal	4,500	Sedge	10
	Unfavorable	3,000	Beaked panicum	10
			Eastern gamagrass	10
			American elm	10
			Canada wildrye	5
			Switchgrass	5
			Indiangrass	5
			Vine-mesquite	5
			Panicum	5
			Buffalograss	5
			Sugarberry	5
			Eastern cottonwood	5
Lassiter				
32	Favorable	5,000	Sedge	20
	Normal	4,000	Beaked panicum	10
	Unfavorable	2,500	Panicum	10
			Longleaf uniola	10
			Little bluestem	5
			Virginia wildrye	5
			Greenbrier	5
			Switchcane	5
Muldrow				
35	Favorable	2,600	Beaked panicum	15
	Normal	2,000	Sedge	15
	Unfavorable	1,600	Switchgrass	10
			Canada wildrye	10
			Eastern gamagrass	5
			Broadleaf uniola	5
			Greenbrier	5
Norwood				
38	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
Redlake				
40	Favorable	6,000	Giant cane	15
	Normal	4,000	Canada wildrye	10
	Unfavorable	2,000	Sedge	10
			Switchgrass	10
			Indiangrass	10
			Broadleaf uniola	5
			Eastern gamagrass	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
Roxton				
41	Favorable	8,000	Virginia wildrye	15
	Normal	5,500	Sedge	10
	Unfavorable	4,000	Beaked panicum	10
			Eastern gamagrass	10
			American elm	10
			Canada wildrye	5
			Switchgrass	5
			Indiangrass	5
			Vine-mesquite	5
			Panicum	5
			Buffalograss	5
			Sugarberry	5
			Eastern cottonwood	5
Severn				
42, 43	Favorable	4,500	Little bluestem	15
	Normal	3,000	Big bluestem	10
	Unfavorable	2,000	Canada wildrye	10
			Panicum	10
			Indiangrass	5
			Switchgrass	5
			Sedge	5
			Scribner panicum	5
144:				
Severn part	Favorable	4,500	Little bluestem	15
	Normal	3,000	Big bluestem	10
	Unfavorable	2,000	Canada wildrye	10
			Panicum	10
			Indiangrass	5
			Switchgrass	5
			Sedge	5
			Scribner panicum	5
Kiomatia part	Favorable	5,000	Beaked panicum	20
	Normal	4,000	Giant cane	20
	Unfavorable	2,500	Sedge	10
			Virginia wildrye	10
			Purpletop	10
			Longleaf uniola	5
Trinity				
47, 48	Favorable	6,500	Virginia wildrye	15
	Normal	4,000	Sedge	15
	Unfavorable	3,000	Eastern gamagrass	10
			Switchgrass	10
			Indiangrass	10
			Giant cane	5
			Beaked panicum	5
			Panicum	5
Varro				
50	Favorable	5,500	Sedge	10
	Normal	3,500	Beaked panicum	10
	Unfavorable	2,000	Virginia wildrye	10
			Longleaf uniola	10
			Indiangrass	10
			Scribner panicum	10
			Blackseed needlegrass	10
			Giant cane	5
			Purpletop	5
			Eastern gamagrass	5
			Fringeleaf paspalum	5
			Common carpetgrass	5
Whakana				
51, 52	Favorable	4,000	Longleaf uniola	20
	Normal	2,500	Pinehill bluestem	10
	Unfavorable	1,500	Panicum	10
			Beaked panicum	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
[1]53:				
Whakana part-------	Favorable	4,000	Longleaf uniola----------	20
	Normal	2,500	Pinehill bluestem----------	10
	Unfavorable	1,500	Panicum----------	10
			Beaked panicum----------	5
			Purpletop----------	5
			Gayfeather----------	5
			Sedge----------	5
Porum part---------	Favorable	3,500	Big bluestem----------	20
	Normal	2,500	Little bluestem----------	15
	Unfavorable	1,800	Indiangrass----------	5
			Switchgrass----------	5
			Longspike tridens----------	5
			Panicum----------	5
			Tickclover----------	5
			Sedge----------	5
Woodtell 55----------	Favorable	3,500	Pinehill bluestem----------	20
	Normal	2,500	Panicum----------	10
	Unfavorable	2,000	Sedge----------	10
			Brownseed paspalum----------	10
			Indiangrass----------	5
			Longleaf uniola----------	5
			Purpletop----------	5
			Carolina jointtail----------	5
			Knotroot bristlegrass----------	5
			Splitbeard bluestem----------	5

[1]See map unit description for the composition and behavior of the map unit. Map units 3, 13, and 21 have urban components that are not rated.

TABLE 9.--BUILDING SITE DEVELOPMENT

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Ambia:					
1	Severe: floods, wetness, too clayey.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.
Annona:					
2, [1]3	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.
Austin:					
4	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, low strength.
Belk:					
5	Moderate: floods, wetness.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.
Benklin:					
6	Severe: wetness.	Moderate: wetness, low strength.	Severe: wetness, low strength.	Moderate: wetness, low strength.	Severe: low strength.
Bernaldo:					
7	Moderate: wetness.	Moderate: low strength.	Moderate: low strength, wetness.	Moderate: low strength, wetness.	Moderate: low strength.
Burleson:					
8	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell.
Caspiana:					
9	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength, shrink-swell.
Crockett:					
10	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, corrosive, low strength.	Severe: shrink-swell, low strength.
Deport:					
11, 12, [1]13	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.
Derly:					
14	Severe: wetness.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, corrosive, shrink-swell.	Severe: wetness, low strength, shrink-swell.
[1]15:					
Derly part	Severe: wetness.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, low strength, shrink-swell.	Severe: wetness, corrosive, shrink-swell.	Severe: wetness, low strength, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Derly:					
[1]15:					
Raino part	Severe: wetness, too clayey.	Moderate: shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness.	Severe: low strength.
Desha:					
16	Severe: wetness, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.
Elbon:					
17	Moderate: wetness, floods.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.
18	Severe: floods.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell, floods.
Ferris:					
19	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Freestone:					
[1]20:					
Freestone part	Severe: wetness, too clayey.	Moderate: shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness.	Severe: low strength, shrink-swell.
Hicota part	Moderate: wetness.	Moderate: low strength.	Moderate: wetness, low strength.	Moderate: low strength, wetness.	Moderate: low strength.
[1]21	Severe: wetness, too clayey.	Moderate: shrink-swell.	Severe: wetness, shrink-swell.	Moderate: wetness.	Severe: low strength, shrink-swell.
Guyton:					
22	Severe: floods, wetness, cutbanks cave.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Harjo:					
23	Severe: too clayey, wetness, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.
Heiden:					
24	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
[1]25:					
Heiden part	Severe: cutbanks cave, too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Ferris part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Houston Black: 26, 27	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
Karma: 28	Slight	Slight	Slight	Slight	Moderate: low strength.
Kaufman: 29	Severe: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: shrink-swell.
30	Severe: too clayey, wetness.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.
Lamar: 31	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.
Lassiter: 32	Severe: floods, wetness.	Severe: floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods.
Leson: 33	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell.
Mabank: [1]34: Mabank part	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.
Crockett part	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, corrosive, low strength.	Severe: shrink-swell, low strength.
Muldrow: 35	Severe: wetness, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: wetness, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.
Normangee: 36, 37	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell, corrosive.	Severe: shrink-swell, low strength.
Norwood: 38	Moderate: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: low strength.
Parisian: 39	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength, wetness.	Severe: shrink-swell, low strength.
Redlake: 40	Severe: floods, too clayey.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: floods, shrink-swell, low strength.	Severe: low strength, shrink-swell.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Roxton: 41	Severe: floods, wetness, too clayey.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.
Severn: 42, 43	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
144: Severn part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
Kiomatia part	Severe: floods, too sandy.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Stephen: 45	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
146: Stephen part	Severe: depth to rock.	Moderate: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.
Eddy part	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.
Trinity: 47	Severe: wetness, too clayey, cutbanks cave.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: wetness, shrink-swell, floods.	Severe: shrink-swell.
48	Severe: wetness, floods, too clayey.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell, wetness.	Severe: floods, shrink-swell.
Urban land: 49.					
Varro: 50	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Whakana: 51	Slight	Slight	Slight	Slight	Slight.
52	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: slope.
153: Whakana part	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: slope.
Porum part	Severe: too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: slope, low strength, shrink-swell.	Severe: low strength, shrink-swell.
Wilson: 54	Severe: wetness, too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.

See footnote at end of table.

TABLE 9.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
Woodtell: 55	Severe: wetness.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, wetness, low strength.	Severe: shrink-swell, low strength.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban components that are not rated.

TABLE 10.--SANITARY FACILITIES

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Ambia:					
1	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: wetness, too clayey.
Annona:					
2, [1]3	Severe: percs slowly, wetness.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey.
Austin:					
4	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: depth to rock, too clayey.	Slight	Poor: too clayey.
Belk:					
5	Moderate: floods.	Severe: floods.	Moderate: floods.	Moderate: floods.	Poor: too clayey.
Benklin:					
6	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Fair: too clayey.
Bernaldo:					
7	Moderate: wetness.	Moderate: seepage.	Severe: wetness.	Moderate: wetness.	Good.
Burleson:					
8	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Caspiana:					
9	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Crockett:					
10	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Deport:					
11, [1]13	Severe: percs slowly, wetness.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
12	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
Derly:					
14	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, thin layer.
[1]15:					
Derly part	Severe: percs slowly, wetness.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: wetness, thin layer.
Raino part	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey, wetness.	Severe: wetness.	Fair: thin layer.

See footnote at end of table.

TABLE 10.--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
Desha:					
16	Severe: percs slowly, wetness.	Severe: floods.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
Elbon:					
17	Severe: percs slowly, wetness.	Severe: wetness, floods.	Moderate: floods.	Severe: wetness, floods.	Fair: too clayey.
18	Severe: floods, percs slowly, wetness.	Severe: wetness, floods.	Severe: floods.	Severe: wetness, floods.	Fair: too clayey.
Ferris:					
19	Severe: percs slowly.	Severe: slope.	Severe: too clayey.	Moderate: slope.	Poor: too clayey.
Freestone:					
[1]20:					
Freestone part	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Severe: wetness.	Fair: thin layer.
Hicota part	Moderate: wetness, percs slowly.	Moderate: seepage.	Severe: wetness, too clayey.	Severe: wetness.	Good.
[1]21	Severe: percs slowly, wetness.	Severe: wetness.	Severe: too clayey.	Severe: wetness.	Fair: thin layer.
Guyton:					
22	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
Harjo:					
23	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: wetness, floods, too clayey.	Severe: wetness, floods.	Poor: too clayey, wetness.
Heiden:					
24	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
[1]25:					
Heiden part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Ferris part	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Houston Black:					
26	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
27	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Karma:					
28	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.

See footnote at end of table.

TABLE 10.--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
Kaufman:					
29	Severe: percs slowly.	Slight	Severe: too clayey, wetness.	Moderate: floods.	Poor: too clayey, wetness.
30	Severe: percs slowly, floods.	Slight	Severe: floods, too clayey, wetness.	Severe: floods.	Poor: too clayey, wetness.
Lamar:					
31	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Lassiter:					
32	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Good.
Leson:					
33	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Mabank:					
[1]34:					
Mabank part	Severe: percs slowly, wetness.	Slight	Severe: too clayey.	Severe: wetness.	Poor: too clayey.
Crockett part	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
Muldrow:					
35	Severe: percs slowly, wetness.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack.
Normangee:					
36, 37	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Norwood:					
38	Moderate: floods.	Moderate: seepage.	Moderate: floods.	Moderate: floods.	Good.
Parisian:					
39	Severe: percs slowly, wetness.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey.
Redlake:					
40	Severe: percs slowly, floods.	Severe: floods.	Severe: floods, too clayey.	Severe: floods.	Poor: hard to pack, too clayey.
Roxton:					
41	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
Severn:					
42, 43	Severe: floods.	Severe: seepage, floods.	Severe: seepage, floods.	Severe: seepage, floods.	Good.
[1]44:					
Severn part	Severe: floods.	Severe: seepage, floods.	Severe: seepage, floods.	Severe: seepage, floods.	Good.

See footnote at end of table.

TABLE 10.--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
Severn:					
[1]44:					
Kiomatia part	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: floods, seepage.	Fair: too sandy.
Stephen:					
45	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
[1]46:					
Stephen part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
Eddy part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Trinity:					
47	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, too clayey.	Severe: wetness, floods.	Poor: too clayey.
48	Severe: wetness, floods, percs slowly.	Severe: wetness, floods.	Severe: floods, too clayey, wetness.	Severe: floods, wetness.	Poor: too clayey.
Urban land:					
49.					
Varro:					
50	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
Whakana:					
51	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
52	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
[1]53:					
Whakana part	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Porum part	Severe: percs slowly.	Severe: wetness, slope.	Severe: too clayey.	Severe: wetness.	Poor: hard to pack, too clayey.
Wilson:					
54	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: wetness.	Poor: too clayey.
Woodtell:					
55	Severe: percs slowly, wetness.	Severe: slope.	Severe: too clayey.	Severe: wetness.	Poor: thin layer.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban components that are not rated.

TABLE 11.--CONSTRUCTION MATERIALS

["Shrink-swell" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," "poor," and "unsuited." Absence of an entry means soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Ambia:				
1	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
Annona:				
2, [1]3	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Austin:				
4	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Belk:				
5	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Benklin:				
6	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Bernaldo:				
7	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Burleson:				
8	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Caspiana:				
9	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Crockett:				
10	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Deport:				
11, 12, [1]13	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Derly:				
14	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, thin layer.
[1]15:				
Derly part	Poor: wetness, low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness, thin layer.
Raino part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Desha:				
16	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Elbon:				
17, 18	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Ferris:				
19	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Freestone:				
[1]20:				
Freestone part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Hicota part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
[1]21	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Guyton:				
22	Poor: wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: wetness.
Harjo:				
23	Poor: wetness, shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
Heiden:				
24	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
[1]25:				
Heiden part	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Ferris part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Houston Black:				
26, 27	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Karma:				
28	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Kaufman:				
29, 30	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Lamar:				
31	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Lassiter:				
32	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Leson:				
33	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Mabank:				
[1]34:				
Mabank part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Crockett part	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.
Muldrow:				
35	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Normangee:				
36, 37	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Norwood:				
38	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Parisian:				
39	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Redlake:				
40	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Roxton:				
41	Poor: low strength, shrink-swell, wetness.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, wetness.
Severn:				
42, 43	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
[1]44:				
Severn part	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Kiomatia part	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Stephen:				
45	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
[1]46:				
Stephen part	Poor: thin layer, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Stephen:				
[1]46:				
Eddy part	Fair: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
Trinity:				
47, 48	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey..
Urban land:				
49.				
Varro:				
50	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Whakana:				
51	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
52	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
[1]53:				
Whakana part	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer, slope.
Porum part	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Wilson:				
54	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Woodtell:				
55	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban land components that are not rated.

TABLE 12.--WATER MANAGEMENT

["Seepage" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry means soil was not evaluated]

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Ambia:						
1	Slight	Moderate: unstable fill, compressible.	Floods	Wetness, slow intake.	Not needed	Not needed.
Annona:						
2, [1]3	Slight	Moderate: unstable fill, compressible.	Percs slowly	Slow intake, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
Austin:						
4	Severe: depth to rock.	Moderate: compressible.	Not needed	Slow intake	Favorable	Favorable.
Belk:						
5	Moderate: seepage.	Moderate: piping.	Not needed	Slow intake	Not needed	Not needed.
Benklin:						
6	Moderate: seepage.	Moderate: compressible, seepage.	Not needed	Favorable	Not needed	Not needed.
Bernaldo:						
7	Moderate: seepage.	Moderate: piping.	Not needed	Complex slope	Complex slope	Favorable.
Burleson:						
8	Slight	Moderate: unstable fill, hard to pack.	Percs slowly	Slow intake	Percs slowly	Percs slowly.
Caspiana:						
9	Moderate: seepage.	Slight	Favorable	Favorable	Not needed	Favorable.
Crockett:						
10	Slight	Moderate: unstable fill, compressible.	Not needed	Percs slowly, rooting depth, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Deport:						
11, 12, [1]13	Slight	Moderate: unstable fill, compressible.	Percs slowly	Percs slowly, wetness, slow intake.	Slope, wetness, slow intake.	Percs slowly.
Derly:						
14	Slight	Moderate: low strength, compressible.	Wetness, percs slowly.	Wetness, slow intake.	Not needed	Not needed.
[1]15:						
Derly part	Slight	Moderate: low strength, compressible.	Wetness, percs slowly.	Wetness, slow intake.	Not needed	Not needed.
Raino part	Slight	Moderate: unstable fill.	Percs slowly, complex slope.	Percs slowly, complex slope.	Percs slowly, complex slope.	Not needed.
Desha:						
16	Slight	Severe: unstable fill, compressible, low strength.	Percs slowly, wetness.	Slow intake	Wetness, percs slowly.	Wetness, percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Elbon:						
17, 18	Slight	Moderate: compressible, unstable fill.	Floods, percs slowly.	Floods, slow intake.	Not needed	Not needed.
Ferris:						
19	Slight	Moderate: unstable fill.	Not needed	Percs slowly, slow intake.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Freestone:						
[1]20:						
Freestone part	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
Hicota part	Moderate: seepage.	Moderate: compressible, unstable fill.	Not needed	Favorable	Not needed	Not needed.
[1]21	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly	Percs slowly	Percs slowly.
Guyton:						
22	Slight	Moderate: erodes easily, low strength, compressible.	Cutbanks cave, floods, percs slowly.	Percs slowly	Not needed	Wetness.
Harjo:						
23	Slight	Moderate: compressible, unstable fill.	Floods, wetness, percs slowly.	Floods, wetness, slow intake.	Wetness	Wetness.
Heiden:						
24	Slight	Moderate: unstable fill, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.
[1]25:						
Heiden part	Slight	Moderate: unstable fill, shrink-swell.	Not needed	Slow intake	Percs slowly	Percs slowly.
Ferris part	Slight	Moderate: unstable fill.	Not needed	Percs slowly, slow intake.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Houston Black:						
26, 27	Slight	Moderate: compressible, unstable fill.	Percs slowly	Slow intake	Percs slowly	Percs slowly.
Karma:						
28	Severe: seepage.	Moderate: unstable fill, compressible, piping.	Not needed	Erodes easily	Erodes easily, slope.	Erodes easily, slope.
Kaufman:						
29, 30	Slight	Moderate: low strength.	Floods, percs slowly, wetness.	Slow intake	Percs slowly	Percs slowly.
Lamar:						
31	Moderate: seepage.	Moderate: piping, unstable fill.	Not needed	Favorable	Favorable	Favorable.
Lassiter:						
32	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Floods	Wetness	Not needed	Not needed.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Leson: 33	Slight	Moderate: unstable fill, hard to pack.	Percs slowly	Slow intake	Percs slowly	Percs slowly.
Mabank: [1]34: Mabank part	Slight	Moderate: unstable fill.	Percs slowly	Slow intake, percs slowly.	Percs slowly	Percs slowly.
Crockett part	Slight	Moderate: unstable fill, compressible.	Not needed	Percs slowly, rooting depth, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Muldrow: 35	Slight	Severe: compressible, shrink-swell.	Percs slowly, floods.	Percs slowly, floods, wetness.	Percs slowly, wetness.	Percs slowly, wetness.
Normangee: 36, 37	Slight	Moderate: unstable fill.	Not needed	Percs slowly, slow intake, erodes easily.	Slow intake, erodes easily, percs slowly.	Percs slowly, erodes easily.
Norwood: 38	Moderate: seepage.	Moderate: erodes easily.	Not needed	Favorable	Favorable	Favorable.
Parisian: 39	Slight	Moderate: unstable fill, compressible.	Not needed	Slow intake	Favorable	Favorable.
Redlake: 40	Slight	Moderate: unstable fill, compressible.	Floods, percs slowly.	Slow intake, floods.	Percs slowly	Percs slowly.
Roxton: 41	Slight	Moderate: unstable fill, compressible.	Floods	Wetness, slow intake, floods.	Not needed	Not needed.
Severn: 42, 43	Severe: seepage.	Moderate: unstable fill, piping, compressible.	Not needed	Fast intake	Favorable	Favorable.
[1]44: Severn part	Severe: seepage.	Moderate: unstable fill, piping, compressible.	Not needed	Fast intake	Favorable	Favorable.
Kiomatia part	Severe: seepage.	Severe: piping.	Floods, cutbanks cave.	Floods, fast intake.	Too sandy	Floods.
Stephen: 45	Severe: depth to rock.	Severe: thin layer.	Not needed	Droughty, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
[1]46: Stephen part	Severe: depth to rock.	Severe: thin layer.	Not needed	Droughty, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Eddy part	Severe: depth to rock.	Severe: thin layer.	Not needed	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for--		Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Drainage	Irrigation	Terraces and diversions	Grassed waterways
Trinity:						
47	Slight	Moderate: compressible, unstable fill.	Percs slowly	Percs slowly, wetness.	Wetness	Wetness, percs slowly.
48	Slight	Moderate: compressible, unstable fill.	Percs slowly, floods.	Percs slowly, floods, wetness.	Floods, wetness, percs slowly.	Floods, wetness, percs slowly.
Urban land:						
49.						
Varro:						
50	Moderate: seepage.	Moderate: compressible.	Not needed	Floods	Floods	Favorable.
Whakana:						
51, 52	Moderate: seepage.	Moderate: piping.	Not needed	Complex slope	Favorable	Favorable.
[1]53:						
Whakana part	Moderate: seepage.	Moderate: piping.	Not needed	Complex slope	Favorable	Favorable.
Porum part	Slight	Moderate: unstable fill.	Not needed	Percs slowly, slope.	Percs slowly, slope.	Percs slowly, slope.
Wilson:						
54	Slight	Moderate: unstable fill.	Percs slowly	Percs slowly, slow intake.	Percs slowly	Percs slowly.
Woodtell:						
55	Slight	Moderate: unstable fill, compressible.	Percs slowly	Slow intake	Complex slope	Percs slowly.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban land components that are not rated.

TABLE 13.--RECREATIONAL DEVELOPMENT

["Percs slowly" and some of the other terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Ambia:				
1	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.	Severe: floods, wetness, too clayey.
Annona:				
2, [1]3	Severe: percs slowly.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
Austin:				
4	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Belk:				
5	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Benklin:				
6	Moderate: wetness, percs slowly.	Slight	Moderate: wetness, percs slowly.	Slight.
Bernaldo:				
7	Slight	Slight	Moderate: slope.	Slight.
Burleson:				
8	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Caspiana:				
9	Slight	Slight	Slight	Slight.
Crockett:				
10	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Deport:				
11, 12, [1]13	Severe: too clayey, wetness.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
Derly:				
14	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
[1]15:				
Derly part	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, percs slowly.	Severe: wetness.
Raino part	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.
Desha:				
16	Severe: wetness, percs slowly, too clayey.	Severe: too clayey	Severe: wetness, percs slowly, too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Elbon:				
17, 18	Severe: floods, too clayey.	Moderate: floods, too clayey.	Severe: floods, too clayey.	Moderate: floods, too clayey.
Ferris:				
19	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly, slope.	Severe: too clayey.
Freestone:				
[1]20:				
Freestone part	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.
Hicota part	Slight	Slight	Slight	Slight.
[1]21	Moderate: percs slowly, wetness.	Moderate: wetness.	Moderate: percs slowly, wetness.	Slight.
Guyton:				
22	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
Harjo:				
23	Severe: too clayey, wetness, floods.	Severe: floods, too clayey, wetness.	Severe: wetness, floods, percs slowly.	Severe: wetness, floods, too clayey.
Heiden:				
24	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
[1]25:				
Heiden part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Ferris part	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Houston Black:				
26, 27	Severe: percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Karma:				
28	Slight	Slight	Slight	Slight.
Kaufman:				
29	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
30	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: floods, too clayey.	Severe: too clayey.
Lamar:				
31	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Lassiter:				
32	Severe: floods.	Moderate: floods, wetness.	Severe: floods.	Moderate: floods.
Leson:				
33	Severe: too clayey, percs slowly.	Severe: too clayey.	Severe: too clayey, percs slowly.	Severe: too clayey.
Mabank:				
1 34:				
Mabank part	Severe: wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
Crockett part	Severe: percs slowly.	Slight	Severe: percs slowly.	Slight.
Muldrow:				
35	Severe: percs slowly, floods.	Moderate: wetness, too clayey, floods.	Severe: percs slowly.	Moderate: too clayey, wetness.
Normangee:				
36, 37	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
Norwood:				
38	Slight	Slight	Slight	Slight.
Parisian:				
39	Severe: percs slowly, wetness.	Slight	Severe: slope, percs slowly, wetness.	Slight.
Redlake:				
40	Severe: floods, percs slowly, too clayey.	Severe: too clayey.	Severe: percs slowly, too clayey.	Severe: too clayey.
Roxton:				
41	Severe: wetness, floods, percs slowly.	Severe: wetness, floods, too clayey.	Severe: wetness, floods, percs slowly.	Severe: wetness, floods, too clayey.
Severn:				
42, 43	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
1 44:				
Severn part	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Kiomatia part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, too sandy.
Stephen:				
45	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.
1 46:				
Stephen part	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.

See footnote at end of table.

TABLE 13.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Stephen:				
[1]46:				
Eddy part	Moderate: percs slowly, small stones.	Moderate: small stones.	Severe: depth to rock.	Moderate: small stones, too clayey.
Trinity:				
47	Severe: wetness, percs slowly.	Severe: too clayey.	Severe: wetness, too clayey.	Severe: too clayey.
48	Severe: wetness, floods, percs slowly.	Severe: floods, too clayey.	Severe: wetness, floods, percs slowly.	Severe: floods, too clayey.
Urban land:				
49.				
Varro:				
50	Severe: floods.	Moderate: floods.	Severe: floods.	Moderate: floods.
Whakana:				
51	Slight	Slight	Moderate: slope.	Slight.
52	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
[1]53:				
Whakana part	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Porum part	Severe: percs slowly.	Moderate: slope.	Severe: percs slowly, slope.	Slight.
Wilson:				
54	Severe: percs slowly, wetness.	Moderate: wetness.	Severe: percs slowly, wetness.	Moderate: wetness.
Woodtell:				
55	Severe: percs slowly.	Moderate: slope.	Severe: percs slowly.	Slight.

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban land components that are not rated.

TABLE 14.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates the soil was not rated]

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Ambia:												
1	Fair	Fair	Fair	Good	Good	---	Good	Good	Fair	Fair	Good	---
Annona:												
2, [1]3	Fair	Good	Good	Good	Good	---	Fair	Poor	Good	Good	Poor	---
Austin:												
4	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Belk:												
5	Fair	Fair	Good	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
Benklin:												
6	Good	Good	Good	Good	---	---	Poor	Poor	Good	Good	Poor	---
Bernaldo:												
7	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Burleson:												
8	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Caspiana:												
9	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
Crockett:												
10	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
Deport:												
11	Fair	Fair	Poor	---	---	Fair	Poor	Fair	Fair	---	Poor	Poor.
12, [1]13	Fair	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Very poor.	Poor.
Derly:												
14	Fair	Fair	Good	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
[1]15:												
Derly part	Fair	Fair	Good	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
Raino part	Fair	Good	Good	Good	Good	---	Fair	Fair	Good	Good	Fair	---
Desha:												
16	Good	Good	Good	Good	Poor	---	Good	Good	Good	Good	Good	---
Elbon:												
17	Fair	Fair	Fair	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
18	Poor	Fair	Fair	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
Ferris:												
19	Poor	Fair	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Freestone:												
[1]20:												
Freestone part	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---
Hicota part	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
[1]21	Good	Good	Good	Good	Good	---	Poor	Poor	Good	Good	Poor	---

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Guyton:												
22	Poor	Fair	Fair	Fair	Fair	---	Good	Good	Poor	Fair	Good	---
Harjo:												
23	Poor	Fair	Fair	Fair	Fair	---	Poor	Good	Fair	Fair	Fair	---
Heiden:												
24	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
[1]25:												
Heiden part	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Ferris part	Fair	Good	Fair	---	---	Fair	Very poor.	Very poor.	Fair	---	Very poor.	Fair.
Houston Black:												
26, 27	Good	Good	Poor	---	---	Fair	Poor	Poor	Fair	---	Poor	Fair.
Karma:												
28	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Kaufman:												
29	Good	Good	Fair	Good	Good	Fair	Poor	Good	Fair	Good	Fair	---
30	Poor	Poor	Fair	Good	Good	Fair	Poor	Good	Poor	Good	Fair	---
Lamar:												
31	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Lassiter:												
32	Poor	Fair	Fair	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
Leson:												
33	Good	Good	Poor	---	---	Poor	Very poor.	Very poor.	Fair	---	Very poor.	Poor.
Mabank:												
[1]34:												
Mabank part	Fair	Good	Good	Good	---	Fair	Fair	Fair	Good	---	Fair	Fair.
Crockett part	Fair	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
Muldrow:												
35	Fair	Good	Fair	Good	Good	---	Fair	Good	Fair	Good	Fair	---
Normangee:												
36, 37	Fair	Good	Fair	---	---	Good	Poor	Poor	Fair	---	Poor	Fair.
Norwood:												
38	Good	Good	Fair	Good	Good	Fair	Poor	Very poor.	Good	Good	Very poor.	---
Parisian:												
39	Good	Good	Good	Good	---	Good	Poor	Poor	Good	---	Poor	Good.
Redlake:												
40	Fair	Fair	Fair	Good	Good	---	Poor	Poor	Fair	Good	Poor	---
Roxton:												
41	Poor	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
Severn:												
42, 43	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---

See footnote at end of table.

TABLE 14.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements								Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Coniferous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
Severn:												
[1]44:												
Severn part	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
Kiomatia part	Poor	Fair	Fair	Fair	Fair	---	Poor	Very poor.	Fair	Fair	Very poor.	---
Stephen:												
45	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
[1]46:												
Stephen part	Fair	Good	Fair	---	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Eddy part	Poor	Poor	Poor	---	---	Fair	Very poor.	Very poor.	Poor	---	Very poor.	Poor.
Trinity:												
47	Fair	Good	Fair	Good	Good	---	Poor	Fair	Fair	Good	Poor	---
48	Poor	Fair	Fair	Good	Good	---	Poor	Fair	Fair	Fair	Poor	---
Urban land:												
49.												
Varro:												
50	Very poor.	Poor	Fair	Good	Good	---	Poor	Very poor.	Poor	Good	Very poor.	---
Whakana:												
51	Good	Good	Good	Good	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
52	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
[1]53:												
Whakana part	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
Porum part	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---
Wilson:												
54	Fair	Fair	Good	---	---	Fair	Fair	Fair	Fair	---	Fair	Fair.
Woodtell:												
55	Fair	Good	Good	Good	Good	---	Very poor.	Very poor.	Good	Good	Very poor.	---

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban components that are not rated.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of any entry means data were not estimated. NP means nonplastic]

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Ambia:											
1	0-16	Clay loam	CL, CH	A-7-6	0	100	100	90-100	70-95	46-66	25-41
	16-80	Clay, silty clay	CH	A-7-6	0	100	100	90-100	75-95	56-76	33-49
Annona:											
2, 13	0-9	Loam	SM, ML, SM-SC, CL-ML	A-4	0	95-100	95-100	75-95	45-70	<30	NP-7
	9-42	Clay, clay loam	CH	A-7	0	95-100	95-100	90-100	75-95	51-70	30-45
	42-75	Clay, clay loam	CH, CL	A-7	0	95-100	95-100	90-100	75-95	41-55	25-35
Austin:											
4	0-12	Silty clay	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-95	45-65	25-40
	12-27	Silty clay, clay, silty clay loam.	CH, CL	A-7-6	0-5	95-100	90-100	80-100	75-95	45-65	22-38
	27-44	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Belk:											
5	0-26	Clay	CL, CH	A-7-6	0	100	100	95-100	85-95	44-66	22-39
	26-73	Stratified silt loam to very fine sandy loam.	ML, CL-ML, CL	A-4	0	100	100	90-100	70-90	<26	NP-8
Benklin:											
6	0-6	Silt loam	CL, CL-ML	A-4, A-6	0	100	100	85-100	60-90	23-35	6-15
	6-63	Loam, silty clay loam, clay loam.	CL	A-6, A-7-6	0	100	100	85-100	60-95	30-44	11-22
Bernaldo:											
7	0-16	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	100	95-100	90-100	45-65	<25	NP-5
	16-32	Loam, sandy clay loam, clay loam.	CL	A-6	0	100	100	90-100	51-75	28-45	12-24
	32-65	Fine sandy loam, loam, sandy clay loam.	CL, SC	A-4, A-6	0	100	95-100	90-100	45-65	25-45	8-24
Burleson:											
8	0-22	Clay	CH, MH	A-7-6, A-7-5	0-2	83-100	80-100	80-100	80-95	51-80	27-55
	22-80	Clay, silty clay	CH, MH	A-7-6, A-7-5	0-1	95-100	80-100	75-95	70-95	51-80	30-55
Caspiana:											
9	0-10	Silt loam	CL-ML, ML	A-4	0	100	100	100	85-100	<27	NP-7
	10-48	Silty clay loam, silt loam.	CL	A-6, A-7-6	0	100	100	100	85-100	32-43	11-20
	48-80	Silt loam, very fine sandy loam, silty clay loam.	CL-ML, CL	A-4, A-6	0	100	100	100	80-100	23-37	4-15
Crockett:											
10	0-8	Loam	SM, ML, CL, SC	A-2, A-4, A-6	0-2	95-100	95-100	90-100	35-95	15-35	3-15
	8-51	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	65-91	36-60	22-40
	51-73	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-45	11-30

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Deport:											
11, 12, [1]13	0-70	Clay	CH	A-7-6	0	95-100	95-100	95-100	85-99	51-75	30-50
Derly:											
[1]4	0-8	Silt loam	ML, CL, CL-ML	A-4	0	100	100	85-100	55-90	<25	NP-8
	8-12	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	100	90-100	70-95	44-60	23-36
	12-50	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	56-70	33-44
	50-80	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	56-70	33-44
[1]15:											
Derly part	0-8	Silt loam	ML, CL, CL-ML	A-4	0	100	100	85-100	55-90	<25	NP-8
	8-12	Clay loam, clay, silty clay.	CL, CH	A-7	0	100	100	90-100	70-95	44-60	23-36
	12-50	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	56-70	33-44
	50-80	Clay, silty clay	CH	A-7	0	100	100	90-100	75-95	56-70	33-44
Raino part	0-4	Fine sandy loam	ML, CL, SM, SC	A-4	0	95-100	95-100	80-100	40-80	<30	NP-10
	4-36	Loam, sandy clay loam, clay loam.	ML, CL, SC, SM	A-6, A-4	0	95-100	95-100	80-100	40-70	20-40	5-20
	36-63	Clay, sandy clay, silty clay.	CH, CL	A-7	0	95-100	95-100	80-100	55-90	46-74	24-45
Desha:											
16	0-7	Clay	CH	A-7	0	100	100	95-100	95-100	55-80	35-60
	7-70	Silty clay, clay	CH	A-7	0	100	100	95-100	95-100	60-85	40-65
Elbon:											
17, 18	0-21	Silty clay loam	CL, CH	A-7, A-6	0	100	100	95-100	85-100	35-55	15-30
	21-80	Stratified silty clay loam to clay.	CL, CH	A-7, A-6	0	100	100	85-98	80-95	35-55	18-35
Ferris:											
19	0-43	Clay	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
	43-55	Variable.	---	---	---	---	---	---	---	---	---
Freestone:											
[1]20:											
Freestone part	0-16	Fine sandy loam	SM, SC, CL, ML	A-4	0	95-100	95-100	90-100	36-60	20-30	2-10
	16-33	Sandy clay loam, loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	55-85	30-46	12-23
	33-80	Clay, clay loam	CL, CH	A-7	0	95-100	95-100	90-100	65-95	42-70	21-44
Hicota part	0-32	Very fine sandy loam.	ML, CL-ML, SM-SC, SM	A-4	0	100	100	70-95	40-75	<23	NP-6
	32-54	Loam, clay loam, very fine sandy loam.	CL, CL-ML, SC, SM-SC	A-4, A-6	0	100	100	80-100	40-80	23-40	6-20
	54-80	Clay loam, sandy clay loam, clay.	CH, CL, SC	A-7-6	0	100	100	85-100	45-95	41-55	21-38

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Freestone:											
[1]21	0-16	Fine sandy loam	SM, SC, CL, ML	A-4	0	95-100	95-100	90-100	36-60	20-30	2-10
	16-33	Sandy clay loam, loam, clay loam.	CL	A-6, A-7	0	95-100	95-100	90-100	55-85	30-46	12-23
	33-80	Clay, clay loam	CL, CH	A-7	0	95-100	95-100	90-100	65-95	42-70	21-44
Guyton:											
22	0-16	Silt loam	ML, CL-ML	A-4	0	100	100	95-100	65-90	<27	NP-7
	16-36	Silt loam, silty clay loam, clay loam.	CL, CL-ML	A-6, A-4	0	100	100	95-100	75-95	26-40	6-18
	36-72	Silt loam, silty clay loam, clay loam.	CL, CL-ML, ML	A-6, A-4	0	100	100	95-100	65-95	<40	NP-18
Harjo:											
23	0-13	Clay	CH, CL	A-7	0	98-100	98-100	90-100	75-90	45-60	22-35
	13-80	Stratified clay to clay loam.	CH, CL	A-7	0	98-100	98-100	90-100	75-90	45-60	22-35
Heiden:											
24	0-62	Clay	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	62-80	Variable.	---	---	---	---	---	---	---	---	---
[1]25:											
Heiden part	0-62	Clay	CH	A-7-6	0	95-100	90-100	80-100	75-99	54-80	35-55
	62-80	Variable.	---	---	---	---	---	---	---	---	---
Ferris part	0-43	Clay	CH	A-7-6	0	95-100	95-100	75-100	75-98	51-70	35-50
	43-55	Variable.	---	---	---	---	---	---	---	---	---
Houston Black:											
26, 27	0-77	Clay	CH	A-7-6	0	95-100	95-100	95-100	85-100	58-90	34-65
	77-80	Stratified shaly clay.	CH	A-7-6	0	98-100	90-100	90-100	90-100	65-100	40-75
Karma:											
28	0-12	Fine sandy loam	ML, CL, SM, SC	A-4	0	100	98-100	94-100	36-85	<31	NP-10
	12-46	Sandy clay loam, clay loam.	CL, SC	A-4, A-6	0	100	100	90-100	36-90	25-40	7-18
	46-73	Fine sandy loam, loam, sandy clay loam.	ML, CL, SM, SC	A-4, A-6	0	100	98-100	90-100	36-85	<37	NP-16
Kaufman:											
29, 30	0-6	Clay	CH	A-7	0	100	100	90-100	80-95	56-75	33-49
	6-80	Clay	CH	A-7	0	100	100	95-100	90-100	76-96	49-70
Lamar:											
31	0-6	Clay loam	CL, CL-ML	A-6, A-4	0	95-100	95-100	85-100	60-80	20-40	5-18
	6-65	Clay loam, loam, silty clay loam.	CL, CL-ML	A-6, A-4	0	95-100	95-100	85-100	60-80	20-40	5-18
Lassiter:											
32	0-42	Silt loam	CL	A-4, A-6	0	100	100	85-100	60-95	28-39	9-18
	42-72	Loam, clay loam, silty clay loam.	CL	A-4, A-7-6, A-6	0	100	100	90-100	70-95	28-44	9-22
Leson:											
33	0-66	Clay	CH	A-7-6	0	98-100	90-100	90-100	90-100	60-90	35-60
	66-75	Stratified shaly clay.	CH	A-7-6	0	98-100	90-100	90-100	90-100	65-100	40-75

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Mabank:											
[1]34:											
Mabank part-----	0-8	Silt loam-------	CL, ML, SM, SC	A-4	0	95-100	95-100	80-98	40-70	<30	NP-10
	8-72	Clay, clay loam	CH, CL	A-7, A-6	0	95-100	95-100	95-100	60-85	35-65	20-40
Crockett part---	0-8	Silt loam-------	SM, ML, CL, SC	A-2, A-4, A-6	0-2	95-100	95-100	90-100	35-95	15-35	3-15
	8-63	Clay, clay loam, sandy clay.	CH, CL	A-7, A-6	0	85-100	80-100	75-100	65-91	36-60	22-40
	63-73	Clay loam, sandy clay loam, loam.	CL	A-6, A-7	0-5	90-100	85-100	75-100	51-90	30-45	11-30
Muldrow:											
35----------	0-16	Clay loam-------	CL	A-6, A-7-6	0	100	100	96-100	80-98	33-43	12-20
	16-80	Silty clay loam, silty clay, clay.	CL, CH, ML, MH	A-6, A-7	0	100	100	96-100	80-98	37-70	15-40
Normangee:											
36, 37----------	0-7	Clay loam-------	CL	A-6, A-7	0	98-100	96-100	90-100	55-85	30-48	11-25
	7-57	Clay------------	CL, CH	A-7	0	98-100	98-100	90-100	70-96	44-80	22-58
	57-65	Stratified shaly clay.	CL, CH	A-7	0	95-100	90-100	90-100	70-90	41-60	20-35
Norwood:											
38----------	0-8	Silt loam-------	CL, CL-ML	A-4, A-6	0	100	100	95-100	70-90	20-35	4-15
	8-65	Silt loam, silty clay loam, loam.	CL	A-6, A-7	0	100	100	90-100	70-98	30-46	11-26
Parisian:											
39----------	0-11	Silt loam-------	CL	A-4, A-6	0	100	98-100	85-100	60-90	24-42	8-22
	11-17	Clay loam, silty clay loam, clay.	CL, CH	A-7-6	0	100	98-100	90-100	70-95	42-70	22-44
	17-80	Clay, silty clay loam, clay loam.	CH	A-7-6	0	100	98-100	90-100	75-95	51-74	29-47
Redlake:											
40----------	0-45	Clay------------	CL, CH, ML, MH	A-7	0	100	100	98-100	90-99	41-70	18-38
	45-72	Clay loam-------	CL	A-6, A-7	0	100	100	96-100	80-90	37-50	16-26
Roxton:											
41----------	0-18	Clay------------	CH	A-7-6	0	100	100	90-100	70-95	51-71	29-45
	18-43	Clay, silty clay, clay loam.	CH	A-7-6	0	100	100	90-100	70-95	51-71	29-45
	43-64	Clay, silty clay, clay loam.	CH	A-7-6	0	100	100	90-100	70-95	51-71	29-45
Severn:											
42----------	0-4	Very fine sandy loam.	ML, CL-ML, CL	A-4, A-6	0	100	100	94-100	65-97	22-31	3-12
	4-63	Stratified silt loam to loamy very fine sand.	ML, CL-ML	A-4	0	100	100	94-100	65-97	<28	NP-7

See footnote at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Severn:											
43	0-8	Silty clay loam	CL	A-7, A-6	0	100	100	98-100	90-98	33-42	12-19
	8-65	Stratified silt loam to loamy very fine sand.	ML, CL-ML	A-4	0	100	100	94-100	65-97	<28	NP-7
144:											
Severn part	0-4	Silt loam	ML, CL-ML, CL	A-4, A-6	0	100	100	94-100	65-97	22-31	3-12
	4-63	Stratified silt loam to loamy very fine sand.	ML, CL-ML	A-4	0	100	100	94-100	65-97	<28	NP-7
Kiomatia part	0-4	Loamy fine sand	SM, SM-SC	A-4, A-2-4	0	100	95-100	80-100	30-45	18-26	1-4
	4-60	Stratified fine sand to loam.	SM, SM-SC	A-2-4	0	100	95-100	80-90	13-35	<22	NP-5
Stephen:											
45	0-7	Silty clay	CL, CH	A-7-6	0-5	95-100	90-100	85-100	80-90	45-66	22-42
	7-13	Variable	---	---	---	---	---	---	---	---	---
	13-28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
146:											
Stephen part	0-7	Silty clay	CL, CH	A-7-6	0-5	95-100	90-100	85-100	80-90	45-66	22-42
	7-13	Variable	---	---	---	---	---	---	---	---	---
	13-28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Eddy part	0-6	Gravelly clay loam.	GC	A-2, A-6	0-20	40-50	35-50	30-45	20-40	30-40	11-20
	6-10	Gravelly clay loam, very gravelly loam, very gravelly clay loam.	GC, GP-GC	A-2	0-60	20-50	15-45	10-38	8-35	30-40	11-20
	10-28	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Trinity:											
47, 48	0-72	Clay	CH	A-7	0	100	98-100	85-100	80-99	55-90	30-60
Urban land:											
49.											
Varro:											
50	0-60	Clay loam	CL	A-4, A-6	0	100	100	85-100	65-85	30-40	10-20
Whakana:											
51, 52	0-15	Fine sandy loam	CL-ML, SM, SC, SM-SC	A-4	0	100	100	75-90	36-70	<25	NP-10
	15-42	Loam, sandy clay loam, clay loam.	CL	A-4, A-6	0	100	100	90-100	70-80	25-40	8-20
	42-80	Loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	100	100	85-95	60-75	21-38	6-16
153:											
Whakana part	0-15	Fine sandy loam	CL-ML, SM, SC, SM-SC	A-4	0	100	100	75-90	36-70	<25	NP-10
	15-42	Loam, sandy clay loam, clay loam.	CL	A-4, A-6	0	100	100	90-100	70-80	25-40	8-20
	42-80	Loam, sandy clay loam.	CL-ML, CL	A-4, A-6	0	100	100	85-95	60-75	21-38	6-16

See footnotes at end of table.

TABLE 15.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
Whakana:											
[1]53:											
Porum part------	0-7	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	98-100	94-100	36-85	<30	NP-10
	7-31	Clay loam, silty clay loam, silty clay.	CL, CH	A-6, A-7	0	100	100	96-100	80-99	37-70	15-38
	31-65	Silty clay loam, clay loam, sandy clay loam.	CL	A-6, A-7	0	100	100	90-100	51-98	25-50	11-26
Wilson:											
54----------	0-6	Silt loam-------	CL, CL-ML	A-4, A-6	0	95-100	85-100	80-100	60-96	24-36	7-18
	6-39	Silty clay, clay, clay loam.	CL, CH	A-7-6, A-6	0	90-100	80-100	80-100	65-96	40-55	21-35
	39-80	Silty clay, clay	CL, CH	A-7-6, A-6	0	95-100	90-100	85-100	70-90	40-57	24-35
Woodtell:											
55----------	0-4	Loam----------	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	90-100	85-100	75-95	30-60	<25	NP-7
	4-26	Clay, silty clay	CH, CL	A-7-6	0	100	90-100	80-100	60-90	45-60	25-40
	26-51	Clay loam, clay, sandy clay loam.	CL, SC, CH	A-6, A-7-6	0	100	80-100	75-90	36-85	35-55	15-35
	51-63	Stratified sandy clay, sandy loam, shaly clay.	CL, CH, SC	A-6, A-7-6	0	95-100	80-100	75-95	36-90	25-55	16-35

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban land components that are not rated.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[Dashes indicate data were not available. The symbol < means less than; > means greater than. The erosion tolerance factor (T) is for the entire profile. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm						
Ambia:											
1	0-16	0.06-0.2	0.12-0.22	4.5-7.3	<2	Very high	High	High	0.32	5	---
	16-80	<0.06	0.12-0.18	4.5-7.3	<2	Very high	High	Moderate	0.32		
Annona:											
2, [1]3	0-9	0.6-2.0	0.13-0.18	4.5-6.5	<2	Low	Moderate	Moderate	0.43	5	---
	9-42	<0.06	0.12-0.18	4.5-6.0	<2	High	High	Moderate	0.32		
	42-75	<0.06	0.12-0.18	5.6-8.4	<2	High	High	Low	0.28		
Austin:											
4	0-12	0.2-0.6	0.15-0.20	7.9-8.4	<2	High	High	Low	0.32	2	---
	12-27	0.2-0.6	0.15-0.20	7.9-8.4	<2	Moderate	High	Low	0.32		
	27-44	---	---	---	---	---	---	---	---		
Belk:											
5	0-26	<0.06	0.12-0.18	7.9-8.4	<2	High	High	Low	0.32	5	---
	26-73	0.6-2.0	0.16-0.24	7.9-8.4	<2	Low	Moderate	Low	0.28		
Benklin:											
6	0-6	0.6-2.0	0.15-0.24	5.6-7.3	<2	Moderate	Low	Low	0.28	5	---
	6-63	0.2-0.6	0.15-0.24	6.1-8.4	<2	Moderate	Moderate	Low	0.32		
Bernaldo:											
7	0-16	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	Low	Moderate	0.43	5	---
	16-32	0.6-2.0	0.15-0.20	4.5-6.5	<2	Moderate	Moderate	Moderate	0.32		
	32-65	0.6-2.0	0.15-0.20	4.5-6.5	<2	Low	Moderate	Moderate	0.32		
Burleson:											
8	0-22	<0.06	0.12-0.18	5.6-8.4	<2	High	High	Low	---	4	---
	22-80	<0.06	0.12-0.18	7.4-8.4	<2	High	High	Low	---		
Caspiana:											
9	0-10	0.6-2.0	0.21-0.23	5.6-8.4	<2	Low	Low	Low	0.37	5	---
	10-48	0.6-2.0	0.20-0.22	5.6-8.4	<2	Moderate	Moderate	Low	0.32		
	48-80	0.6-2.0	0.15-0.23	6.1-8.4	<2	Low	Moderate	Low	0.32		
Crockett:											
10	0-8	0.6-2.0	0.11-0.20	5.6-7.3	<2	Low	Moderate	Low	0.43	5	---
	8-51	<0.06	0.14-0.18	5.6-7.8	<2	High	High	Low	0.32		
	51-73	0.06-0.2	0.15-0.20	7.4-8.4	<2	Moderate	High	Low	0.32		
Deport:											
11, 12, [1]13	0-70	<0.06	0.12-0.18	5.6-8.4	<2	High	High	Low	0.37	4	---
Derly:											
14	0-8	0.6-2.0	0.13-0.24	4.5-6.0	<2	Low	High	High	0.37	5	---
	8-12	0.06-0.2	0.15-0.22	4.5-5.5	<2	Very high	High	High	0.37		
	12-50	<0.06	0.12-0.18	4.5-6.0	<2	Very high	High	High	0.32		
	50-80	<0.06	0.12-0.18	5.6-7.3	<2	Very high	High	Moderate	0.32		
[1]15:											
Derly part	0-8	0.6-2.0	0.13-0.24	4.5-6.0	<2	Low	High	High	0.37	5	---
	8-12	0.06-0.2	0.15-0.22	4.5-5.5	<2	Very high	High	High	0.37		
	12-50	<0.06	0.12-0.18	4.5-6.0	<2	Very high	High	High	0.32		
	50-80	<0.06	0.12-0.18	5.6-7.3	<2	Very high	High	Moderate	0.32		
Raino part	0-45	0.6-2.0	0.11-0.20	4.5-6.5	<2	Low	Moderate	Moderate	0.32	5	---
	45-36	0.6-2.0	0.15-0.20	4.5-5.5	<2	Moderate	High	Moderate	0.43		
	36-63	<0.06	0.12-0.18	4.5-6.5	<2	High	High	Moderate	0.43		
Desha:											
16	0-7	<0.2	0.12-0.18	6.1-7.8	<2	High	High	Low	---	---	---
	7-70	<0.06	0.12-0.18	6.1-7.8	<2	High	High	Low	---		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm						
Elbon:											
17, 18	0-21	0.2-0.6	0.14-0.20	7.4-8.4	<2	High	High	Low	0.32	5	---
	21-80	0.2-0.6	0.12-0.18	7.4-8.4	<2	High	High	Low	0.32		
Ferris:											
19	0-43	<0.06	0.15-0.18	7.9-8.4	<2	Very high	High	Low	0.32	4	---
	43-55	---	---	---	---	---	---	---	---		
Freestone:											
[1]20:											
Freestone part	0-16	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low	Moderate	Low	0.32	5	---
	16-33	0.2-0.6	0.12-0.17	4.5-6.5	<2	Moderate	High	Moderate	0.43		
	33-80	0.06-0.2	0.12-0.18	4.5-6.5	<2	High	High	Moderate	0.43		
Hicota part	0-32	0.2-6.0	0.11-0.20	5.1-6.5	<2	Low	Low	Moderate	0.37	5	---
	32-54	0.6-2.0	0.12-0.20	4.5-6.0	<2	Moderate	Moderate	High	0.32		
	54-80	0.06-0.2	0.12-0.20	4.5-6.0	<2	High	High	High	0.32		
[1]21	0-16	2.0-6.0	0.11-0.15	5.1-7.3	<2	Low	Moderate	Low	0.32	5	---
	16-33	0.2-0.6	0.12-0.17	4.5-6.5	<2	Moderate	High	Moderate	0.43		
	33-80	0.06-0.2	0.12-0.18	4.5-6.5	<2	High	High	Moderate	0.43		
Guyton:											
22	0-16	0.6-2.0	0.20-0.23	4.5-6.0	<2	Low	High	Moderate	0.49	3	---
	16-36	0.06-0.2	0.15-0.22	5.5	<2	Low	High	Moderate	0.37		
	36-72	0.06-2.0	0.15-0.22	5.1-8.4	<2	Low	High	Low	0.37		
Harjo:											
23	0-13	<0.06	0.14-0.18	7.4-8.4	<2	High	High	Low	---	---	---
	13-80	<0.06	0.14-0.18	7.9-8.4	<2	High	High	Low	---		
Heiden:											
24	0-62	<0.06	0.15-0.20	7.9-8.4	<2	Very high	High	Low	0.32	5	---
	62-80	---	---	---	---	---	---	---	---		
[1]25:											
Heiden part	0-62	<0.06	0.15-0.20	7.9-8.4	<2	Very high	High	Low	0.32	5	---
	62-80	---	---	---	---	---	---	---	---		
Ferris part	0-43	<0.06	0.15-0.18	7.9-8.4	<2	Very high	High	Low	0.32	4	---
	43-55	---	---	---	---	---	---	---	---		
Houston Black:											
26, 27	0-77	<0.06	0.15-0.20	7.4-8.4	<2	Very high	High	Low	0.32	4	---
	77-80	---	---	---	---	---	---	---	---		
Karma:											
28	0-12	0.6-2.0	0.11-0.20	5.6-7.8	<2	Low	Low	Moderate	0.37	5	---
	12-46	0.6-2.0	0.12-0.20	5.6-7.8	<2	Low	Low	Moderate	0.32		
	46-73	0.6-6.0	0.11-0.20	5.6-7.8	<2	Low	Low	Moderate	0.32		
Kaufman:											
29, 30	0-6	0.06-0.2	0.15-0.20	5.6-7.8	<2	High	High	Low	0.32	5	---
	6-80	<0.06	0.15-0.18	5.6-7.8	<2	Very high	High	Low	0.32		
Lamar:											
31	0-6	0.6-2.0	0.12-0.15	6.6-8.4	<2	Moderate	Moderate	Low	0.32	4	---
	6-65	0.6-2.0	0.12-0.15	7.9-8.4	<2	Moderate	Moderate	Low	0.32		
Lassiter:											
32	0-42	0.6-2.0	0.15-0.22	5.6-7.3	<2	Moderate	Moderate	Low	0.28	5	---
	42-72	0.6-2.0	0.15-0.22	5.1-7.3	<2	Moderate	Moderate	Moderate	0.28		
Leson:											
33	0-66	<0.06	0.12-0.18	6.1-8.4	<2	High	High	Low	0.32	4	---
	66-75	<0.06	0.12-0.18	7.4-8.4	<2	High	High	Low	---		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm						
Mabank:											
[1]34:											
Mabank part	0-8	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	Moderate	Moderate	0.43	5	---
	8-72	<0.06	0.12-0.18	5.6-8.4	<2	High	High	Moderate	0.32		
Crockett part	0-8	0.6-2.0	0.11-0.20	5.6-7.3	<2	Low	Moderate	Low	0.43	5	---
	8-63	<0.06	0.14-0.18	5.6-7.8	<2	High	High	Low	0.32		
	63-73	0.06-0.2	0.15-0.20	7.4-8.4	<2	Moderate	High	Low	0.32		
Muldrow:											
35	0-16	0.2-0.6	0.15-0.22	5.1-6.0	<2	Moderate	High	Moderate	---	---	---
	16-80	<0.06	0.12-0.22	6.1-8.4	<2	High	High	Low	---		
Normangee:											
36, 37	0-7	0.06-0.2	0.15-0.20	5.6-7.3	<2	Moderate	High	Low	0.43	3	---
	7-57	<0.06	0.12-0.18	5.6-8.4	<2	High	High	Low	0.37		
	57-65	<0.06	0.12-0.18	6.1-8.4	<2	High	High	Low	---		
Norwood:											
38	0-8	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low	High	Low	0.43	5	---
	8-65	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low	High	Low	0.43		
Parisian:											
39	0-11	0.6-2.0	0.15-0.24	5.6-7.3	<2	Moderate	High	Moderate	0.37	5	---
	11-17	0.06-0.2	0.12-0.22	5.1-6.5	<2	High	High	Moderate	0.32		
	17-80	<0.06	0.12-0.22	6.1-8.4	<2	High	High	Moderate	0.32		
Redlake:											
40	0-45	<0.06	0.12-0.18	7.4-8.4	<2	High	High	Low	0.37	5	---
	45-72	0.06-0.2	0.15-0.20	7.4-8.4	<2	Moderate	High	Low	0.37		
Roxton:											
41	0-18	0.2-0.6	0.12-0.20	6.6-8.4	<2	High	High	Low	0.32	5	---
	18-43	<0.06	0.12-0.22	5.1-7.8	<2	High	High	Moderate	0.32		
	43-64	<0.06	0.12-0.20	5.1-6.5	<2	High	High	Moderate	0.32		
Severn:											
42, 43	0-4	2.0-6.0	0.13-0.20	7.4-8.4	<2	Low	Low	Low	0.32	5	---
	4-63	2.0-6.0	0.11-0.20	7.9-8.4	<2	Low	Low	Low	0.32		
[1]44:											
Severn part	0-4	2.0-6.0	0.13-0.20	7.4-8.4	<2	Low	Low	Low	0.32	5	---
	4-63	2.0-6.0	0.11-0.20	7.9-8.4	<2	Low	Low	Low	0.32		
Kiomatia part	0-4	0.6-2.0	0.10-0.15	6.1-8.4	<2	Low	Low	Low	0.17	5	---
	4-60	6.0-20	0.05-0.10	6.1-8.4	<2	Low	Low	Low	0.17		
Stephen:											
45	0-7	0.2-0.6	0.10-0.15	7.9-8.4	<2	Moderate	High	Low	0.32	1	---
	7-13	---	---	---	---	---	---	---	---		
	13-28	---	---	---	---	---	---	---	---		
[1]46:											
Stephen part	0-7	0.2-0.6	0.10-0.15	7.9-8.4	<2	Moderate	High	Low	0.32	1	---
	7-13	---	---	---	---	---	---	---	---		
	13-28	---	---	---	---	---	---	---	---		
Eddy part	0-6	0.2-0.6	0.10-0.13	7.9-8.4	<2	Low	High	Low	0.24	1	---
	6-10	0.2-0.6	0.03-0.07	7.9-8.4	<2	Low	High	Low	0.24		
	10-28	---	---	---	---	---	---	---	---		
Trinity:											
47, 48	0-72	<0.06	0.15-0.20	7.4-8.4	<2	Very high	High	Low	0.32	5	---
Urban land:											
49.											

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH	mmhos/cm						
Varro:											
50	0-60	0.6-2.0	0.15-0.20	7.4-8.4	<2	Moderate	Moderate	Low	0.28	5	---
Whakana:											
51, 52	0-15	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low	Low	Moderate	0.32	5	---
	15-42	0.6-2.0	0.10-0.15	4.5-6.5	<2	Moderate	Moderate	Moderate	0.32		
	42-80	2.0-6.0	0.10-0.15	4.5-6.0	<2	Low	Low	High	0.32		
[1]53:											
Whakana part	0-15	2.0-6.0	0.10-0.15	5.1-7.3	<2	Low	Low	Moderate	0.32	5	---
	15-42	0.6-2.0	0.10-0.15	4.5-6.5	<2	Moderate	Moderate	Moderate	0.32		
	42-80	2.0-6.0	0.10-0.15	4.5-6.0	<2	Low	Low	High	0.32		
Porum part	0-7	0.6-2.0	0.11-0.20	4.5-6.0	<2	Low	High	Moderate	0.37	5	---
	7-31	<0.06	0.14-0.22	4.5-6.0	<2	High	High	High	0.43		
	31-65	0.2-0.6	0.17-0.22	5.6-7.8	<2	Moderate	High	Moderate	0.32		
Wilson:											
54	0-6	0.2-0.6	0.15-0.20	5.6-7.8	<2	Low	High	Low	0.43	5	---
	6-39	<0.06	0.14-0.20	5.6-7.8	<2	High	High	Low	0.37		
	39-80	<0.06	0.12-0.15	6.6-8.4	<2	High	High	Low	0.37		
Woodtell:											
55	0-4	0.6-2.0	0.10-0.15	4.5-6.5	<2	Low	Moderate	High	0.43	4	---
	4-26	<0.06	0.12-0.18	4.5-5.5	<2	High	High	High	0.32		
	26-51	0.06-0.2	0.15-0.20	4.5-6.0	<2	High	High	High	0.32		
	51-63	0.06-0.2	0.12-0.18	4.5-7.3	<2	Moderate	High	High	---		

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban land components that are not rated.

TABLE 17.--SOIL AND WATER FEATURES

[Absence of entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Ambia: 1	D	Frequent	Brief	Oct-May	0-1.5	Apparent	Oct-May	>60	---
Annona: 2, [1]3	D	None	---	---	2.0-4.0	Apparent	Dec-Feb	>60	---
Austin: 4	C	None	---	---	>6.0	---	---	20-40	Rippable
Belk: 5	D	Rare to common.	Very brief	Mar-May	>6.0	---	---	>60	---
Benklin: 6	C	None	---	---	1.5-2.5	Apparent	Nov-May	>60	---
Bernaldo: 7	B	None	---	---	4.0-6.0	Apparent	Nov-Feb	>60	---
Burleson: 8	D	None	---	---	>6.0	---	---	>60	---
Caspiana: 9	B	None to rare	---	---	>4.0	Apparent	Dec-Apr	>60	---
Crockett: 10	D	None	---	---	>6.0	---	---	>60	---
Deport: 11, 12, [1]13	D	None	---	---	0-2.0	Apparent	Dec-May	>60	---
Derly: 14	D	None	---	---	0-1.5	Perched	Oct-May	>60	---
[1]15:									
Derly part	D	None	---	---	0-1.5	Perched	Oct-May	>60	---
Raino part	D	None	---	---	2.0-5.0	Apparent	Dec-Mar	>60	---
Desha: 16	D	Rare to common.	Long to very long.	Dec-Jun	0-1.0	Perched	Dec-May	>60	---
Elbon: 17, 18	B	Occasional to frequent	Brief	Oct-May	2.5-3.5	Apparent	Dec-Apr	>60	---
Ferris: 19	D	None	---	---	>6.0	---	---	>60	---

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	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Freestone:									
[1]20:									
Freestone part-	C	None	---	---	1.0-3.0	Apparent	Dec-May	>60	---
Hicota part	B	None	---	---	3.0-5.0	Apparent	Nov-May	>60	---
[1]21	C	None	---	---	1.0-3.0	Apparent	Dec-May	>60	---
Guyton:									
22	D	Frequent	Very brief to long.	Oct-May	0-1.5	Apparent	Oct-May	>60	---
Harjo:									
23	D	Frequent	Very long	Oct-Jun	1.0	Apparent	Oct-Jun	>60	---
Heiden:									
24	D	None	---	---	>6.0	---	---	>60	---
[1]25:									
Heiden part	D	None	---	---	>6.0	---	---	>60	---
Ferris part	D	None	---	---	>6.0	---	---	>60	---
Houston Black:									
26, 27	D	None	---	---	>6.0	---	---	>60	---
Karma:									
28	B	None	---	---	>6.0	---	---	>60	---
Kaufman:									
29, 30	D	Occasional to frequent	Brief	Oct-May	0-3.5	Apparent	Nov-Apr	>60	---
Lamar:									
31	B	None	---	---	>6.0	---	---	>60	---
Lassiter:									
32	B	Frequent	Brief	Oct-May	1.5-3.5	Apparent	Nov-May	>60	---
Leson:									
33	D	None	---	---	>6.0	---	---	>60	---
Mabank:									
[1]34:									
Mabank part	D	None	---	---	0.6-1.0	Perched	Dec-Mar	>60	---
Crockett part	D	None	---	---	>6.0	---	---	>60	---
Muldrow:									
35	D	Rare	---	---	0-2.0	Apparent	Sep-Mar	>60	---
Normangee:									
36, 37	D	None	---	---	>6.0	---	---	>60	---

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	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Norwood: 38	B	Occasional	Very brief	Oct-May	>6.0	---	---	>60	---
Parisian: 39	D	None	---	---	1.0-2.0	Perched	Dec-Apr	>60	---
Redlake: 40	D	Occasional	Very brief	Jan-May	>6.0	---	---	>60	---
Roxton: 41	D	Frequent	Brief	Oct-May	0-2.0	Apparent	Oct-May	>60	---
Severn: 42, 43	B	Occasional	Very brief	Jan-Oct	>6.0	---	---	>60	---
[1]44: Severn part	B	Frequent	Very brief	Jan-Oct	>6.0	---	---	>60	---
Kiomatia part	A	Frequent	Brief	Feb-Jun	3.0-5.0	Apparent	Jan-Jul	>60	---
Stephen: 45	C	None	---	---	>6.0	---	---	7-20	Rippable
[1]46: Stephen part	C	None	---	---	>6.0	---	---	7-20	Rippable
Eddy part	C	None	---	---	>6.0	---	---	3-15	Rippable
Trinity: 47, 48	D	Occasional to frequent	Brief	Feb-May	0-3.0	Apparent	Nov-Feb	>60	---
Urban land: 49.									
Varro: 50	B	Frequent	Very brief	Oct-May	5.0-6.0	Apparent	Jan-Jun	>60	---
Whakana: 51, 52	B	None	---	---	>6.0	---	---	>60	---
[1]53: Whakana part	B	None	---	---	>6.0	---	---	>60	---
Porum part	C	None	---	---	2.0-3.0	Apparent	Dec-Apr	>60	---
Wilson: 54	D	None	---	---	0-1.0	Perched	Nov-Mar	>60	---
Woodtell: 55	D	None	---	---	1.5-4.0	Apparent	Dec-Feb	>60	---

[1]This map unit is made up of two or more dominant kinds of soil. See map unit description for the composition and behavior of the whole map unit. Map units 3, 13, and 21 have urban land components that are not rated.

TABLE 18.--HIGHWAY TEST DATA

Soil name and location	Report number	Depth	Horizon	Mechanical analysis										Liquid limit	Plasticity index	Classification	
				Percentage passing sieve--							Percentage smaller than--						
				5/8-in	3/8-in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 60 (0.25 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHTO	Unified
		In												Pct			
Deport clay:																	
From post office in Cunningham, 0.65 mile west on Farm Road 196, 0.7 mile south on field road, 950 feet east of field road.	73-93-R	8-25	AC1g	100	100	100	100	100	100	99	92	53	46	53	35	A-7-6	CH
Hicota very fine sandy loam:																	
From the square in Paris, 11.8 miles north on U.S. 271 to an oiled county road, 350 yards south in pasture.	73-211-R	14-32	A&B	100	100	100	100	99	97	68	50	4	2	20	3	A-4	ML
	73-212-R	32-44	B&A	100	100	100	100	99	97	72	59	19	17	27	12	A-6	CL
	73-213-R	67-80	B23t	100	100	100	100	100	99	84	75	46	43	55	38	A-7-6	CH
Kaufman clay:																	
From the intersection of Farm Road 895 and county road in Charleston, 8.3 miles east and north on Farm Road 895 to its intersection with county road in Kensing, 0.6 mile east and southeast on Farm Road 895 and county road, 0.15 mile south on county road, 1.15 miles east, 1.45 miles south of county road in pasture.	73-108-R	19-35	A13	100	100	100	100	99	99	95	92	77	68	80	54	A-7-6	CH
	73-109-R	50-69	B22g	100	100	100	100	100	100	97	94	82	76	94	68	A-7-6	CH
	73-110-R	69-84	B23g	100	100	100	100	100	100	96	93	82	75	89	64	A-7-6	CH
Normangee clay loam:																	
From the Square in Paris, 11.4 miles west on U.S. 82, 75 feet north.	73-100-R	7-16	B21t	100	100	100	100	99	99	96	89	54	50	56	35	A-7-6	CH
	72-101-R	48-57	B3	100	99	99	99	98	98	95	90	85	59	79	58	A-7-6	CH
Parisian silt loam:																	
From Square in Paris on U.S. 82 to Loop 286 west, 2.5 miles west, 0.7 mile north on Loop 286, 3.6 miles west on county road, 0.1 mile north, 0.7 mile west, 50 feet north of road ditch.	73-90-R	0-11	A1	100	100	100	99	98	97	85	72	19	13	36	14	A-6	CL
	73-91-R	17-21	B21t	100	100	100	100	99	99	91	85	56	53	64	40	A-7-6	CH
	73-92-R	56-68	B3	100	100	100	99	99	98	89	81	42	37	53	37	A-7-6	CH
Redlake clay:																	
From Chicota, Texas, 2.8 miles west on Farm Road 197, 2.0 miles north on County road, 0.1 mile east, 0.5 mile north, 0.8 mile west in a pecan orchard.	73-104-R	6-24	B21	100	100	100	100	100	100	100	96	59	47	53	33	A-7-6	CH

TABLE 19.--CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Ambia	Fine, montmorillonitic, nonacid, thermic Vertic Fluvaquents
Annona	Fine, montmorillonitic, thermic Vertic Paleudalfs
Austin	Fine-silty, carbonatic, thermic Entic Haplustolls
Belk	Clayey over loamy, mixed, thermic Fluventic Eutrochrepts
Benklin	Fine-silty, mixed, thermic Aquic Argiudolls
*Bernaldo	Fine-loamy, siliceous, thermic Glossic Paleudalfs
Burleson	Fine, montmorillonitic, thermic Udic Pellusterts
Caspiana	Fine-silty, mixed, thermic Typic Argiudolls
Crockett	Fine, montmorillonitic, thermic Udertic Paleustalfs
Deport	Fine, montmorillonitic, thermic Udorthentic Pellusterts
Derly	Fine, montmorillonitic, thermic Typic Glossaqualfs
*Desha	Very-fine, mixed, thermic Vertic Hapludolls
Eddy	Loamy-skeletal, carbonatic, thermic, shallow Typic Ustorthents
Elbon	Fine, mixed, thermic Fluventic Hapludolls
Ferris	Fine, montmorillonitic, thermic Udorthentic Chromusterts
Freestone	Fine-loamy, siliceous, thermic Glossaquic Paleudalfs
Guyton	Fine-silty, siliceous, thermic Typic Glossaqualfs
Harjo	Fine, mixed (calcareous), thermic Typic Fluvaquents
Heiden	Fine, montmorillonitic, thermic Udic Chromusterts
Hicota	Coarse-loamy, siliceous, thermic Typic Glossudalfs
Houston Black	Fine, montmorillonitic, thermic Udic Pellusterts
Karma	Fine-loamy, mixed, thermic Typic Hapludalfs
Kaufman	Very-fine, montmorillonitic, thermic Typic Pelluderts
Kiomatia	Sandy, mixed, thermic Typic Udifluvents
Lamar	Fine-silty, mixed, thermic Typic Ustochrepts
Lassiter	Fine-silty, mixed, nonacid, thermic Aquic Udifluvents
Leson	Fine, montmorillonitic, thermic Udic Pellusterts
Mabank	Fine, montmorillonitic, thermic Vertic Albaqualfs
*Muldrow	Fine, mixed, thermic Typic Argiaquolls
Normangee	Fine, montmorillonitic, thermic Vertic Haplustalfs
Norwood	Fine-silty, mixed (calcareous), thermic Typic Udifluvents
Parisian	Fine, montmorillonitic, thermic Vertic Argiudolls
Porum	Fine, mixed, thermic Glossaquic Paleudalfs
Raino	Fine-loamy over clayey, siliceous, thermic Aquic Glossudalfs
Redlake	Fine, mixed, thermic Vertic Eutrochrepts
Roxton	Fine, montmorillonitic, thermic Vertic Haplaquolls
Severn	Coarse-silty, mixed (calcareous), thermic Typic Udifluvents
Stephen	Clayey, mixed, thermic, shallow Entic Haplustolls
Trinity	Very-fine, montmorillonitic, thermic Typic Pelluderts
Varro	Fine-loamy, mixed (calcareous), thermic Typic Udifluvents
Whakana	Fine-loamy, mixed, thermic Glossic Paleudalfs
Wilson	Fine, montmorillonitic, thermic Vertic Ochraqualfs
Woodtell	Fine, montmorillonitic, thermic Vertic Hapludalfs

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