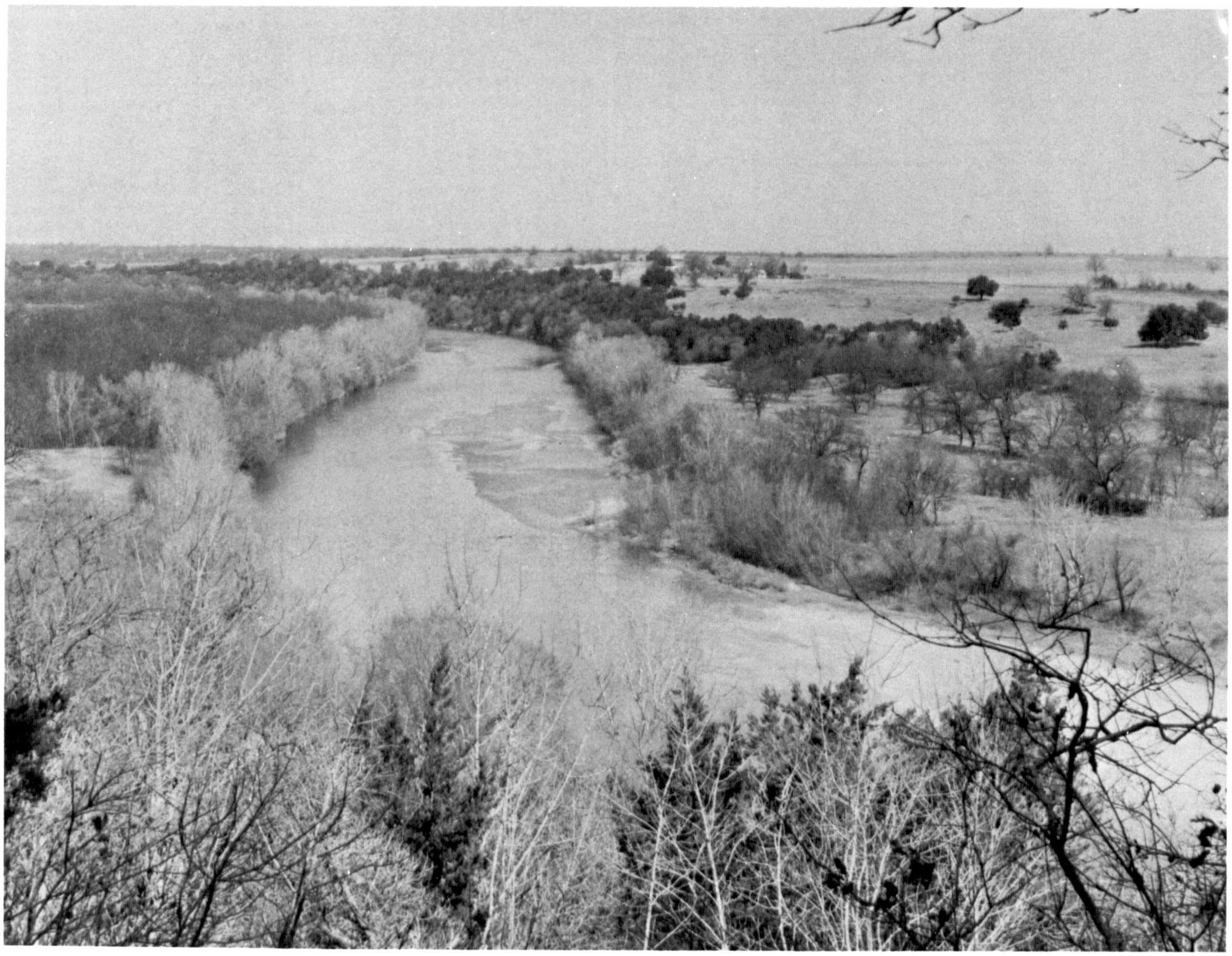
SOIL SURVEY OF

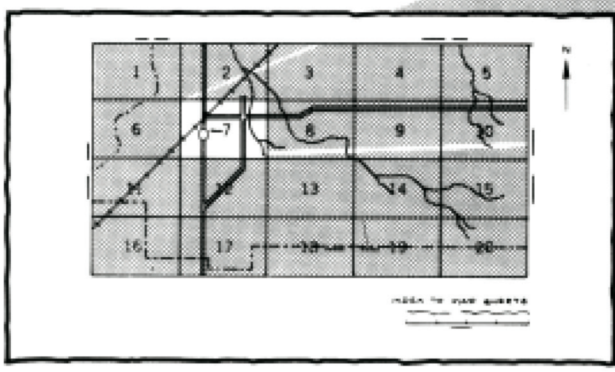
Hood and Somervell Counties, Texas

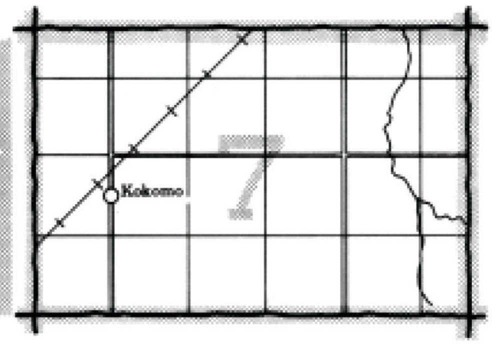


United States Department of Agriculture
Soil Conservation Service
in cooperation with
Texas Agricultural Experiment Station

HOW TO USE

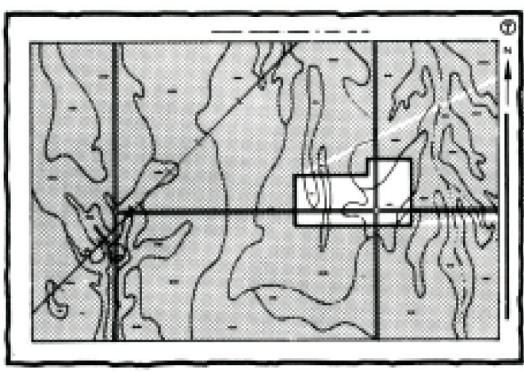
1. Locate your area of interest on the "Index to Map Sheets"

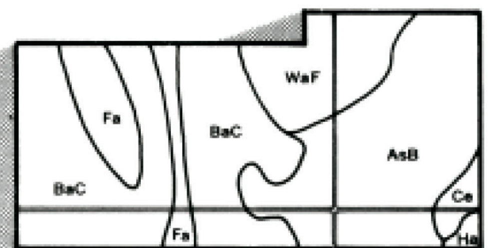




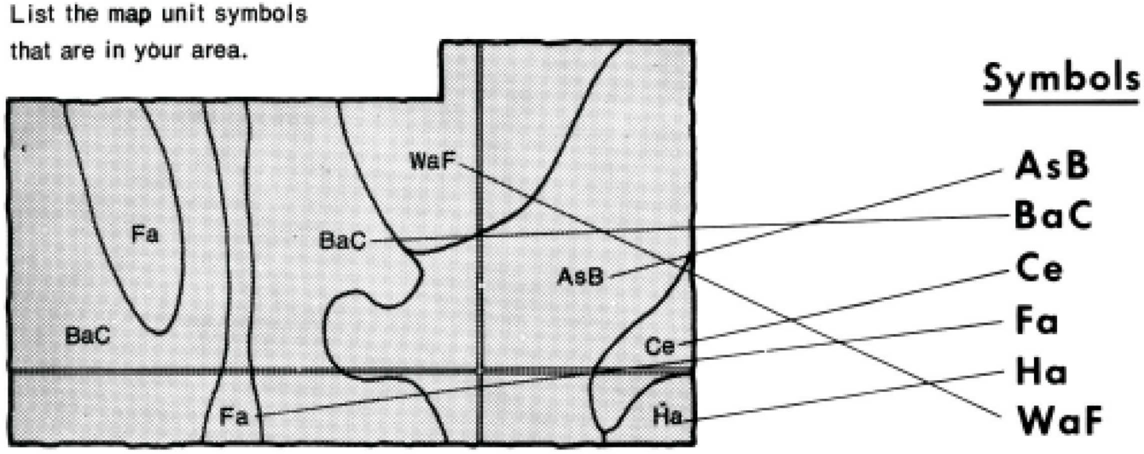
2. Note the number of the map sheet and turn to that sheet.

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



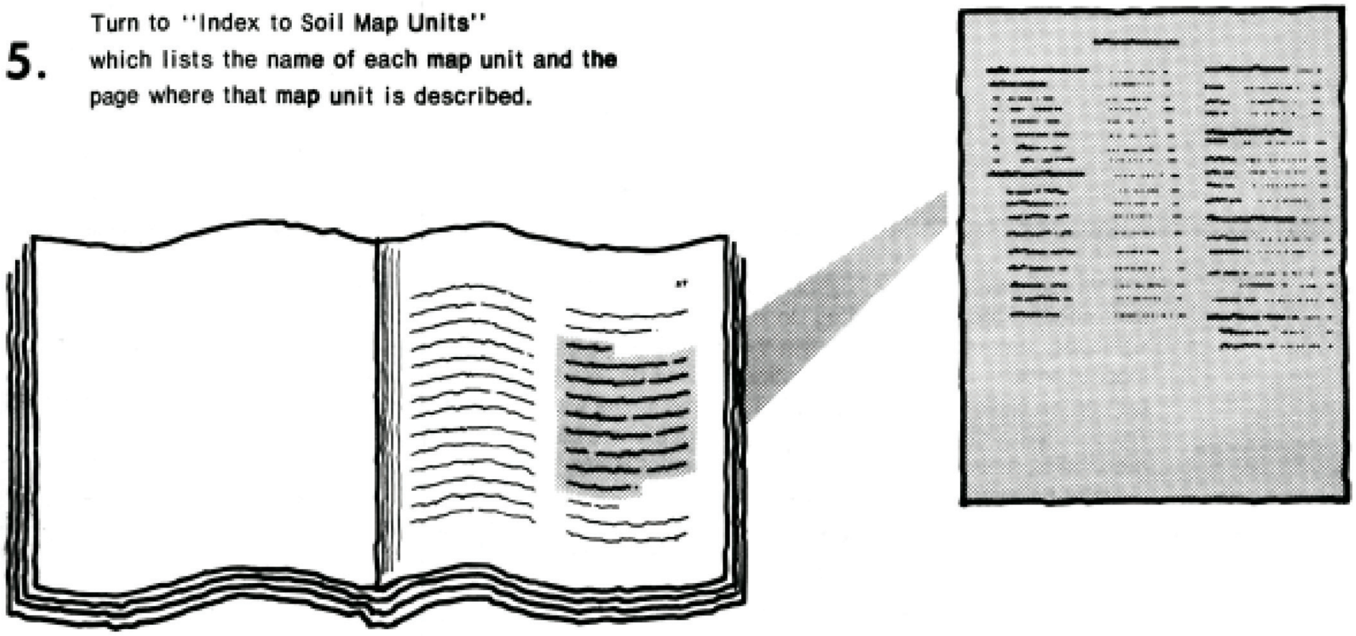


4. List the map unit symbols that are in your area.

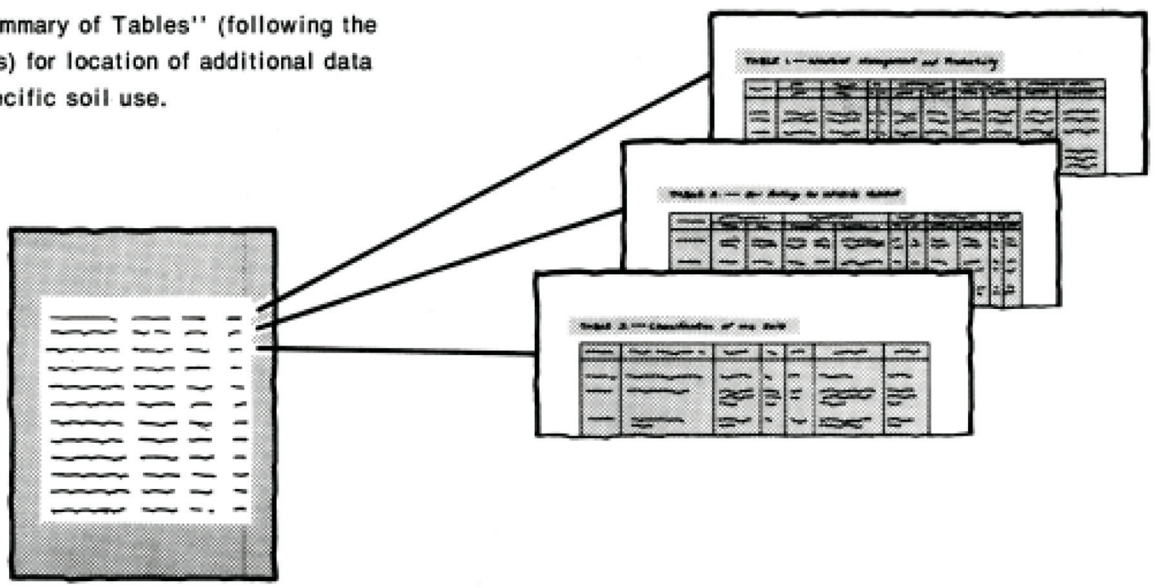


THIS SOIL SURVEY

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 1970-74. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1975. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Hood-Parker Soil and Water Conservation District and the Bosque Soil and Water Conservation District.

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: A bend in the Brazos River. The Yahola-Gaddy complex, frequently flooded, is on the flood plain.

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Issued December 1978

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Summary of Tables

Foreword

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

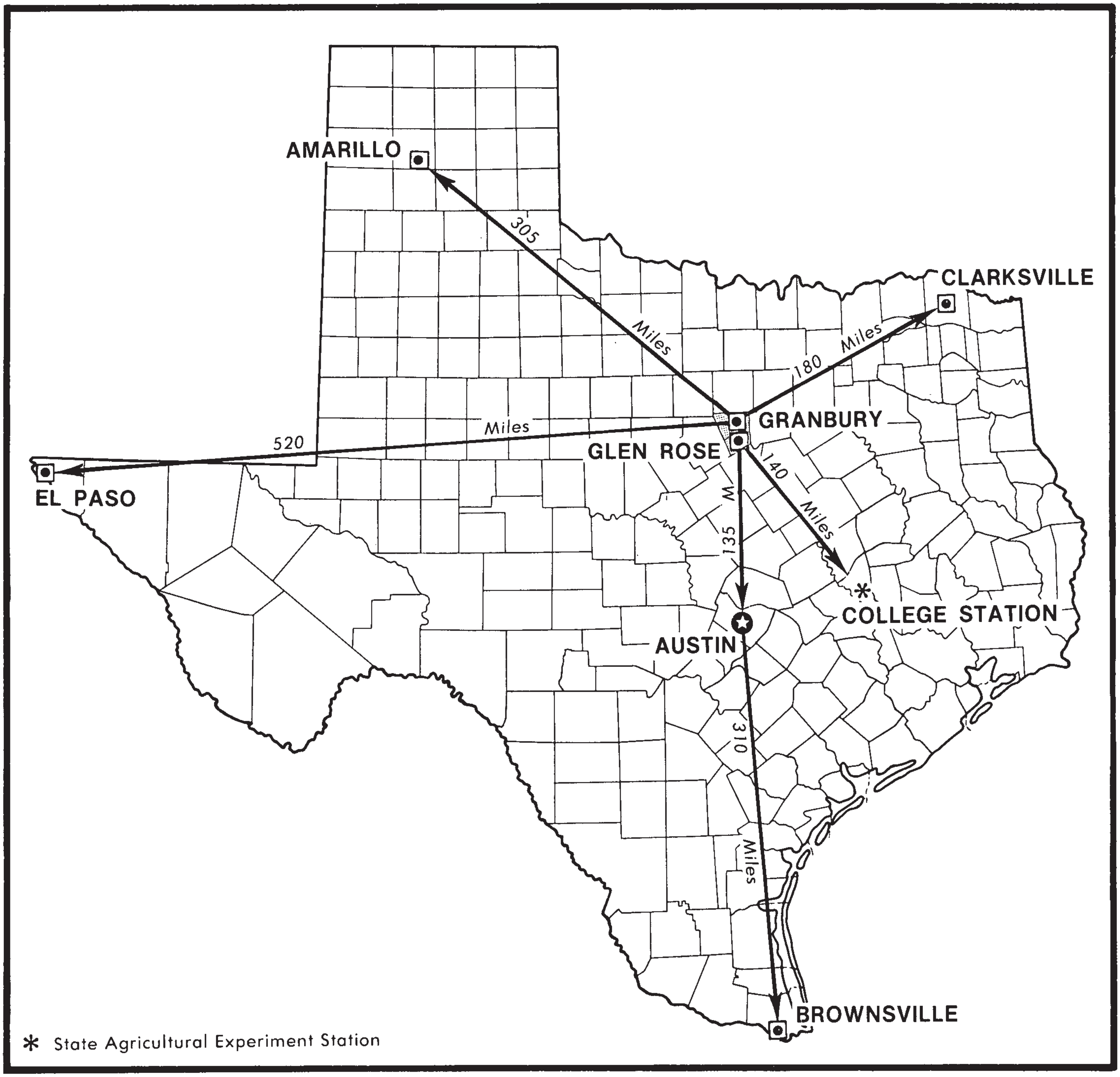
This soil survey has been prepared for many different users. Farmers, ranchers, foresters, and agronomists can use it to determine the potential of the soil and the management practices required for food and fiber production. Planners, community officials, engineers, developers, builders, and homebuyers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

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 Hood and Somervell Counties in Texas.

SOIL SURVEY OF HOOD AND SOMERVELL COUNTIES, TEXAS

By Winfred C. Coburn, Soil Conservation Service

Soils surveyed by Winfred C. Coburn, James E. Bower,
Ernesto DeLeon, Harold W. Hyde, J. David Kelley, and Billy J. Wagner,
Soil Conservation Service

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

HOOD AND SOMERVELL COUNTIES are in north-central Texas (see map on facing page). The counties have a total area of 398,720 acres, or 623 square miles. Granbury, with a population of 2,473, is the seat of Hood County; Glen Rose, with a population of 1,554, is the seat of Somervell County. Other towns in the survey area include Acton, Lipan, and Tolar.

The counties are mostly in the Grand Prairie and West Cross Timbers Land Resource Areas, and a small area in the northwest corner of Hood County is in the North Central Prairies Land Resource Area. The survey area is characterized by open prairie grasslands, juniper-covered limestone hills, and sandy areas on uplands and along the Brazos River. The terrain, cut by the Brazos and Paluxy Rivers, is rough, with eroded plateaus and ravines. Kickapoo and Squaw Creeks are other major streams that drain the survey area. Elevation ranges from about 600 feet along the flood plain of the Brazos River to about 1,350 feet in the southwestern part of Somervell County.

General nature of the counties

In the paragraphs that follow is general information concerning the counties. Settlement and population, climate, agriculture, and natural resources are described.

Settlement and population

Hood County. Barnard's Trading Post was one of the earliest settlements in Hood County. After the Civil War settlement increased, especially along the Brazos River. Early settlers also located along the fertile valleys of the Paluxy River, Kickapoo and Richardson Creeks, and other streams.

Hood County was created and organized in 1866 and named for John Bell Hood, a Confederate general. The county or sections of the county have been parts of the municipalities of San Felipe de Austin and Viesca, and of Robertson, Navarro, McLennan, Johnson, and Erath Counties.

Population in Hood County increased until about 1910, when the population reached 10,008. Population decreased from 1910 to 1950, mainly because of the two world wars, droughts, and the depression. From 1950 until about 1970, population rose slightly. Since the completion of Lake Granbury on the Brazos River in September 1969, numerous developments along and near the lake and along the Brazos below the dam have caused a rapid growth in population.

Somervell County. Early settlers in Somervell County came to the more productive soils along the Brazos and Paluxy Rivers and Squaw Creek. The first settlement in the county, called Springtown, was founded by L.B. McClanahan in 1859. It was later named Barnard's Mill, and it became a post office in 1859. The name was changed to Glen Rose in 1872. Other early trading posts were at Wilcox, Rainbow, Glass, and Nemo.

Somervell County was created from Hood County, organized in 1875, and named for Alexander Somervell.

Population in Somervell County increased until 1910, when it reached 3,931. The increase is mainly attributable to agricultural growth. Population generally declined between 1910 and 1950. After 1950 the population began to stabilize and increase slightly. In 1970 the population was 2,793.

Climate

Hood and Somervell Counties are hot in summer but cool in winter, when an occasional surge of cold air causes a sharp drop in otherwise mild temperatures. Rain falls throughout the year and is highest in spring and fall. Snowfalls are infrequent. Annual total precipitation is normally adequate for peanuts, feed grains, and small grains.

Table 1 gives data on temperature and precipitation for the survey area, as recorded at Granbury for the period 1951 to 1975. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 48 degrees F, and the average daily minimum temperature is 35 degrees. The lowest temperature on record, which occurred at Granbury on January 12, 1973, is 1 degree. In summer the average temperature is 84 degrees, and the average daily maximum temperature is 96 degrees. The highest recorded temperature, which occurred on July 25, 1964, is 110 degrees.

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

Of the total annual precipitation, 18 inches, or 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 15 inches. The heaviest 1-day rainfall during the period of record was 6.8 inches at Granbury on October 4, 1959. Thunderstorms occur on about 45 days each year, and most occur in spring.

Average seasonal snowfall is 2 inches. The greatest snow depth at any one time during the period of record was 12 inches. On the average, 1 day has at least 1 inch of snow on the ground, but the number of such days varies greatly from year to year.

The average relative humidity in midafternoon is about 55 percent. Humidity is higher at night, and the average at dawn is about 80 percent. The prevailing wind is from the south. Average windspeed is highest, 13 miles per hour, in March.

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

Climatic data in this section were specially prepared for the Soil Conservation Service by the National Climatic Center, Asheville, North Carolina.

Farming

The first settlers of Hood and Somervell Counties were mainly cattle ranchers who settled along the valleys of the Brazos and Paluxy Rivers beginning about 1854. About 1874, farming because more diversified. In 1876, Hood County had four flour and grist mills and nine cotton gins.

During these early years of farming, knowledge of practices to conserve soil, such as returning crop residue to the soil, were not known or not practiced. Erosion soon had reduced the productivity of the land. Many areas were abandoned and left to actively erode and form gullies.

In addition to individual efforts in solving these erosion problems, the Bosque Soil and Water Conservation District was organized on October 8, 1941. The Hood-Parker Soil and Water Conservation District was organized in 1941. Their main objectives at that time were conserving soil and water and improving the living conditions of the rural family.

Cattle production is still the main farm enterprise in the survey area. Livestock operations are primarily cow-calf. Goats, sheep, hogs, dairy cattle, chickens, and a few herds of exotic animals are also raised.

Peanuts and grain sorghum are the main crops. Cotton and corn have declined in importance because of insect and disease problems. On most of the larger peanut farms, livestock is a secondary enterprise. Since about 1958, many acres of cultivated land have been converted to pastureland.

Natural resources

Soil is the most important natural resource in the survey area. Livestock and crops are marketable products.

In most parts of both counties, water supplies are adequate for domestic use and for livestock. The underground geologic formations known as the Trinity Sand and Paluxy Sand Formations are important water-bearing sources for wells. No extensive areas of underground water have been found in sufficient volume for irrigation. Above-ground sources of water include the Brazos River, the Paluxy River, and Lake Granbury. Sometimes the salt content of this water makes its use questionable, so a periodic salinity analysis is a good safeguard against salt buildup in the soil.

Deposits of sand and gravel are mostly in or adjacent to the Brazos River. Silica sand is mined in the eastern part of Somervell County. Road material is obtained from the shallow limestone soils, and the limestone is marketed as a building material.

Juniper is cut for fenceposts, and trees, mostly live oak, are dug for nursery stock.

Oil and gas are produced in only one area in the northwestern part of Hood 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, 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 4 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 grasses*, *range grasses*, *urban uses*, and *recreation areas*. Cultivated farm crops are those grown extensively by farmers in the survey area. Pasture grasses include improved bermudagrass, lovegrass, and Kleingrass. Range grasses include little bluestem, sideoats grama, indiangrass, silver bluestem, King Ranch bluestem, and Texas wintergrass. Urban uses include residential, commercial, and industrial developments. Recreation areas include nature study trails, wilderness areas, hunting and fishing areas, camp areas, playgrounds, and paths and trails.

Descriptions of map units

1. Tarrant-Purves

Very shallow to shallow, undulating to hilly, clayey soils that formed in limestone; on uplands

The soils of this unit are undulating to hilly. They are on broad ridgetops and hillsides (fig. 1).

This unit makes up about 39 percent of the survey area. Tarrant soils make up about 50 percent of the unit; Purves soils, about 11 percent; and minor soils, the remaining 39 percent.

Tarrant soils have a surface layer of dark grayish brown and brown, calcareous cobbly clay and very cobbly clay about 14 inches thick. Fractured and platy limestone bedrock that contains brown clay in vertical and horizontal cracks is at a depth of 14 inches.

Purves soils have a surface layer about 13 inches thick. The upper part is dark grayish brown, calcareous stony clay; the middle part is brown, calcareous clay; and the lower part is brown, calcareous very gravelly clay. Fractured limestone is at a depth of 13 inches.

Minor soils in this unit are Aledo, Bolar, Bosque, Brackett, Denton, Frio, Hensley, Krum, Maloterre, Pedernales, Seawillow, Sunev, Venus, and Windthorst soils. The undulating Aledo soils are on limestone hills and support open grassland vegetation. Bolar soils are on hillsides and foot slopes between limestone ridges. Bosque and Frio soils are on the flood plains of streams. The very steep Brackett soils are on convex to plane side slopes. The nearly level to gently sloping Hensley soils are on broad ridgetops. The gently sloping Krum soils are in broad, filled valleys. Maloterre soils are on breaks below steep slopes. Pedernales and Windthorst soils are on foot slopes in areas where sandy soils are intermingled with limestone soils. Seawillow and Sunev soils are on foot slopes below limestone hills. Venus soils are on geologic terraces along streams.

This unit is used mainly for range, but a few areas are farmed to small grains and forage sorghums. Most of the acreage has been cleared of juniper and mesquite brush. Shallow depth to rock and stones on the surface are the main limitations for farming and for most other purposes.

This unit has low potential for cultivated farm crops. Stones on the surface are the main limitation. Shallow depth to rock makes the potential low for residential use. Because the terrain is rough, many scenic vantage points are available for building sites. Although potential for rangeland wildlife habitat is only medium, the unit furnishes habitat for most of the deer in the survey area.

2. Aledo-Bolar

Shallow to moderately deep, undulating, loamy soils that formed in limestone and marl; on uplands

The soils of this unit are undulating. They are on broad, stony ridgetops, hillsides, and foot slopes (fig. 2).

This unit makes up about 18 percent of the survey area. Aledo soils make up about 50 percent of the unit; Bolar soils, about 16 percent; and minor soils, the remaining 34 percent.

Aledo soils have a surface layer of dark grayish brown, calcareous gravelly clay loam and very gravelly clay loam about 14 inches thick. Limestone bedrock is at a depth of 14 inches.

Bolar soils have a surface layer of dark grayish brown, calcareous stony clay loam and clay loam about 13 inches thick. The subsoil is light brownish gray, calcareous clay loam to a depth of 22 inches and very pale brown, calcareous clay loam to a depth of 28 inches. Fractured limestone is at a depth of about 28 inches.

Minor soils in this unit are Bosque, Brackett, Denton, Frio, Hensley, Krum, Maloterre, Purves, Sunev, and Tarrant soils. Bosque and Frio soils are on the flood plains of streams. The steep Brackett soils are on convex side slopes below hilltops. The gently sloping Denton soils are on broad ridgetops. The nearly level to gently sloping Hensley soils are on broad ridgetops. The gently sloping Krum soils are in broad valleys. Maloterre soils are on slightly benched areas in a random pattern. Purves and Tarrant soils are on ridgetops and hillsides and have a more clayey texture. Sunev soils are on foot slopes below stony areas.

This unit is used mainly for range, but a few areas are farmed to small grains and forage sorghums. Most of the unit is now open prairie, but a few areas are being invaded by juniper, sumac, and mesquite trees. Shallow rooting depth is the main limitation for farming and for most other purposes.

This unit has low potential for cultivated farm crops. Small stones on the surface are the main limitation. Because of shallow depth to bedrock, the unit has low potential for residential use. Potential for rangeland wildlife habitat is low.

3. Windthorst-Duffau

Deep, gently sloping to sloping, loamy and sandy soils that formed in loamy sediments or in stratified clayey, sandy, or weakly cemented sandstone; on uplands

The soils of this unit are mostly on broad erosional uplands (fig. 3).

This unit makes up about 15 percent of the survey area. Windthorst soils make up about 58 percent of the unit; Duffau soils, about 15 percent; and minor soils, the remaining 27 percent.

Windthorst soils have a surface layer of brown, slightly acid fine sandy loam about 5 inches thick. The subsoil between depths of 5 and 18 inches is red, slightly acid sandy clay; between depths of 18 and 28 inches, it is yellowish red, slightly acid sandy clay that has yellowish mottles; and between depths of 28 and 38 inches, it is yellowish red, medium acid sandy clay that has many prominent red, very pale brown, and pale brown mottles. The underlying material to a depth of 56 inches is mottled yellow, brownish yellow, and very pale brown, slightly acid fine sandy loam; to a depth of 62 inches it is white, neutral, weakly cemented sandstone.

Duffau soils have a surface layer of brown, slightly acid fine sandy loam about 12 inches thick. The subsoil between depths of 12 and 32 inches is yellowish red, neutral sandy clay loam; between depths of 32 and 40 inches, it is reddish brown, neutral sandy clay loam; and between depths of 40 and 64 inches, it is reddish yellow, neutral sandy clay loam that has brownish yellow and red mottles. The underlying material to a depth of 80 inches is mottled reddish yellow, very pale brown, and yellowish red, neutral fine sandy loam. It contains pockets of sandy clay loam and thin, discontinuous bands of weakly cemented sandstone.

Minor soils in this unit are Blanket, Bosque, Bunyan, Chaney, Demona, Frio, Hassee, Nimrod, Patilo, Pedernales, Thurber, and Truce soils. Blanket soils are in broad, shallow valleys. Bosque, Bunyan, and Frio soils are on flood plains of streams. The gently sloping Chaney and Demona soils are in broad areas and have a surface layer of loamy fine sand. Hassee soils are in circular to oblong depressions or drainageways. The nearly level to gently sloping Nimrod and Patilo soils are deep and have a sandy surface layer. Pedernales soils are on low knolls and in areas close to limestone soils. Thurber soils are on broad, shallow flats. Truce soils are on foot slopes and some ridgetops.

This unit is used mainly as pasture, but a considerable acreage is cropland. The main limitation is the slow water intake rate of most of the soils, and in addition the soils are highly erodible.

With brush management and proper grazing use, this unit has high potential for range. This unit has medium potential for habitat for small animals such as quail and dove. The subsoil expands when wet and contracts when dry; this is the main limitation for residential use.

4. Bastrop-Yahola

Deep, nearly level to sloping, loamy and sandy soils that formed in loamy sediments and in loamy calcareous alluvium; on terraces and bottom lands

In this unit are nearly level to sloping soils on uplands and nearly level to gently sloping soils on bottom lands on or near the Brazos River (fig. 4).

This unit makes up about 11 percent of the survey area. Bastrop soils make up about 42 percent of the unit; Yahola soils, about 9 percent; and minor soils, the remaining 49 percent.

Bastrop soils have a surface layer of brown, slightly acid to medium acid fine sandy loam about 13 inches thick. The subsoil is yellowish red, slightly acid sandy clay loam that extends to a depth of about 80 inches or more.

Yahola soils have a surface layer of brown, calcareous, stratified fine sandy loam about 18 inches thick. The underlying material between depths of 18 and 28 inches is light brown, calcareous loam that has evident bedding planes; between depths of 28 and 48 inches, it is reddish yellow, calcareous, stratified fine sandy loam; and between depths of 48 and 62 inches, it is pink, calcareous, stratified loamy fine sand.

Minor soils in this unit are Decordova, Duffau, Gaddy, Hassee, Paluxy, Pedernales, Purves, Sunev, Tarrant, and Venus soils. The nearly level to gently sloping, sandy Decordova soils are on terraces near the Brazos River. The gently sloping to sloping Duffau and Pedernales soils are on erosional uplands in areas intergrading with soils on terraces. The nearly level to gently sloping Gaddy soils are on flood plains. The nearly level to gently sloping, somewhat poorly drained Hassee soils are in depressional areas. The nearly level to sloping Paluxy soils are on terraces adjacent to flood plains of the Brazos River. The gently sloping to steep Purves and Tarrant soils are in stony areas along or adjacent to streams and rivers. The gently sloping to sloping Sunev soils are on foot slopes. The gently sloping Venus soils are on low terraces.

This unit is used mainly as cropland, but a considerable acreage is pastureland. Most of the acreage is well suited to crops, but a small acreage is subject to occasional overflow in spring and fall. The soils in a small area have low available water capacity, which is the main limitation for pastureland.

With proper grazing use and brush management, this unit has high potential for range. Most of the unit has high potential for residential use, but a small area has low potential because of the hazard of occasional overflow. This unit has high potential for habitat for small animals and birds. The recreation potential is high on the Brazos River and Lake Granbury. Pecan orchards are well suited to this unit.

5. Chaney-Nimrod

Deep, gently sloping, sandy soils that formed in clayey, loamy, and sandy sediments; on uplands

The soils of this unit are gently sloping. They are in broad areas on uplands. The soils are dissected by numerous drainageways and streams.

This unit makes up about 10 percent of the survey area. Chaney soils make up about 52 percent of the unit; Nimrod soils, about 14 percent; and minor soils, the remaining 34 percent.

Chaney soils have a surface layer of pale brown, slightly acid loamy fine sand about 12 inches thick. The upper part of the subsoil is yellowish brown, slightly acid sandy clay that has red and yellowish brown mottles and that extends to a depth of 17 inches. The middle part is brownish yellow, medium acid sandy clay that has red and light gray mottles and that extends to a depth of 34 inches. The lower part is light gray, strongly acid sandy clay that has yellowish brown, brownish yellow, and red mottles and that extends to a depth of 44 inches. The underlying material to a depth of 56 inches is mottled light gray, brownish yellow, yellowish brown, dark red, and red, slightly acid sandy clay loam and to a depth of 72 inches is light olive gray, calcareous shaly clay that has yellowish mottles.

Nimrod soils have a surface layer of pale brown, neutral fine sand about 8 inches thick. The subsurface layer, to a depth of 26 inches, is very pale brown, neutral fine sand. The upper part of the subsoil is brownish yellow, medium acid sandy clay loam that has mottles of light brownish gray and red and that extends to a depth of 34 inches. The middle part is brownish yellow, medium acid sandy clay loam that has mottles of light gray, very pale brown, yellowish red, and red and that extends to a depth of 50 inches. The lower part is light gray, strongly acid sandy clay loam that has mottles of yellow, brownish yellow, yellowish red, and red and that extends to a depth of 72 inches. The underlying material to a depth of 80 inches is white, strongly acid loamy fine sand that has reddish yellow mottles.

Minor soils of this unit are Bunyan, Demona, Duffau, Hassee, Patilo, Pedernales, Thurber, Truce, and Windthorst soils. Bunyan soils are on narrow flood plains of small streams. The gently sloping Demona soils are on footslopes and in shallow valleys. Hassee soils are in slightly depressional, somewhat poorly drained areas. The nearly level to gently sloping, deep, sandy Patilo soils are very near Nimrod soils. Pedernales and Windthorst soils are on plane to convex surfaces on higher slopes and knolls. Duffau and Thurber soils are in broad, shallow valleys. Truce soils are on ridgetops and foot slopes.

This unit is used mainly for cropland. Soil blowing and the slow water intake rate are limitations for cultivated crops.

This unit has high potential for cultivated farm crops and improved pasture. To achieve this potential, a good fertilization program and weed control are required. The unit has medium potential for most residential uses. Soil wetness and shrinking and swelling of the subsoil are limitations. The unit has high potential for wildlife habitat, especially for quail and dove. This unit has high potential for vegetables and truck crops such as watermelons, cantaloupes, and peas.

6. Frio-Bosque

Deep, nearly level, clayey and loamy soils that formed in calcareous, clayey and loamy alluvium; on bottom lands

The soils of this unit are nearly level. They are on flood plains of streams that drain areas of soils that formed over limestone.

This unit makes up about 4 percent of the survey area. Frio soils make up about 31 percent of the unit; Bosque soils, about 30 percent; and minor soils, the remaining 39 percent.

Frio soils have a surface layer of dark grayish brown and very dark grayish brown, calcareous silty clay about 26 inches thick. The subsoil is grayish brown, calcareous silty clay that extends to a depth of 38 inches. The underlying material to a depth of 62 inches is pale brown, calcareous silty clay.

Bosque soils have a surface layer of dark grayish brown and grayish brown, calcareous loam and clay loam about 30 inches thick. The subsoil is light brownish gray, calcareous clay loam that extends to a depth of 46 inches. The underlying material to a depth of 62 inches is pale brown, calcareous clay loam.

Minor soils of this unit are Bastrop, Blanket, Gaddy, Krum, Sunev, Venus, and Yahola soils. The gently sloping Bastrop soils are on geologic terraces on the Paluxy River. Blanket and Krum soils are in broad, shallow valleys adjacent to the flood plains. Gaddy and Yahola soils are on occasionally flooded flood plains below steep banks of the Paluxy River, Robinson Creek, Richardson Creek, and Pony Creek. The gently sloping Sunev and Venus soils are on low geologic terraces adjacent to the flood plain.

This unit is used mainly as cropland, but a considerable acreage is improved pasture. The main limitation for cultivated crops is that some soils are subject to occasional flooding in spring and fall.

This unit has high potential for cultivated farm crops, especially small grains and forage sorghums. Occasional flooding is difficult to overcome, making the potential for residential use low. The unit has high potential for wildlife habitat and for recreation areas. The Paluxy River and Dinosaur Valley State Park have areas for camping, picnicking, and fishing.

7. Krum-Sunev

Deep, nearly level to sloping, clayey and loamy soils that formed in calcareous, clayey and loamy sediments; on uplands

The soils of this unit are nearly level to sloping. They are in filled valleys and on foot slopes below soils underlain by limestone.

This unit makes up about 3 percent of the survey area. Krum soils make up about 32 percent of the unit; Sunev soils, about 31 percent; and minor soils, the remaining 37 percent.

Krum soils have a surface layer of dark grayish brown, calcareous clay about 29 inches thick. The subsoil is brown, calcareous clay that extends to a depth of 48 inches. The underlying material to a depth of 62 inches is brown, calcareous clay.

Sunev soils have a surface layer of brown, calcareous clay loam about 12 inches thick. The upper part of the subsoil is brown, calcareous clay loam that extends to a depth of 26 inches. The lower part is yellowish brown, calcareous clay loam that extends to a depth of 42 inches. The underlying material to a depth of 62 inches is very pale brown, calcareous clay loam.

Minor soils of this unit are Blanket, Bolar, Bosque, Denton, Maloterre, Purves, Seawillow, Tarrant, and Thurber soils. Blanket soils are in broad, shallow, filled valleys. The gently sloping Bolar soils are on benches between stony limestone soils. The nearly level Bosque soils are on flood plains of streams. The gently sloping Denton soils are on broad ridgetops at high elevations. The undulating to hilly Maloterre, Purves, and Tarrant soils are on ridgetops and breaks of limestone hills. The gently sloping to sloping Seawillow soils are on foot slopes below limestone soils. Thurber soils are in broad, shallow flats.

This unit is used mainly as cropland, but a considerable acreage is rangeland. The clayey surface layer, which is difficult to till under certain moisture conditions, is the main limitation. Too much lime and slopes that are too steep are also limitations for crops. Most of the acreage in range has been cleared of juniper, mesquite, and sumac.

With terracing and contour farming, this unit has high potential for cultivated farm crops. It has high potential for rangeland. The unit has medium potential for most residential uses because the shrinking and swelling of the clayey soils is a limitation that is difficult to overcome. Potential for wildlife habitat is medium.

Broad land use considerations

Table 4 gives the potential of each unit on the general soil map for several broad land uses. A more detailed explanation of these potentials is given in the following paragraphs.

Most map units in the survey area have medium to high potential for cultivated farm crops. Only map units 1 and 2 have low potential. The deep, sandy and loamy soils in units 3, 4, and 5 are mainly farmed to peanuts, grain sorghums, forage sorghums, and peach and pecan orchards. The deep, clayey and loamy soils in units 6 and 7 are mainly farmed to forage sorghums, grain sorghums, and oats.

All map units in the survey area have medium to high potential for pasture. Improved pasture grasses are dominantly bermudagrass, Kleingrass, and lovegrass. Well managed pasture requires proper grazing use to maintain adequate stubble height, fertilization to replace soil nutrients, and spraying or shredding to control weeds.

All map units have medium to high potential for range. The climax plant communities range from open prairies with tall and mid grasses to dense stands of scrub oak trees with tall grasses. Map units used as range also provide suitable habitat for wildlife. Units 1 and 2 furnish most of the habitat for deer and turkey. Units 4 and 6 furnish excellent habitat for small animals, such as birds and squirrels, and for larger animals such as deer.

Approximately 28,000 acres have been developed for urban uses in Hood and Somervell Counties. Granbury, Glen Rose, and the area around Lake Granbury are the major urban areas. Each year considerable land is being developed for urban uses in these areas, particularly around Lake Granbury. Much of this acreage had been well suited as cropland.

Most units in the survey area have limitations that affect urban development. Shallow depth to rock is a limitation in units 1 and 2. Occasional flooding is a limitation in units 4 and 6 and is difficult to overcome. The other units have limitations that can be overcome by proper design and careful installation procedures.

All units have high to low potentials for most recreational uses. Units 1 and 2 are on rugged terrain and support juniper, live oak, and other trees. These units are good nature study areas, wilderness areas, and hunting areas. Most deer in the survey area live in unit 1. Units 4 and 5 have flowing or intermittent streams, which make them good areas for nature trails, bird watching, hunting, and fishing. Fishing areas in units 4 and 5 include Lake Granbury, the Brazos River, and the Paluxy River. Map units 3 and 5 support a dense scrub forest with a thick understory of greenbriers and other plants. Nature trails, hunting, and fishing in small ponds are the main forms of recreation in these units. Quail are plentiful in old, grown-up fence rows.

Most of the map units have limitations for use as playgrounds. Units 2, 3, 4, and 5 have limitations, including small stones, slope, slow permeability, and flooding in places, that can be overcome by good design and careful installation. Map units 1, 6, and 7 are limited by large stones, the heavy clay texture, and occasional flooding. These limitations are difficult to overcome.

Soils information can be used as a guide in planning the orderly growth and development of the counties. It is especially helpful in determining what land should be allocated to each use.

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, Bastrop loamy fine sand, 1 to 5 percent slopes, is one of several phases within the Bastrop series.

Some map units are made up of two or more dominant kinds of soil. Such map units are called soil complexes, soil associations, and undifferentiated groups.

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

A *soil association* is made up of soils that are geographically associated and are shown as one unit on the map because it is not practical to separate them. A soil association has considerable regularity in geographic pattern and in the kinds of soil that are a part of it. The extent of the soils can differ appreciably from one delineation to another; nevertheless, interpretations can be made for use and management of the soils. Aledo-Bolar association, undulating, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because there is little value in separating them. The pattern and proportion of the soils are not uniform. An area shown on the map has at least one of the dominant (named) soils or may have all of them. Brackett soils, hilly, is an undifferentiated group in this survey area.

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

The acreage and proportionate extent of each map unit are given in table 5, 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—Aledo-Bolar association, undulating. This unit consists of gently sloping to strongly sloping, stony soils on limestone uplands. Areas have a slightly benched or stairstep appearance (fig. 5). Fragments of limestone from 1 to 12 inches across cover from 1 to 20 percent of the surface. Slopes are 1 to 8 percent. Areas are irregular in shape and range from 30 to 1,000 acres in size.

About 60 percent of this association is Aledo soils, about 20 percent is Bolar soils, and about 20 percent is other soils and rock outcrops. Aledo soils are on ridgetops and in narrow bands 300 to 700 feet wide along upper benches, and Bolar soils are on mid to lower benches and on foot slopes. Some areas of Aledo and Bolar soils are large enough that they could have been mapped separately, but since use and management are similar, separate mapping was not justified.

Typically, Aledo soils have a surface layer of dark grayish brown, calcareous gravelly clay loam and very gravelly clay loam about 14 inches thick. Coarsely fractured limestone is at a depth of 14 inches.

Aledo soils are high in natural fertility and organic matter content. Permeability is moderate, and available water capacity is very low. The root zone is shallow because the soil is shallow over rock.

Typically, Bolar soils have a surface layer of dark grayish brown, calcareous stony clay loam and clay loam about 13 inches thick. The subsoil is light brownish gray, calcareous clay loam to a depth of 22 inches and very pale brown, calcareous clay loam to a depth of 28 inches. Fractured limestone is at a depth of about 28 inches.

Bolar soils are high in natural fertility and organic matter content. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep, and the soil is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Brackett, Maloterre, Purves, and Tarrant soils. Also included are a few outcrops of limestone bedrock. The steep Brackett soils are along breaks at higher elevations. Maloterre soils are on the outer edges of benches. Purves and Tarrant soils are in oblong areas on ridgetops and on narrow, stony rims above steep breaks. Also included are small areas of Aledo soils having slopes of as much as 12 percent. Included soils make up less than 20 percent of any mapped area.

These soils are used as range. They have medium potential for range production because of content of stones, low available water capacity, and the restricted root zone. The climax plant community is a mixture of tall and mid grasses and a few motts of live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low for cultivated crops or pasture. The shallow root zone and content of stones are limitations that are very difficult to overcome.

These soils have low potential for most urban uses. Depth to rock, content of stones, and slope are limitations that are difficult to overcome. Aledo part in capability subclass VIs, Shallow range site; Bolar part in capability subclass VIs, Clay Loam range site.

2—Bastrop loamy fine sand, 1 to 5 percent slopes. This deep, well drained, gently sloping soil is on geologic terraces, mostly along the Brazos River. Areas are irregular in shape and range from 10 to 300 acres in size, but average about 30 acres.

Typically, the surface layer is light brown, medium acid loamy fine sand about 10 inches thick. The subsoil is yellowish red sandy clay loam that extends to a depth of about 78 inches; it is neutral in the upper part and slightly acid in the lower part. The underlying material to a depth of 80 inches is reddish yellow, neutral sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is medium. This soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Decordova, Duffau, Hassee, and Pedernales soils. Decordova soils are on flood plains. Duffau soils are in transitional areas between soils of alluvial origin and those formed on uplands. Hassee soils are in small, circular to oblong depressions. Pedernales soils are in circular to oblong areas on low knolls. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops and small grains. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Soil blowing is a hazard if cultivated crops are grown. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help reduce runoff and control soil blowing. Potential is high for pasture production. Bermudagrass and lovegrass are well suited to this soil.

Potential is high for range production. The climax plant community is a mixture of tall and mid grasses with post oak and blackjack oak trees. The soil has high potential for fruit and pecan trees.

This soil has high potential for most urban uses. Low strength is a limitation for local roads and streets, but this limitation can be easily overcome by good design and careful installation. Capability subclass IIIe; Loamy Sand range site.

3—Bastrop fine sandy loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on geologic terraces, mostly along the Brazos River. Areas are irregular in shape and range from 10 to 40 acres in size, but average about 15 acres.

Typically, the surface layer is brown, slightly acid fine sandy loam about 14 inches thick. The subsoil is yellowish red, slightly acid sandy clay loam to a depth of 36 inches and yellowish red, neutral sandy clay loam to a depth of 76 inches. The underlying material to a depth of 80 inches is reddish yellow, calcareous sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Decordova, Hassee, Paluxy, and Pedernales soils. Decordova soils are on flood plains. Hassee soils are in small, circular to oblong depressions. Paluxy soils are in long, narrow bands adjacent to the flood plain. Pedernales soils are in oblong areas on low knolls. Included soils make up less than 10 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. Soil blowing is a hazard if cultivated crops are grown. Minimum tillage and the use of cover crops, including grasses and legumes, help control erosion. This soil has high potential for pasture production. Bermudagrass and lovegrass are well suited. This soil also has high potential for fruit and pecan trees.

Potential is high for native range plants. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees.

This soil has high potential for most urban uses. Low strength is a limitation for local roads and streets, but this limitation can be easily overcome by good design and careful installation. Capability class I; Sandy Loam range site.

4—Bastrop fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on geologic terraces mostly along the Brazos River. Areas are irregular in shape and range from 10 to 100 acres in size, but average about 20 acres.

Typically, the surface layer is brown fine sandy loam about 13 inches thick. It is slightly acid in the upper part and medium acid in the lower part. The subsoil is yellowish red, slightly acid sandy clay loam that extends to a depth of 80 inches or more.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Decordova, Duffau, Hassee, Paluxy, and Pedernales soils. Decordova soils are on flood plains. Duffau soils are in transitional areas between alluvial soils and upland soils of other origin. Hassee soils are in small, circular to oblong depressions. Paluxy soils are in long, narrow bands adjacent to the flood plain. Pedernales soils are in oblong areas on low knolls and in other areas at slightly higher elevations. Included soils make up less than 15 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Soil blowing is a hazard. Minimum tillage and the use of cover crops, including grasses and legumes, help control erosion. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. Terraces and contour cultivation also help control erosion. This soil has high potential for fruit trees and pecan trees.

Potential is high as pastureland. Improved grasses such as bermudagrass and lovegrass are suited. The soil also has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees.

This soil has high potential for most urban uses. Low strength is a limitation for local roads and streets, but this limitation can be easily overcome by good design and careful installation. Capability subclass IIe; Sandy Loam range site.

5—Bastrop fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on geologic terraces mostly along the Brazos River. Areas are irregular in shape and range from 15 to 100 acres in size.

Typically, the surface layer is brown, neutral fine sandy loam about 12 inches thick. The subsoil is yellowish red, neutral to moderately alkaline sandy clay loam to a depth of 64 inches and reddish yellow, moderately alkaline sandy clay loam to a depth of 80 inches or more.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Paluxy, Pedernales, and Windthorst soils. Paluxy soils are on flood plains. Pedernales and Windthorst soils are in transitional areas between alluvial soils and soils of other origin. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as range and pastureland. It has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak, blackjack oak, and hackberry trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has high potential as pastureland. Bermudagrass and lovegrass are well suited. Management concerns on pastureland are proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or shredding to control weeds.

Potential is medium for row crops and small grains. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Because of slope, a contour cropping system and terraces are needed to prevent erosion.

This soil has high potential for most urban uses. Low strength is a limitation for local roads and streets, but this limitation can be easily overcome by good design and careful installation. Capability subclass IIIe; Sandy Loam range site.

6—Bastrop fine sandy loam, 1 to 5 percent slopes, eroded. This deep, well drained, gently sloping soil is on geologic terraces on uplands mostly along the Brazos River. Areas are irregular in shape and range from 10 to 200 acres in size, but average about 20 acres. Sheet erosion has removed most of the surface layer, and the soils are dissected by small drainageways and rills about 4 to 10 feet wide, 20 to 50 feet apart, and 4 to 16 inches deep.

Typically the surface layer is brown, slightly acid fine sandy loam about 5 inches thick. The subsoil is red, neutral sandy clay loam to a depth of 28 inches and yellowish red, neutral sandy clay loam to a depth of 72 inches. The underlying material to a depth of 80 inches is reddish yellow, mildly alkaline loam that contains pockets of fine sandy loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is high. The soil has fair tilth and can be worked throughout only a narrow range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Hassee, Pedernales, and Windthorst soils. Hassee soils are in small, oblong to circular depressions and have slopes of less than 2 percent. Pedernales and Windthorst soils are on low knolls and ridges at slightly higher elevations. Also included are areas of Bastrop soils that have a surface layer of sandy clay loam or clay loam. Included soils make up less than 20 percent of any mapped area.

This soil is used dominantly as pastureland and range, which consists of old cultivated fields no longer being cultivated. It has medium potential as pastureland. Bermudagrass, lovegrass, and Kleingrass are well suited to this soil. Management concerns on pastureland are proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or shredding to control weeds. This soil has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak, blackjack oak, and hackberry trees.

Potential is medium for most row crops. The soil is better suited to small grains than to other crops. The soil has medium potential for peanuts because the surface layer has been thinned by erosion.

This soil has high potential for most urban uses. Low strength and slope are limitations, but these limitations can be easily overcome by good design and careful installation. Capability subclass IIIe; Sandy Loam range site.

7—Bastrop fine sandy loam, 5 to 8 percent slopes. This deep, well drained, sloping soil is on foot slopes above the flood plain of the Brazos River. Areas are irregular in shape and range from 15 to 50 acres in size.

Typically, the surface layer is brown, neutral fine sandy loam about 14 inches thick. The subsoil is reddish brown, neutral sandy clay loam to a depth of 32 inches and yellowish red, neutral sandy clay loam to a depth of 67 inches. The underlying material to a depth of 80 inches is reddish yellow, moderately alkaline sandy clay loam.

This soil is low in natural fertility and organic matter content. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Paluxy, Pedernales, and Tarrant soils. Paluxy soils are on flood plains. Pedernales soils are at the tops of slopes. Tarrant soils are on remnants of limestone hills along the Brazos River. Also included are areas of eroded Bastrop soils marked by drainageways and a few shallow gullies. Included soils make up less than 15 percent of any mapped area.

This soil is dominantly used as range. It has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak, blackjack oak, and hackberry trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has high potential as pastureland. Bermudagrass and lovegrass are well suited.

Potential is medium as cropland. The soil is better suited to small grains than to other crops. Most areas of this soil are not cultivated because the steep slopes require extensive terrace systems and other management practices.

Potential for most urban uses is high. Low strength is a limitation for local roads and streets, and slope is a limitation for small commercial buildings. These limitations can be easily overcome by good design and careful installation. Capability subclass IVe; Sandy Loam range site.

8—Bastrop complex, gullied. This complex consists of deep, well drained, undulating soils. These soils are on geologic terraces on uplands along the Brazos River. Areas are irregular in shape and range from 10 to 25 acres in size. Slopes range from 1 to 8 percent.

About 50 percent of this unit is Bastrop soils; 30 percent is gullies, 4 to 30 feet wide and 2 to 12 feet deep, that have nearly vertical banks; and about 20 percent is minor soils. Areas between gullies are mostly noneroded Bastrop soils, but these areas are inaccessible because of the gullies (fig. 6). These gullies and the Bastrop soils are so intricately mixed or so small that they cannot be shown separately at the scale mapped.

Typically, the surface layer is brown, slightly acid fine sandy loam about 10 inches thick. The subsoil is reddish brown, neutral sandy clay loam to a depth of 34 inches and brown, neutral to mildly alkaline sandy clay loam to a depth of 80 inches or more.

These soils are low in natural fertility and organic matter content. Permeability is moderate, and available water capacity is high. The root zone is deep, and the soil can be easily penetrated by plant roots.

Included with these soils in mapping are small areas of Paluxy, Pedernales, and Windthorst soils. The sloping Paluxy soils are just above the flood plain. Pedernales and Windthorst soils are at higher elevations on side slopes. Included soils make up less than 20 percent of any mapped area.

These soils are dominantly used as range, but they have low potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. Potential is low for pastureland. Gullies can be shaped and planted to bermudagrass, but this is expensive.

These soils have low potential for cropland and most urban uses because of the deep gullies. Capability subclass VIe; Sandy Loam range site.

9—Blanket clay loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is in broad, shallow valleys of uplands. Areas are irregular in shape and range from 10 to 60 acres in size, but average about 20 acres.

Typically, the surface layer is dark grayish brown clay loam about 12 inches thick. It is neutral in the upper part and mildly alkaline in the lower part. The subsoil is very dark grayish brown, mildly alkaline clay to a depth of 30 inches; dark grayish brown, calcareous clay to a depth of 42 inches; and brown, calcareous clay to a depth of 54 inches. The underlying material to a depth of 62 inches is grayish brown, calcareous clay.

This is a productive soil. Organic matter content is high. Permeability is moderately slow, and available water capacity is high. The soil has good tilth and can be worked over a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Frio, Thurber, and Venus soils. Frio soils are generally near a major stream. Thurber soils are in irregularly shaped areas in different landscape positions. Venus soils are in long, narrow bands close to streams. Also included is a soil that has a surface layer of fine sandy loam and that is on the outer edges of areas joining sandy soils. Included soils make up less than 15 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Potential is high for pasture production. Kleingrass and bermudagrass are well suited.

Potential is high for range production. The climax plant community is a mixture of tall and mid grasses and scattered post oak, live oak, and elm trees.

This soil has medium potential for most urban uses. Shrinking and swelling upon wetting and drying and low strength are limitations, but these limitations can be overcome by good design and careful installation. The clayey lower layers take in water slowly. This is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the adsorption area or by modifying the filter field. Also, the clayey lower layers severely limit potential for shallow excavations. Capability subclass IIe; Clay Loam range site.

10—Bolar clay loam, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping soil is on ridges on uplands and is surrounded by shallow, limestone soils. Areas are irregular in shape and range from 10 to 30 acres in size.

Typically, the surface layer is dark grayish brown and very dark grayish brown, calcareous clay loam about 15 inches thick. The subsoil is grayish brown, calcareous clay loam to a depth of 30 inches and pale brown, calcareous clay loam to a depth of 34 inches. Fractured limestone bedrock interbedded with calcareous clayey marl is at a depth of 34 inches.

This is a productive soil. Organic matter content is high. Permeability is moderate, and available water capacity is medium. The soil has fair tilth and can be worked well under only a narrow range of moisture content. The root zone is moderately deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Denton, Krum, and Purves soils. Denton soils are in irregularly shaped, slightly convex areas generally close to the center of a mapped area. Krum soils are at lower elevations in drainageways. Purves soils are in oblong areas on low knolls and in irregularly shaped areas near the edges of a mapped area. Also included are soils in which limestone is below a depth of 40 inches. Soils that contain broken stone lines and that have fragment content of more than 15 percent in the upper part are included in places. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as range. It has high potential for range production. The climax plant community is a mixture of mid and short grasses and scattered live oak and Spanish oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Kleingrass and bermudagrass are well suited.

Potential is high as cropland. Small grains are the main crop. Return of crop residue to the soil helps maintain productivity and tilth.

Potential for most urban uses is medium. Depth to rock is a limitation for septic tank absorption fields, sewage lagoons, and trench type sanitary landfills, and this limitation is very difficult to overcome. Low strength is a limitation for dwellings, small commercial buildings, and local roads and streets, but this limitation can be easily overcome by good design and careful installation. Capability subclass IIe; Clay Loam range site.

11—Bolar clay loam, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping soil is on narrow side slopes of uplands. Areas are usually long, narrow bands between more sloping, shallow limestone soils. They range from 10 to 50 acres in size, but average about 30 acres.

Typically, the surface layer is dark grayish brown and grayish brown, calcareous clay loam about 12 inches thick. The subsoil is light yellowish brown, calcareous clay loam to a depth of 38 inches. This is underlain by fractured limestone bedrock interbedded with calcareous clayey marl.

This is a productive soil. Organic matter content is high. Permeability is moderate, and available water capacity is medium. The soil has fair tilth and can be worked well under only a narrow range of moisture content. The root zone is moderately deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Denton, Purves, Sunev, and Tarrant soils. Denton soils are in irregularly shaped areas. Purves soils are in narrow strips at the tops of slopes and at the bottoms of slopes between shallow, limestone soils. Sunev soils are near the outlets of drainageways. Tarrant soils are in narrow strips generally on the edges of mapped areas. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as range. It has high potential for range production. The climax plant community is a mixture of mid and short grasses with scattered live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Kleingrass and bermudagrass are well suited.

Potential is medium as cropland. The shape of mapped areas, their location, and slope are limitations if this soil is to be cropped. Small grains are better suited than other cultivated crops.

This soil has medium potential for most urban uses. Depth to rock is a limitation for septic tank absorption fields, sewage lagoons, and trench type sanitary landfills, and this limitation is very difficult to overcome. Low strength is a limitation for dwellings, small commercial buildings, and local roads and streets, but this limitation can be easily overcome by good design and careful installation. Capability subclass IIIe; Clay Loam range site.

12—Bosque loam, occasionally flooded. This deep, well drained, nearly level soil is on the flood plains of major streams. It is flooded occasionally for short periods. Areas are long and oblong in shape and range from 10 to 150 acres in size, but average about 50 acres.

Typically, the surface layer is dark grayish brown, calcareous loam to a depth of 20 inches and grayish brown, calcareous clay loam to a depth of 30 inches. The subsoil is light brownish gray, calcareous clay loam that extends to a depth of 46 inches. The underlying material to a depth of 62 inches is pale brown, calcareous clay loam.

This is a productive soil. Organic matter content is high. The soil is flooded occasionally for short periods. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Frio, Venus, and Yahola soils. Frio soils are in lower lying areas. Venus soils are on the outer edge of the flood plain or in oblong to circular areas throughout mapped areas. Yahola soils are in long, narrow, oblong areas close to the stream's edge in a position several feet below the Bosque soils. Included soils make up less than 20 percent of the map unit.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, maintain tilth, and maintain productivity. In some lower areas a small dike adjacent to the stream channel is necessary to prevent occasional overflow. Potential for pasture production is high. Improved grasses such as Kleingrass and bermudagrass are well suited.

Potential for range production is high. The climax plant community is a mixture of tall and mid grasses with scattered pecan, cottonwood, live oak, and elm trees. This soil has high potential for openland wildlife habitat. Habitat is favorable for many birds, small animals, and deer.

This soil has low potential for most urban uses. Flooding is the main limitation, and it can be overcome only by major flood control measures. Capability subclass IIw; Loamy Bottomland range site.

13—Brackett soils, hilly. This map unit consists of loamy soils on uplands. Slopes are 10 to 30 percent. Areas are irregular in shape and range from 25 to 400 acres in size.

This unit is made up dominantly of Brackett soils on hillsides. Brackett soils having variable surface textures make up about 65 percent of the unit. Rock outcrops and soils that are similar to Brackett soils but that are underlain by hard limestone or that are very shallow over chalky material make up the remainder of the unit. The proportions of these soils vary, and not all of these soils are in all mapped areas.

Typically, the surface layer is light brownish gray, calcareous loam about 4 inches thick. The subsoil is very pale brown, calcareous clay loam that extends to a depth of 16 inches. The underlying material to a depth of 40 inches is very pale brown, calcareous gravelly clay loam that shows cleavage planes of rock structure.

Brackett soils are low in natural fertility. Permeability is moderately slow, and available water capacity is low. The root zone is restricted because the soil is shallow over fragments of limestone.

Included with these soils in mapping are small areas of Bolar, Maloterre, Seawillow, and Tarrant soils. Bolar and Seawillow soils are in drainageways and on foot slopes. Maloterre soils are on narrow bands around the slopes. Tarrant soils are in narrow bands around the rims of slope breaks. Also included are Rock outcrops on ridges and areas of Brackett soils having slopes of as much as 45 percent. Included soils make up about 35 percent of the map unit.

These soils are used as range. They have low potential for range production. The climax plant community is a mixture of tall, mid, and short grasses with scattered Spanish oak and live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low as cropland or pastureland. The shallow root zone, steep slopes, and limestone fragments on the surface are limitations that are very difficult to overcome.

These soils have low potential for most urban uses. Depth to rock and slope are limitations that are very difficult to overcome. Most areas, however, have a scenic view. Capability subclass VIIs; Steep Adobe range site.

14—Bunyan fine sandy loam, occasionally flooded. This deep, well drained, nearly level soil is on flood plains of small streams. It is flooded occasionally in areas next to shallow stream channels. Areas are long and narrow and range from 10 to 60 acres in size.

Typically, the surface layer is brown, slightly acid fine sandy loam about 8 inches thick. The underlying material is alluvial. It is brown, neutral clay loam to a depth of 20 inches; grayish brown, mildly alkaline clay loam to a depth of 34 inches; pale brown, calcareous fine sandy loam to a depth of 45 inches; grayish brown, calcareous fine sandy loam to a depth of 58 inches; and light brownish gray, calcareous clay loam to a depth of 62 inches.

Crops on this soil respond well to fertilization. Organic matter content is low. Most areas are flooded occasionally for brief periods. Permeability is moderate, and available water capacity is high. The soil has fair tilth and can be worked through only a narrow range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bosque and Frio soils. Bosque and Frio soils occur in irregular patterns where the flood plain broadens. Also included is a soil that is similar to Bunyan soils except that clay content in the fine earth fraction is less than 18 percent. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as pastureland. It has high potential for pasture production. Management concerns include proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or shredding to control weeds. Bermudagrass, lovegrass, and Kleingrass are well suited to this soil. Potential as cropland is medium. High yields can be obtained, but the hazard of flooding lowers the potential of the soil for crops.

Potential for range production and wildlife habitat is high. The climax plant community is a mixture of tall, mid, and short grasses with scattered pecan, elm, cottonwood, and live oak trees. This vegetation provides favorable habitat for many birds, small animals, and deer.

This soil has low potential for most urban uses. Flooding is the main limitation, and this can only be overcome by major flood control measures. Capability subclass IIw; Loamy Bottomland range site.

15—Chaney loamy fine sand, 1 to 5 percent slopes. This deep, moderately well drained, gently sloping soil is on broad uplands. Areas are irregular in shape and range from 6 to 200 acres in size, but average about 20 acres.

Typically, the surface layer is pale brown, slightly acid loamy fine sand about 12 inches thick. The upper part of the subsoil is yellowish brown, slightly acid sandy clay that has red and yellowish brown mottles and that extends to a depth of 17 inches. The middle part is brownish yellow, medium acid sandy clay that has red and light gray mottles and that extends to a depth of 34 inches. The lower part is light gray, strongly acid sandy clay that has yellowish brown, brownish yellow, and red mottles and that extends to a depth of 44 inches. The underlying material to a depth of 56 inches is mottled light gray, brownish yellow, yellowish brown, dark red, and red, slightly acid sandy clay loam and to a depth of 72 inches is light olive gray, calcareous shaly clay that has yellowish mottles.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is slow, and available water capacity is medium. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, but root movement is restricted by the sandy clay lower layers. In places during wet seasons, a water table is perched above the sandy clay lower layers.

Included with this soil in mapping are small areas of Chaney loamy fine sand, 1 to 5 percent slopes, eroded, and small areas of Demona, Nimrod, Pedernales, and Windthorst soils. The eroded Chaney soil is in irregularly shaped areas in windblown cultivated fields. Demona and Nimrod soils are in areas where the surface layer is thicker. Pedernales soils are in circular to oblong patterns at the highest point on a knoll. Windthorst soils are in oblong patterns on knolls but are not so high in the landscape as Pedernales soils. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops and small grains (fig. 7). Soil blowing is a hazard. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help control erosion. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. This soil has high potential for pasture production. Improved grasses, such as bermudagrass and lovegrass, are well suited.

Potential is medium for range production. The climax plant community is a mixture of tall and mid grasses and thick stands of scrub post oak and blackjack oak.

This soil has medium potential for most urban uses. The clayey lower layers take in water slowly. This is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Low strength is a limitation for local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIIe; Loamy Sand range site.

16—Chaney loamy fine sand, 1 to 5 percent slopes, eroded. This deep, moderately well drained, gently sloping soil is on uplands and has a plane to convex surface. Areas are irregular in shape and range from 6 to 50 acres in size, but average about 12 acres. Erosion has thinned the surface layer to less than 6 inches and has left rills near the breaks of convex slopes.

Typically, the surface layer is light brown, slightly acid loamy fine sand about 3 inches thick. The subsoil is mottled yellowish red and strong brown, slightly acid sandy clay to a depth of 16 inches; mottled red, white, yellowish brown, and yellowish red, slightly acid sandy clay to a depth of 35 inches; and mottled white, light gray, red, dark red, yellowish brown, and brownish yellow, slightly acid sandy clay to a depth of 48 inches. The underlying material to a depth of 62 inches is coarsely mottled light gray, yellowish brown, and yellowish red, medium acid sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is slow, and available water capacity is high. The soil has fair tilth and can be worked best under a narrow range of moisture content. The root zone is deep, but root movement is restricted by the sandy clay lower layers. In places during wet seasons, a water table is perched above the sandy clay lower layers.

Included with this soil in mapping are small areas of Windthorst soils. Windthorst soils are on low knolls and ridges. Also included are small areas of soils in which deep tillage has mixed the sandy clay subsoil with the loamy fine sand surface layer to produce a surface layer of sandy clay loam to fine sandy loam. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as pastureland. It has high potential for pasture production. Improved grasses such as bermudagrass and lovegrass are well suited to this soil. Management concerns include proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or shredding to control weeds. This soil has medium potential for cropland production. Where the soil has a very thin surface layer, it is droughty; this causes plants to go into stress quickly.

Potential is low as range. The climax plant community is a mixture of tall and mid grasses with thick stands of scrub post oak and blackjack oak trees.

Potential for most urban uses is medium. The clayey lower layers take in water slowly. This is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Low strength is a limitation for local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIIe; Loamy Sand range site.

17—Decordova loamy fine sand, 0 to 5 percent slopes. This deep, well drained, nearly level to gently sloping soil is on upland geologic terraces. Areas are irregular in shape and range from 20 to 300 acres in size.

Typically, the surface layer is light brown, slightly acid loamy fine sand about 14 inches thick. The subsoil is yellowish red, slightly acid fine sandy loam to a depth of 58 inches; reddish yellow, slightly acid fine sandy loam to a depth of 78 inches; and yellowish red, neutral fine sandy loam to a depth of 80 inches.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately rapid, and available water capacity is medium. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bastrop, Duffau, Paluxy, and Pedernales soils. Bastrop soils are in irregularly shaped areas in a random pattern. Duffau soils are at higher elevations and on knolls in oblong areas. Paluxy soils are at lower elevations above the soils on flood plains. Pedernales soils are on the upper parts of slopes on sharp slope breaks. Also included is a soil that is similar to Decordova soils except that the sandy surface layer is 20 to 30 inches thick. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops, truck crops, and small grains. Soil blowing is a hazard. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help control erosion. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. Potential is medium for pasture production. Bermudagrass and lovegrass are well suited.

Potential is medium as range. The climax plant community is a mixture of tall and mid grasses with thick stands of post oak and blackjack oak trees.

This soil has high potential for most urban uses. Seepage is a limitation for sewage lagoons and area type sanitary landfills, and this limitation is very difficult to overcome. The soil is too sandy to be used for trench type sanitary landfills. Capability subclass IVe; Loamy Sand range site.

18—Demona loamy fine sand, 1 to 5 percent slopes. This deep, moderately well drained, gently sloping soil is on broad uplands. Areas are irregular in shape and range from 10 to 300 acres in size, but average about 30 acres. Surfaces are plane to convex, and some areas have an undulating surface.

Typically, the surface layer is brown, slightly acid loamy fine sand about 4 inches thick. The subsurface layer is very pale brown, slightly acid loamy fine sand that extends to a depth of 34 inches. The upper part of the subsoil is brownish yellow, medium acid sandy clay that has mottles of red, yellowish brown, brownish yellow, and light brownish gray and that extends to a depth of 40 inches. The middle part is light gray, medium acid sandy clay that has mottles of yellowish brown and red and that extends to a depth of 48 inches. The lower part is light gray, medium acid sandy clay loam that has mottles of red, brownish yellow, and yellowish brown and that extends to a depth of 56 inches. The underlying material to a depth of 80 inches is white, strongly acid sandy clay loam that has mottles of light red, red, yellowish brown, and brownish yellow.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is low. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, but root movement is restricted by the sandy clay lower layers. During wet seasons, a temporary water table is perched above the sandy clay lower layers.

Included with this soil in mapping are small areas of Chaney, Nimrod, and Patilo soils. Chaney soils are on low knolls. Nimrod soils are in a random pattern. Patilo soils are on ridges at higher elevations. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops. Soil blowing is a hazard. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help control erosion. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. This soil has high potential for pasture production. Improved grasses such as bermudagrass and lovegrass are well suited.

Potential for range production is medium. The climax plant community is a mixture of tall and mid grasses and thick stands of scrub post oak and blackjack oak trees and greenbrier.

This soil has medium potential for most urban uses. The clayey lower layers take in water slowly. This is a limitation for septic tank absorption fields and is difficult to overcome. Seepage and wetness are limitations for sewage lagoon areas, area type sanitary landfills, and shallow excavations, and these limitations are also very difficult to overcome. Capability subclass IIIe; Sandy range site.

19—Denton clay, 1 to 3 percent slopes. This moderately deep, well drained, gently sloping soil is on uplands. Soil areas are irregular in shape and range from 15 to 100 acres in size. The surface is plane to slightly concave.

Typically, the surface layer is dark grayish brown and brown, calcareous clay about 32 inches thick. The underlying material, to a depth of 38 inches, is brown, calcareous very gravelly clay. At a depth of 38 inches is fractured limestone.

This is a productive soil. Organic matter content is high. Permeability is slow, and available water capacity is medium. The soil has fair tilth and is worked best under a narrow range of moisture content. The root zone is moderately deep, and the movement of roots is slightly restricted by the clayey lower layers.

Included with this soil in mapping are small areas of Aledo, Bolar, Krum, and Purves soils. Aledo soils are in oblong patterns on isolated low, stony knolls. Bolar soils are on the lower parts of foot slopes. Krum soils are along drainageways or in shallow, filled valleys. Purves soils are on the outer edges of mapped areas and in places at slightly higher elevations in mapped areas. Included soils make up less than 30 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Terraces and contour cultivation help control erosion. This soil has medium potential as pastureland. Kleingrass and bermudagrass are well suited.

Potential is high for range production. The climax plant community is a mixture of tall and mid grasses with scattered motts of live oak trees.

This soil has low potential for most urban uses. Depth to rock and shrinking and swelling upon wetting and drying are limitations that are very difficult to overcome. Capability subclass IIe; Clay Loam range site.

20—Denton clay, 3 to 5 percent slopes. This moderately deep, well drained, gently sloping soil is on side slopes on uplands. Areas are irregular in shape and range from 15 to 30 acres in size.

Typically, the surface layer is very dark grayish brown and brown, calcareous clay about 32 inches thick. The underlying material to a depth of 35 inches is pale brown, calcareous clay. Fractured limestone is at a depth of 35 inches.

This is a productive soil. Organic matter content is high. Permeability is slow, and available water capacity is medium. The soil has fair tilth and can be worked well under only a narrow range of moisture content. The root zone is moderately deep, and the movement of roots is slightly restricted by the clayey lower layers.

Included with this soil in mapping are small areas of Bolar, Purves, and Sunev soils. Bolar soils are generally at the bottoms of slopes. Purves soils are on slight ridges and adjacent to shallow, stony, limestone soils. Sunev soils are in small drainageways. Also included is a soil that is more than 40 inches deep over limestone. Included soils are in areas of less than 10 acres and make up less than 20 percent of any mapped area.

This soil is dominantly used as rangeland. It has high potential for range production. The climax plant community is a mixture of tall and mid grasses with a few motts of live oak trees. Management concerns include proper grazing, adequate rest periods, and brush management. This soil has medium potential as pastureland. Kleingrass and bermudagrass are well suited to this soil.

Potential is medium as cropland mainly because of slope. Small grains are the main crop.

The soil has low potential for most urban uses. Depth to rock and shrinking and swelling upon wetting and drying are limitations that are very difficult to overcome. Capability subclass IIIe; Clay Loam range site.

21—Duffau loamy fine sand, 1 to 5 percent slopes. This deep, well drained, gently sloping soil is in shallow valleys of uplands. Areas are irregular in shape and range from 10 to 60 acres in size.

Typically, the surface layer is brown, neutral loamy fine sand about 12 inches thick. The subsoil is yellowish red, neutral sandy clay loam to a depth of 22 inches; reddish yellow, slightly acid sandy clay loam to a depth of 44 inches; and mottled very pale brown, yellowish red, and reddish yellow, medium acid sandy clay loam to a depth of 80 inches or more.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chaney and Windthorst soils. Chaney soils are on the lower parts of slopes. Windthorst soils are in oblong patterns on the higher parts of slopes and on low knolls. Also included are areas of Duffau fine sandy loam in a random pattern. Included soils make up less than 15 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops and small grains. It is well suited to peanuts. Soil blowing is a hazard. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help control soil blowing. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. Potential is high for pasture production. Improved grasses such as bermudagrass and lovegrass are well suited.

Potential is high for range production. The climax plant community is a mixture of tall and mid grasses and thick stands of post oak and blackjack oak trees and greenbrier.

This soil has high potential for most urban uses. Low strength is a limitation for dwellings, small commercial buildings, and local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIIe; Loamy Sand range site.

22—Duffau fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is in shallow valleys of uplands. Areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is brown, slightly acid fine sandy loam about 12 inches thick. The upper part of the subsoil is yellowish red, neutral sandy clay loam that extends to a depth of 32 inches. The middle part is reddish brown, neutral sandy clay loam that extends to a depth of 40 inches. The lower part is reddish yellow, neutral sandy clay loam that has brownish yellow and red mottles and that extends to a depth of 64 inches. The underlying material to a depth of 80 inches is mottled reddish yellow, very pale brown, and yellowish red, neutral fine sandy loam that contains thin, discontinuous bands of weakly cemented sandstone.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chaney, Pedernales, and Windthorst soils. Chaney soils are on the lower parts of slopes. Pedernales and Windthorst soils occur in circular to oblong patterns on the higher parts of slopes and on low knolls. Also included is a soil that is similar to Duffau soils except that the sandy clay loam layers are less than 60 inches deep over a less clayey layer. A soil that has browner hues in its lower layers is also included. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as pastureland. It has high potential for pasture production. Bermudagrass and lovegrass are well suited. Management concerns include proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or shredding to control weeds. This soil has high potential as cropland. Peanuts, grain sorghums, and forage sorghums are well suited.

Potential is high as rangeland. The climax plant community is a mixture of tall and mid grasses with post oak and blackjack oak trees and greenbriers.

This soil has high potential for most urban uses. Low strength is a limitation for dwellings, small commercial buildings, and local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIe; Sandy Loam range site.

23—Duffau fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on foot slopes on uplands. Areas are irregular in shape and range from 10 to 100 acres in size, but average about 20 acres.

Typically, the surface layer is yellowish brown, neutral fine sandy loam about 3 inches thick. The subsurface layer is light yellowish brown, neutral fine sandy loam to a depth of 14 inches. The subsoil is red, slightly acid sandy clay loam to a depth of 36 inches; yellowish red, slightly acid sandy clay loam to a depth of 46 inches; and reddish yellow, neutral sandy clay loam to a depth of 64 inches. The underlying material to a depth of 80 inches is reddish yellow, mildly alkaline sandy clay loam that contains pockets of fine sandy loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is medium. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Pedernales, Seawillow, and Windthorst soils. Pedernales and Windthorst soils are on small knolls and narrow ridges. Seawillow soils are on the upper parts of slopes. Also included are soils that are similar to Duffau soils except that they have calcareous underlying material at a depth of less than 60 inches. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as rangeland. It has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. The soil has high potential as pastureland. Bermudagrass and lovegrass are well suited.

Potential as cropland is medium. Terraces and contour cultivation help control erosion.

This soil has high potential for most urban uses. Low strength and slope are limitations for dwellings, small commercial buildings, local roads and streets, and sewage lagoon areas, but these limitations can be overcome by good design and careful installation. Capability subclass IIIe; Sandy Loam range site.

24—Duffau fine sandy loam, 1 to 5 percent slopes, eroded. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to 140 acres in size, but average about 20 acres. The soil has been subjected to moderate to severe sheet erosion and in places is dissected by small rills that can be obliterated by tillage. The rills are at varying intervals depending on water concentration and slope.

Typically, the surface layer is light brown, slightly acid fine sandy loam about 4 inches thick. The subsoil is yellowish red, neutral sandy clay loam to a depth of 46 inches and reddish yellow, neutral sandy clay loam to a depth of 68 inches. The underlying material to a depth of 72 inches is reddish yellow, neutral sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderate, and available water capacity is medium. The soil has fair tilth and can be worked well under only a narrow range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Chaney, Pedernales, and Windthorst soils. Chaney soils, which are eroded, are generally in lower areas. Pedernales and Windthorst soils are generally on knolls or at slightly higher elevations. Also included are areas of soils that have a surface layer of sandy clay loam or clay loam caused by the mixing of the subsoil with the surface layer during plowing. Included soils make up less than 25 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops and small grains. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Terraces and contour cultivation help control erosion. Grain and forage sorghums are the best suited crops.

Potential is medium as pastureland. Well suited improved grasses are bermudagrass, lovegrass, and Kleingrass. The soil has medium potential for native plants.

This soil has high potential for most urban uses. Low strength and slope are limitations for dwellings, small commercial buildings, local roads and streets, and sewage lagoon areas, but these limitations can be overcome by good design and careful installation. Capability subclass IIIe; Sandy Loam range site.

25—Duffau fine sandy loam, 5 to 8 percent slopes. This deep, well drained, sloping soil is on foot slopes on uplands. Areas are irregular in shape and range from 15 to 40 acres in size.

Typically, the surface layer is yellowish brown, slightly acid fine sandy loam about 4 inches thick. The subsurface layer is pale brown, slightly acid fine sandy loam to a depth of 10 inches. The subsoil is yellowish red, slightly acid sandy clay loam to a depth of 36 inches; and yellowish red, neutral sandy clay loam to a depth of 66 inches. The underlying material to a depth of 80 inches is pink, neutral, weakly cemented sandstone.

This soil is low in natural fertility and organic matter content. Permeability is moderate, and available water capacity is medium. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Pedernales, Sunev, and Windthorst soils. Pedernales and Windthorst soils are on the higher parts of slopes. Sunev soils are below areas of limestone soils. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as rangeland. It has medium potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Bermudagrass is well suited.

Potential as cropland is low. Because of slope, erosion control is difficult.

This soil has medium potential for most urban uses. Slope and low strength are limitations that can be overcome by good design and careful installation. Capability subclass IVe; Sandy Loam range site.

26—Frio silty clay, occasionally flooded. This deep, well drained, nearly level soil is on flood plains of major streams. Areas are oblong and range from 10 to 200 acres in size, but average about 80 acres.

Typically, the surface layer is dark grayish brown and very dark grayish brown, calcareous silty clay about 26 inches thick. The subsoil is grayish brown, calcareous silty clay that extends to a depth of 38 inches. The underlying material to a depth of 62 inches is pale brown, calcareous silty clay.

This is a productive soil. Organic matter content is high. Flooding occurs occasionally and very briefly, mostly in the period of May through October. Permeability is moderately slow, and available water capacity is high. The soil has good tilth but can be worked through only a narrow range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bosque, Venus, and Yahola soils. Bosque and Yahola soils are on flood plains. Venus soils are on uplands adjacent to flood plains. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. In some lower lying areas, a small dike or diversion is necessary for protection from occasional overflows. This soil has high potential as pastureland. Improved grasses such as Kleingrass and bermudagrass are well suited.

Potential is high for range production. The climax plant community is a mixture of tall, mid, and short grasses with pecan, live oak, elm, and cottonwood scattered throughout. The soil has high potential for openland wildlife habitat. The native vegetation provides favorable habitat for many animals.

This soil has low potential for most urban uses. Flooding is a limitation that can be overcome only by major flood control measures. Capability subclass IIw; Loamy Bottomland range site.

27—Hassee fine sandy loam, 0 to 1 percent slopes. This deep, somewhat poorly drained, nearly level soil is on uplands. Areas are oval to irregular in shape and range from 5 to 25 acres in size. The surface is plane to concave.

Typically, the surface layer is dark grayish brown, neutral fine sandy loam about 6 inches thick. The subsurface layer, to a depth of 9 inches, is light brownish gray, neutral fine sandy loam. The subsoil is very dark gray, neutral clay to a depth of 16 inches; very dark grayish brown, neutral clay to a depth of 32 inches; and dark grayish brown, calcareous clay to a depth of 44 inches. The underlying material to a depth of 62 inches is light brownish gray, calcareous clay.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is very slow, and available water capacity is high. During wet seasons, a temporary water table is perched above the clayey lower layers. The soil has poor tilth and can be worked best under a narrow range of moisture content. The root zone is deep, but root movement is very restricted by the heavy clay layers.

Included with this soil in mapping are small areas of Thurber soils. Also included are small areas of soils in which the surface layer is more than 20 inches thick and small areas of potholes or playas associated with soils on geologic terraces of the Brazos River. Some of these areas are more sandy than is typical for the series. Included soils make up less than 15 percent of any mapped area.

This soil is dominantly used as cropland. It has low potential for row crops or small grains. Crop residues left on the surface help maintain soil tilth and productivity. This soil has low potential as pastureland. Bermudagrass, lovegrass, and Kleingrass are suited.

Potential is low for native range plants. The soil is droughty and produces only moderate amounts of forage.

The soil has low potential for most urban uses. Shrinking and swelling with changes in moisture, low strength, and corrosivity to uncoated steel are the most restrictive features. Capability subclass IIIw; Claypan Prairie range site.

28—Hassee fine sandy loam, 1 to 3 percent slopes. This deep, somewhat poorly drained, gently sloping soil is on uplands. Areas are circular to oblong in shape and range from 5 to 20 acres in size. The surface is plane to concave.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam about 11 inches thick. The subsurface layer is light brownish gray, neutral fine sandy loam that extends to a depth of 14 inches. The upper part of the subsoil is dark grayish brown, neutral clay that extends to a depth of 20 inches. The middle part is dark gray, neutral clay that has a few faint reddish mottles and that extends to a depth of 30 inches. The lower part is dark grayish brown, calcareous clay that extends to a depth of 49 inches. The underlying material to a depth of 62 inches is light brownish gray, calcareous clay.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is very slow, and available water capacity is high. During wet seasons, a temporary water table is perched above the clayey lower layers. The soil has poor tilth and can be worked well under only a narrow range of moisture content. The root zone is deep, but root movement is restricted by heavy clay layers.

Included with this soil in mapping are small areas of Chaney, Demona, and Thurber soils. Chaney soils are generally on the edges of mapped areas and in some higher areas. Demona soils are generally in convex areas adjacent to drainageways. Thurber soils are in circular areas generally at the lowest elevations in the mapped area. Also included, in areas where sediments eroded from higher slopes have accumulated, is a soil that is similar to Hassee soils except that the surface layer is thicker than 20 inches. Included soils make up less than 10 percent of any mapped area.

This soil is dominantly used as cropland. It has low potential for row crops or small grains. Grain and forage sorghums are suited.

Potential is low as pastureland and for native range plants. The soil is droughty and produces only moderate amounts of forage.

This soil has low potential for most urban uses. Shrinking and swelling with changes in moisture, low strength, and corrosivity to uncoated steel are the most restrictive features. Capability subclass IIIe; Claypan Prairie range site.

29—Hensley stony clay loam, 0 to 3 percent slopes. This shallow, well drained, nearly level to gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to 100 acres in size. Flat limestone fragments from 3 inches to 10 feet across the long axis cover from 5 to 30 percent of the surface.

Typically, the surface layer is brown, neutral stony clay loam about 4 inches thick. The subsoil is reddish brown, neutral clay that extends to a depth of 18 inches. Limestone bedrock that has a few fractures is at a depth of 18 inches.

This soil is low in natural fertility. Organic matter content is low. Permeability is slow, and available water capacity is low. The root zone is shallow, and root movement is restricted except in fractures in the limestone bedrock.

Included with this soil in mapping are small areas of Pedernales and Tarrant soils. Pedernales soils are on convex knolls. Tarrant soils are on small knolls or near the break of a ridge. Also included are small areas of a soil that is similar to Hensley soils except that it has limestone bedrock at a depth of more than 20 inches. Included soils make up less than 20 percent of any mapped area.

This soil is used as range. It has medium potential for range production. The climax plant community consists of mid and short grasses with scattered live oak and post oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

This soil has low potential as cropland and for most urban uses. Capability subclass VIs; Redland range site.

30—Krum clay, 0 to 1 percent slopes. This deep, well drained, nearly level soil is in broad, filled valleys adjacent to stream drainageways. Areas are long and oblong in shape and range from 10 to 80 acres in size, but average about 30 acres.

Typically, the surface layer is dark grayish brown and very dark grayish brown, calcareous clay about 22 inches thick. The subsoil is grayish brown, calcareous clay that extends to a depth of 42 inches. The underlying material to a depth of 62 inches is light yellowish brown, calcareous clay.

This is a productive soil. Organic matter content is high. Permeability is moderately slow, and available water capacity is high. The soil has fair tilth and can be worked well under only a narrow range of moisture content. The root zone is deep, but some roots and their movement are restricted by the clayey layers.

Included with this soil in mapping are small areas of Denton, Frio, and Venus soils. Denton soils are along low ridges. Frio soils are in long, narrow, shallow drainageways close to large streams. Venus soils are in irregularly shaped areas and on small ridges adjacent to streams. Also included is a soil that is similar to Krum soils except that it has gilgai microrelief, and a soil that is noncalcareous in the upper 10 inches. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. This soil has medium potential for pasture production. Kleingrass and bermudagrass are well suited.

Potential is high as range. The climax plant community is a mixture of tall and mid grasses with a few motts of live oak and other hardwood trees.

This soil has low potential for most urban uses. Clay texture, shrinking and swelling upon wetting and drying, and low strength are limitations. Capability subclass IIs; Clay Loam range site.

31—Krum clay, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is in shallow, filled valleys and along drainageways. Areas are generally oblong in shape and range from 10 to 150 acres in size, but average about 40 acres.

Typically, the surface layer is dark grayish brown, calcareous clay about 29 inches thick. The subsoil is brown, calcareous clay that extends to a depth of 48 inches. The underlying material to a depth of 62 inches is brown, calcareous clay.

This is a productive soil. Organic matter content is high. Permeability is moderately slow, and available water capacity is high. The soil has fair tilth and can be worked well under only a narrow range of moisture content. The root zone is deep, but some roots and their movement are restricted by the clayey layers.

Included with this soil in mapping are small areas of Denton, Frio, and Venus soils. Denton soils are usually on the upper parts of slopes below areas of shallow soils. Frio soils are in long, narrow depressions, or sloughs, along larger streams. Venus soils are on the uppermost slope of the mapped area. A soil that is similar to Krum soils except that it is gray or black is also included. Included soils make up less than 20 percent of any mapped area.

This soil is mainly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, control runoff, reduce soil temperature, and maintain soil tilth and productivity. This soil has medium potential for pasture production. Kleingrass and bermudagrass are well suited.

Potential is high as rangeland. The climax plant community is a mixture of tall and mid grasses with a few motts of live oak and other hardwood trees.

Potential for most urban uses is low. Clay texture, shrinking and swelling upon wetting and drying, and low strength are limitations. Capability subclass IIe; Clay Loam range site.

32—Maloterre gravelly clay loam, 1 to 8 percent slopes. This very shallow, somewhat excessively drained, gently sloping to sloping soil is on ridgetops. These ridgetops are mostly smooth but are benched in places. Fragments of limestone from 1 to 24 inches across cover from 1 to 30 percent of the surface. Areas are irregular in shape and range from 10 to 200 acres in size, but average about 50 acres.

Typically, the surface layer is light brownish gray, calcareous gravelly clay loam about 5 inches thick. Indurated limestone is at a depth of about 5 inches.

This soil is low in natural fertility. Permeability is moderately slow, and available water capacity is very low. The root zone is very shallow, and root movement is restricted by the limestone.

Included with this soil in mapping are small areas of Aledo, Bolar, Brackett, Purves, and Tarrant soils. Aledo soils are on ridgetops and side slopes. Bolar soils are on benches in long, narrow bands between slope breaks. The steep Brackett soils are on the upper parts of slopes. Purves soils are generally near the centers of broad, flat ridgetops. Tarrant soils are intermingled without any pattern. Also included is a soil that is similar to Maloterre soils except that the surface is darker. Included soils make up less than 30 percent of any mapped area.

This soil is used as range. It has low potential for range production. The climax plant community is a mixture of mid and tall grasses with a few live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

This soil has low potential as pastureland or cropland. The very shallow root zone and the gravelly to stony surface limit its use to range.

Potential is low for most urban uses. Depth to rock is a severe limitation that is difficult to overcome. Capability subclass VIIs; Very Shallow range site.

33—Nimrod fine sand, 1 to 5 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Areas are irregular in shape and range in size from 15 to 300 acres, but average about 40 acres.

Typically, the surface layer is pale brown, neutral fine sand about 8 inches thick. The subsurface layer, to a depth of 26 inches, is very pale brown, neutral fine sand. The upper part of the subsoil is brownish yellow, medium acid sandy clay loam that has mottles of light brownish gray and red and that extends to a depth of 34 inches. The middle part is brownish yellow, medium acid sandy clay loam that has mottles of light gray, very pale brown, yellowish red, and red and that extends to a depth of 50 inches. The lower part is light gray, strongly acid sandy clay loam that has mottles of yellow, brownish yellow, yellowish red, and red and that extends to a depth of 72 inches. The underlying material to a depth of 80 inches is white, strongly acid loamy fine sand that has reddish yellow mottles.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is low. During wet seasons, a temporary water table is perched above the sandy clay loam lower layers. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Chaney, Demona, Patilo, and Windthorst soils. Chaney soils are in oblong areas on low knolls. Demona and Patilo soils are in no discernible pattern of occurrence. Windthorst soils are on high knolls and at the edges of mapped areas. Included soils make up less than 35 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops. Peanuts are well suited. Soil blowing is a hazard. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help reduce runoff and control soil blowing. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. This soil has high potential as pastureland. Improved grasses such as bermudagrass and lovegrass are well suited.

Potential is medium as range. The climax plant community is a mixture of tall and mid grasses with forests of scrub post oak and blackjack oak trees and an understory of greenbriers.

The soil has medium potential for most urban uses. Wetness, seepage, and slow intake of water into the sandy clay loam lower layers are limitations. Capability subclass IIIe; Sandy range site.

34—Paluxy very fine sandy loam, 0 to 1 percent slopes. This deep, well drained, nearly level soil is on geologic terraces adjacent to and parallel to the flood plains of the Brazos River. The surface is plane to slightly concave. Soil areas are elongated in shape and range from 20 to 150 acres in size.

Typically, the surface layer is brown, neutral very fine sandy loam about 16 inches thick. The subsoil is reddish brown, neutral very fine sandy loam to a depth of 36 inches and yellowish red, neutral very fine sandy loam to a depth of 52 inches. The underlying material to a depth of 62 inches is reddish yellow, calcareous very fine sandy loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately rapid, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bastrop, Decordova, and Hassee soils. Bastrop soils are in a random pattern and on the edge of the mapped area away from the flood plain. Decordova soils are at higher elevations or on low ridges. The poorly drained Hassee soils are in circular to oblong, slight depressions. Included soils make up less than 20 percent of any mapped area.

This soil is used dominantly as cropland. It has high potential for row crops and small grains. Soil blowing is a hazard. Crop residues left on the surface help conserve moisture, reduce soil temperature, and maintain soil tilth and productivity. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help reduce runoff and control soil blowing. This soil has high potential as pastureland. Bermudagrass and lovegrass are well suited.

Potential as range is high. The climax plant community is a mixture of tall and mid grasses with scattered elm, hackberry, cottonwood, and pecan trees.

This soil has high potential for most urban uses. Seepage is a limitation for trench and area sanitary landfills and for sewage lagoon areas. Low strength is a limitation for local roads and streets, but this limitation can be overcome by good design and careful installation. Capability class I; Sandy Loam range site.

35—Paluxy very fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on geologic terraces adjacent to and parallel to the flood plain of the Brazos River. Areas are oblong in shape and range from 15 to 100 acres in size.

Typically, the surface layer is brown, slightly acid very fine sandy loam about 10 inches thick. The subsoil is reddish brown, slightly acid very fine sandy loam to a depth of 34 inches and yellowish red, neutral very fine sandy loam to a depth of 46 inches. The underlying material to a depth of 62 inches is reddish yellow, calcareous very fine sandy loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately rapid, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bastrop, Decordova, and Duffau soils. Bastrop soils are in irregularly shaped areas in a random pattern. Decordova soils are on the upper parts of slopes away from the flood plain. Duffau soils are in oblong areas on low knolls. Also included is a soil that is similar to Paluxy soils except that the secondary carbonates are below a depth of 80 inches. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for most row crops and small grains. Soil blowing is a hazard. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help reduce runoff and control soil blowing. This soil has high potential as pastureland. Bermudagrass and lovegrass are well suited.

Potential is high as rangeland. The climax plant community is a mixture of tall and mid grasses with scattered elm, hackberry, cottonwood, and pecan trees.

The soil has high potential for most urban uses. Seepage is a limitation for trench and area type sanitary landfills and sewage lagoon areas. Low strength is a limitation for local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIe; Sandy Loam range site.

36—Paluxy very fine sandy loam, 5 to 8 percent slopes. This deep, well drained, sloping soil is on geologic terraces on banks or sharp rises adjacent to the flood plain of the Brazos River. Soil areas are long and very narrow in shape and range from 15 to 80 acres in size.

Typically, the surface layer is light brown, neutral very fine sandy loam about 12 inches thick. The subsoil is yellowish red, neutral very fine sandy loam to a depth of 21 inches and yellowish red, mildly alkaline very fine sandy loam to a depth of 37 inches. The underlying material to a depth of 62 inches is reddish yellow, calcareous very fine sandy loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately rapid, and available water capacity is high. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bastrop, Decordova and Pedernales soils. Bastrop and Decordova soils are on flood plains. Pedernales soils are on steep, convex breaks on the upper parts of slopes. Also included is a soil that is similar to Paluxy soils except that carbonates occur above a depth of 36 inches. Included soils make up less than 30 percent of any mapped area.

This soil is dominantly used as range. It has medium potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered elm, hackberry, and pecan trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Bermudagrass is well suited.

Potential as cropland is low. Slopes are too steep and areas are too narrow to be feasible for cropland.

This soil has medium potential for most urban uses. Seepage and low strength are limitations. Capability subclass IVe; Sandy Loam range site.

37—Patilo fine sand, 0 to 3 percent slopes. This deep, moderately well drained, nearly level to gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to 200 acres in size.

Typically, the surface layer is pale brown, neutral fine sand about 10 inches thick. The subsurface layer, to a depth of 48 inches, is very pale brown, neutral fine sand. The upper part of the subsoil is brownish yellow, strongly acid sandy clay loam that has yellowish red, pale brown, and light brownish gray mottles and that extends to a depth of 54 inches. The lower part is white, strongly acid sandy clay loam that has reddish yellow, strong brown, and red mottles and that extends to a depth of 68 inches. The underlying material to a depth of 80 inches is coarsely mottled reddish yellow, red, and light gray, strongly acid fine sandy loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is low. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep and easily penetrated by plant roots. In places during wet seasons, a temporary water table is perched above the sandy clay loam lower layers.

Included with the soil in mapping are small areas of Demona, Duffau, and Nimrod soils. Demona soils are in depressional areas. Duffau and Nimrod soils occur in a random pattern on the landscape. Also included is a soil that is similar to Patilo soils except that the sandy surface layer is thicker than 80 inches. Included soils make up less than 30 percent of any mapped area.

This soil is dominantly used as rangeland. It has low potential for range production. The climax plant community is a mixture of tall and mid grasses with scrub forests of post oak, blackjack oak, and greenbriers. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Bermudagrass and lovegrass are well suited.

Potential is medium for row crops, especially peanuts, and for truck crops such as watermelons. Soil blowing is a hazard and can be controlled by planting cover crops, by stripcropping, and by using minimum tillage practices.

This soil has high potential for most urban uses. Seepage, sandy texture, and wetness are limitations. Capability subclass IIIe; Deep Sand range site.

38—Pedernales fine sandy loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is brown, neutral fine sandy loam about 12 inches thick. The subsoil is yellowish red, neutral sandy clay to a depth of 42 inches and reddish yellow, calcareous sandy clay loam to a depth of 49 inches. The underlying material to a depth of 62 inches is very pale brown, calcareous sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, but some root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Bastrop and Windthorst soils. Bastrop soils are on the outer edges of terraces of the Brazos River. Windthorst soils occur in a random pattern. Also included is a soil that is similar to Pedernales soils except that secondary carbonates occur at a depth of less than 28 inches. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as pastureland. It has medium potential for pasture production. Improved grasses such as bermudagrass and lovegrass are well suited. Management concerns include proper grazing to maintain adequate stubble height, fertilizing to replace soil nutrients, and spraying or shredding to control weeds. This soil has low potential for range production. The climax plant community is a mixture of mid and tall grasses with scattered post oak and blackjack oak trees.

Potential is medium as cropland. Small grains and row crops such as grain or forage sorghums are well suited.

This soil has medium potential for most urban uses. The sandy clay subsoil takes in water slowly. This is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Capability subclass IIe; Tight Sandy Loam range site.

39—Pedernales fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on plane to convex foot slopes. Areas are irregular in shape and range from 10 to 80 acres in size.

Typically, the surface layer is brown, slightly acid fine sandy loam about 13 inches thick. The subsoil is red, neutral sandy clay to a depth of 24 inches; yellowish red, mildly alkaline sandy clay to a depth of 37 inches; and reddish yellow, calcareous sandy clay to a depth of 45 inches. The underlying material to a depth of 62 inches is reddish yellow, calcareous sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is high. The root zone is deep, but some root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Bastrop, Duffau, Seawillow, and Windthorst soils. Bastrop soils are on the outer edges of terraces of the Brazos River. Duffau soils are on the lower parts of slopes. Seawillow soils are on convex knolls and on the upper parts of slopes. Windthorst soils occur in a random pattern. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as range. It has low potential for range production. The climax plant community is a mixture of mid and tall grasses with scattered post oak and blackjack oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Bermudagrass and lovegrass are suited.

Potential is low as cropland. Terraces and contour cultivation are needed to control erosion.

This soil has medium potential for most urban uses. The sandy clay subsoil takes in water slowly. This is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Capability subclass IIIe; Tight Sandy Loam range site.

40—Pedernales fine sandy loam, 1 to 5 percent slopes, eroded. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 5 to 40 acres in size. Sheet erosion has removed about 50 to 75 percent of the original surface layer. There are a few shallow gullies about 10 inches deep, but these gullies are crossable with farm machinery.

Typically, the surface layer is brown, neutral fine sandy loam about 4 inches thick. The subsoil is yellowish red, neutral sandy clay to a depth of 18 inches; yellowish red, mildly alkaline sandy clay to a depth of 32 inches; and yellowish red, mildly alkaline sandy clay loam to a depth of 38 inches. The underlying material to a depth of 60 inches is reddish yellow, moderately alkaline sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is high. The soil has fair tilth and can be worked best in only a narrow range of moisture content. The root zone is deep, but some root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Duffau, Seawillow, and Windthorst soils. Duffau and Windthorst soils are in a random pattern. Seawillow soils are on the higher parts of slopes and on low knolls. Also included is a soil that is similar to Pedernales soils except that secondary carbonates occur within 28 inches of the surface. A soil in which the subsoil has been mixed with the surface layer to form a surface layer of loam or clay loam is included. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly in old, abandoned cultivated fields and is used as range, but it has low potential for range production. The climax plant community is a mixture of mid and tall grasses with scattered post oak and blackjack oak trees. This soil has low potential for pastureland. Bermudagrass, lovegrass, and Kleingrass are suited.

Potential is low as cropland. Terraces and contour cultivation are needed to control erosion.

This soil has medium potential for most urban uses. The sandy clay subsoil takes in water slowly. This is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Capability subclass IIIe; Tight Sandy Loam range site.

41—Pedernales fine sandy loam, 5 to 8 percent slopes, eroded. This deep, well drained, sloping soil is on uplands on foot slopes and convex ridgetops. Areas are irregular in shape and range from 10 to 50 acres in size. There are a few shallow rills and gullies, and in some areas about 75 percent of the surface layer has been removed by sheet erosion.

Typically, the surface layer is brown, neutral fine sandy loam about 6 inches thick. The subsoil is yellowish red, neutral sandy clay to a depth of 34 inches and reddish yellow, calcareous sandy clay to a depth of 40 inches. The underlying material to a depth of 62 inches is pink, calcareous sandy clay loam.

This soil is low in natural fertility. Permeability is moderately slow, and available water capacity is high. The root zone is deep, but some root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Duffau, Seawillow, and Windthorst soils. Duffau soils are on the lower parts of slopes and along drainageways. Seawillow soils are on the upper parts of slopes and on convex knolls. Windthorst soils are in a random pattern. Included soils make up less than 30 percent of any mapped area.

This soil is used as range. It has low potential for range production. The climax plant community is a mixture of mid and tall grasses with scattered post oak trees.

This soil has low potential as pastureland and cropland. The steeper slopes make it subject to erosion if natural vegetation is removed.

Potential for most urban uses is medium. The sandy clay subsoil takes in water slowly. This is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Slope is a limitation for sewage lagoons. Capability subclass VIe; Tight Sandy Loam range site.

42—Purves clay, 1 to 3 percent slopes. This shallow, well drained, gently sloping soil is in broad, plane to slightly convex areas on hilltops. Areas are irregular in shape and range from 5 to 90 acres in size.

Typically, the surface layer is very dark grayish brown, dark grayish brown, and brown, calcareous clay about 18 inches thick. Fractured limestone is at a depth of 18 inches.

This soil has high organic matter content. Permeability is moderately slow, and available water capacity is low. The soil has fair tilth and can be worked best under a narrow range of moisture content. The root zone is shallow, and root movement is restricted by the limestone bedrock.

Included with this soil in mapping are small areas of Bolar, Denton, Sunev, and Tarrant soils. Bolar soils are on the lower parts of slopes. Denton soils are on broad, plane slopes. Sunev soils are on the lower parts of slopes and in shallow drainageways. Tarrant soils are in oblong areas on the upper parts of slopes and on slightly higher ridges and knolls. Also included is a soil that is similar to Purves soils except that it is noncalcareous. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as rangeland. It has medium potential for range production. The climax plant community is mainly mid grasses with a few live oak and mesquite trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low as pastureland and cropland because of droughtiness and the shallow root zone.

This soil has low potential for most urban uses. Depth to rock, shrinking and swelling upon wetting and drying, and high corrosivity to uncoated steel are the major restrictive features. Capability subclass IIIe; Shallow range site.

43—Purves clay, 3 to 5 percent slopes. This shallow, well drained, gently sloping soil is on sideslopes below limestone hills. Areas are long, narrow bands or irregularly shaped areas adjacent to limestone hills. Most areas are 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown and brown, calcareous clay to a depth of 12 inches and brown, calcareous very gravelly clay to a depth of about 17 inches. This is underlain by fractured limestone.

Organic matter content is high. Permeability is moderately slow, and available water capacity is low. The soil has fair tilth and can be worked well under only a narrow range of moisture content. The root zone is shallow, and root movement is restricted by the limestone bedrock.

Included with this soil in mapping are small areas of Bolar, Denton, Sunev, and Tarrant soils. Bolar soils are in narrow bands across the slope on all parts of the slope. Denton soils are in a random pattern. Sunev soils are at the bases of slopes. Tarrant soils are generally in an oblong pattern on the upper parts of slopes. Also included is a soil that is similar to Purves soils except that it is noncalcareous. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as rangeland. It has medium potential for range production. The climax plant community is mainly mid grasses with a few live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low as pastureland and cropland because of droughtiness and the shallow root zone.

This soil has low potential for most urban uses. The major restrictive features are depth to rock, shrinking and swelling upon wetting and drying, and corrosivity to uncoated steel. Capability subclass IVe; Shallow range site.

44—Seawillow loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on foot slopes. Areas are long and irregular in shape, following contours of higher stony soils. They range from 10 to 80 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 12 inches thick. The subsoil is very pale brown, calcareous clay loam that extends to a depth of 38 inches. The underlying material to a depth of 62 inches is very pale brown, calcareous clay loam.

This is a productive soil. Organic matter content is moderate. Permeability is moderate, and available water capacity is high. Tilth is fair, and the soil can be worked well under only a narrow range of moisture content. The root zone is moderately deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Brackett, Pedernales, and Sunev soils. Brackett soils are on low knolls and on breaks in the slope. Pedernales soils are on foot slopes near areas of sandier soils. Sunev soils are in no discernible pattern of occurrence. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as range. It has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Bermudagrass and Kleingrass are well suited.

Potential as cropland is medium. Small grains are the main crop. Terraces are necessary on this gently sloping soil to control erosion.

This soil has medium potential for most urban uses. Shrinking and swelling upon wetting and drying and corrosivity to uncoated steel are limitations. Capability subclass IIIe; Clay Loam range site.

45—Seawillow loam, 5 to 8 percent slopes. This deep, well drained, sloping soil is on foot slopes on uplands. Areas are irregular in shape and range from 10 to 50 acres in size.

Typically, the surface layer is grayish brown, calcareous loam about 8 inches thick. The subsoil is yellowish brown, calcareous loam that extends to a depth of 33 inches. The underlying material to a depth of 40 inches is light yellowish brown, calcareous loam.

This is a productive soil. Permeability is moderate, and available water capacity is high. The root zone is moderately deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Purves, Sunev, and Tarrant soils. Purves and Tarrant soils are on the upper parts of slopes and on ridges. Sunev soils are generally along drainageways and receive additional runoff water. Also included are areas marked by rills and shallow gullies 4 to 8 feet wide and 4 to 18 inches deep. Included soils make up less than 30 percent of any mapped area.

This soil is dominantly used as range. It has medium potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low as pastureland and cropland. Erosion occurs when the native vegetation on this sloping soil is disturbed.

This soil has medium potential for most urban uses. Shrinking and swelling upon wetting and drying and corrosivity to uncoated steel are limitations. Capability subclass IVe; Clay Loam range site.

46—Sunev clay loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on foot slopes below limestone hills. Areas are irregular in shape and range from 15 to 150 acres in size, but average about 35 acres.

Typically, the surface layer is brown, calcareous clay loam about 12 inches thick. The subsoil is brown, calcareous clay loam to a depth of 26 inches and yellowish brown, calcareous clay loam to a depth of 42 inches. The underlying material to a depth of 62 inches is very pale brown, calcareous clay loam.

This is a productive soil. Organic matter content is high. Permeability is moderate, but available water capacity is medium. The soil has good tilth but can be worked well in only a narrow range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bolar, Pedernales, Purves, and Seawillow soils. Bolar soils are in narrow bands below the limestone hills. Pedernales soils are in areas intergrading between sandier soils and soils on limestone hills. Purves soils are in a circular pattern on low hills on knobs. Seawillow soils occur in a random pattern. Included soils make up less than 20 percent of any mapped area.

The soil is dominantly used as rangeland. It has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Kleingrass and bermudagrass are well suited.

Potential is medium as cropland. Small grains are well suited to this soil. Terraces and contour cultivation are needed to control erosion.

This soil has high potential for most urban uses. Seepage is a limitation for sewage lagoon areas, and low strength is a limitation for local roads and streets. Capability subclass IIIe; Clay Loam range site.

47—**Sunev clay loam, 5 to 8 percent slopes.** This deep, well drained, sloping soil is on foot slopes below shallow limestone soils. Areas are irregular in shape and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, calcareous clay loam about 10 inches thick. The subsurface layer is brown, calcareous clay loam that extends to a depth of 16 inches. The subsoil is brown, calcareous clay loam to a depth of 28 inches and light yellowish brown, calcareous clay loam to a depth of 44 inches. The underlying material to a depth of 62 inches is very pale brown, calcareous loam.

This is a productive soil. Organic matter content is high. Permeability is moderate, and available water capacity is medium. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bolar, Purves, Seawillow, and Tarrant soils. Bolar soils are just below shallow limestone soils. Purves soils are in oblong areas on the upper parts of slopes or on small knolls. Seawillow soils are on the upper parts of slopes and in areas intergrading from limestone soils to sandier soils. Tarrant soils are on higher slopes and ridges. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as range. It has high potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Bermudagrass is suited.

Potential is low as cropland. Slope and the hazard of erosion are the major limitations in farming this soil.

Potential for most urban uses is high. Seepage, slope, and low strength are limitations, but these limitations can be overcome by good design and careful installation. Capability subclass IVe; Clay Loam range site.

48—**Tarrant-Bolar association, hilly.** This unit consists of hilly, stony soils on uplands. Areas have a complex surface and a slight stairstep appearance on longer slopes and a plane or convex appearance on shorter slopes. Tarrant soils typically have slopes of 10 to 30 percent. Bolar soils have slopes of 5 to 8 percent. Fragments of limestone from 3 inches to 3 feet across the long axis cover from 5 to 60 percent of the surface. Areas are irregular in shape and range from 25 to 1,000 acres in size, but average about 150 acres.

About 62 percent of this association is Tarrant soils, about 20 percent is Bolar soils, and about 18 percent is other soils and rock outcrops. Tarrant soils are on the edges of the benches and on the steeper upper slopes, and Bolar soils are along drainageways, on long foot slopes, and in mid positions on the benches. These soils could have been mapped separately, but since use and management are similar, separate mapping was not justified.

Typically, Tarrant soils have a surface layer of dark grayish brown, calcareous cobbly clay about 15 inches thick. Fractured, platy limestone that has dark brown clay in the horizontal and vertical cracks is at a depth of 15 inches.

Tarrant soils have high natural fertility and organic matter content. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow because the soil is shallow over limestone.

Typically, Bolar soils have a surface layer of dark grayish brown and brown, calcareous stony clay loam and clay loam about 14 inches thick. The subsoil is light yellowish brown, calcareous clay loam to a depth of 26 inches and very pale brown, calcareous clay loam to a depth of 32 inches. Fractured limestone is at a depth of 32 inches.

Bolar soils have high natural fertility and organic matter content. Permeability is moderate, and available water capacity is medium. The root zone is moderately deep, and the soil is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Brackett, Denton, Purves, and Sunev soils. Brackett soils are on steep slope breaks. Denton and Sunev soils are on foot slopes or near drainageways. Purves soils are on the middle parts of benches. Also included are areas of Tarrant soils having slopes of as much as 45 percent. Included soils make up less than 25 percent of any mapped area.

These soils are used as range (fig. 8). They have medium potential for range production because of stones, low available water capacity, and the shallow root zone. The climax plant community is a mixture of tall and mid grasses with scattered live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. These soils have fair potential for rangeland wildlife habitat. Animals use the area for escape from predators and as nesting areas.

These soils have low potential as cropland and pastureland. The shallow root zone and stones are limitations that are very difficult to overcome.

Potential is low for most urban uses. Depth to rock, stones, and slope are limitations that are difficult to overcome. Most areas, however, have a scenic view. Tarrant part in capability subclass VIIs, Steep Rocky range site; Bolar part in capability subclass VIs; Clay Loam range site.

49—Tarrant-Purves association, undulating. This unit consists of undulating, stony soils on uplands. Slopes are dominantly 1 to 8 percent, except for short, steep scarps in some areas. The surface is complex, and areas have a slight stairstep appearance. Fragments of limestone, ranging from 3 inches to 4 feet across, cover from 2 to 60 percent of the surface. Areas are irregular in shape and range from 10 to 500 acres in size.

About 65 percent of this association is Tarrant soils, about 25 percent is Purves soils, and about 10 percent is other soils and rock outcrops. Tarrant soils are on narrow ridgetops, on the edges of benches, and on the steeper slope breaks. Purves soils are on broad ridgetops near the middle of benches and slope breaks. These soils could have been mapped separately, but since use and management are similar, separate mapping was not justified.

Typically, Tarrant soils have a surface layer of dark grayish brown, calcareous cobbly clay to a depth of 6 inches and brown, calcareous very cobbly clay to a depth of about 14 inches. This is underlain by fractured, platy limestone bedrock.

Tarrant soils have high natural fertility and organic matter content. Permeability is moderately slow, and available water capacity is very low. The root zone is shallow because the soil is shallow over limestone.

Typically, Purves soils have a surface layer of dark grayish brown and brown, calcareous stony clay and clay about 13 inches thick. Fractured limestone is at a depth of 13 inches.

Purves soils have high natural fertility and organic matter content. Permeability is moderately slow, and available water capacity is low. The root zone is shallow because the soil is shallow over limestone.

Included with this soil in mapping are small areas of Aledo, Bolar, Brackett, Hensley, and Maloterre soils. Aledo soils are in a random pattern. Bolar soils are in long, narrow strips in mid positions on the benches and on longer foot slopes. The steep Brackett soils are on the upper parts of short slopes at high elevations. The nearly level Hensley soils are on ridgetops. The gently sloping Maloterre soils are on benches. Included soils make up less than 20 percent of any mapped area.

These soils are used as range. They have medium potential for range production because of stones, low available water capacity, and the shallow root zone. The climax plant community is a mixture of tall and mid grasses with scattered live oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This association has fair potential for rangeland wildlife habitat.

Potential is low as cropland or pastureland. The shallow root zone, stones, and slope are limitations that are very difficult to overcome.

These soils have low potential for most urban uses. Stones, depth to rock, and slope are limitations that are difficult to overcome. Most areas, however, have a scenic view. Tarrant part in capability subclass VIIs, Low Stony Hill range site; Purves part in capability subclass VIs, Shallow range site.

50—Thurber clay loam, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping soil is in broad, shallow valleys. Areas are irregular in shape and range from 10 to 60 acres in size.

Typically, the surface layer is dark grayish brown, slightly acid clay loam about 10 inches thick. The subsoil is very dark grayish brown, neutral clay to a depth of 26 inches and dark grayish brown, calcareous clay to a depth of 35 inches. The underlying material is grayish brown, calcareous clay to a depth of 44 inches and light brownish gray, calcareous clay to a depth of 62 inches or more.

This soil is medium in natural fertility. Organic matter content is low. Permeability is very slow, and available water capacity is high. This soil has poor tilth and can be worked best under only a narrow range of moisture content. The root zone is deep, but root movement is restricted by the clayey lower layers.

Included with this soil in mapping are small areas of Hassee and Krum soils. The somewhat poorly drained Hassee soils are in circular to oblong, depressional areas. Krum soils are adjacent to foot slopes of limestone hills. Included soils make up less than 15 percent of any mapped area.

This soil is used dominantly as range. It has medium potential for range production. The climax plant community is mostly short grasses with some mid grasses. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has low potential as pastureland.

Potential is medium as cropland. Grain sorghums, forage sorghums, and small grains are better suited than other crops.

Potential for most urban uses is low. Slow water intake, shrinking and swelling upon wetting and drying, and clay content are limitations that are very difficult to overcome. Capability subclass IIIe; Claypan Prairie range site.

51—Truce fine sandy loam, 1 to 5 percent slopes, eroded. This deep, well drained, gently sloping soil is on ridgetops of uplands. Areas are irregular in shape and range from 10 to 25 acres in size. Water erosion has thinned the surface layer in most areas. There are a few rills and shallow gullies about 6 to 18 inches deep and 2 to 6 feet wide.

Typically, the surface layer is yellowish brown, neutral fine sandy loam about 3 inches thick. The subsoil is reddish brown, slightly acid clay to a depth of 20 inches; brown, neutral clay to a depth of 30 inches; and yellowish brown, calcareous clay to a depth of 48 inches. Gray, weak red, and brownish yellow, calcareous, brittle clayey shale is at a depth of 48 inches.

This soil is low in natural fertility and organic matter content. Permeability is slow, and available water capacity is medium. The soil has poor tilth and can be worked well under only a narrow range of moisture content. The root zone is deep, but root movement is restricted by the clayey lower layers.

Included with this soil in mapping are small areas of Pedernales and Windthorst soils. These soils are underlain by sandstone at a depth of less than 40 inches and are generally on ridgetops. Pedernales and Windthorst soils are in similar positions as Truce soils but formed over different material. Also included are areas of Truce soils that have a surface layer of sandy clay loam. Included soils make up less than 30 percent of any mapped area.

This soil is dominantly used as range. It has low potential for range production. The climax plant community is a mixture of short and mid grasses with scattered post oak and elm trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low as pastureland and cropland because plants go into stress quickly during dry periods.

The soil has low potential for most urban uses. Slow water intake, clay content, and low strength are limitations that are very difficult to overcome. Capability subclass IIIe; Tight Sandy Loam range site.

52—Truce stony soils, 1 to 8 percent slopes. This deep, well drained, gently sloping to sloping soil is on uplands. The texture of the surface layer ranges from fine sandy loam to stony fine sandy loam. Areas are irregular in shape and range from 15 to 120 acres in size.

This unit is about 75 percent Truce soils and 25 percent rock outcrops and other soils. None of the other soils make up more than 5 to 10 percent of the map unit. In most areas 15 to 30 percent of the surface is covered with fragments of sandstone that are 4 inches to 6 feet across. The rock outcrops and less extensive soils are in such an intricate pattern that separate mapping was not practical.

Typically, the surface layer is brown, neutral stony fine sandy loam about 4 inches thick. The subsurface layer is brown, neutral fine sandy loam that extends to a depth of 6 inches. The subsoil is yellowish red, slightly acid clay to a depth of 24 inches; brown, neutral clay to a depth of 35 inches; and yellowish brown, mildly alkaline clay to a depth of 42 inches. The underlying material to a depth of 62 inches is light gray and light reddish brown, calcareous shaly clay.

This soil is low in natural fertility and organic matter content. Permeability is slow, and available water capacity is medium. The root zone is deep, but root movement is restricted by the clayey lower layers and by fragments of sandstone.

Included with this soil in mapping are small areas of Pedernales and Windthorst soils. Pedernales and Windthorst soils are on the lower parts of foot slopes. Also included are small areas of a soil that has a surface layer of clay and that is calcareous to the surface. Included soils make up less than 10 percent of any mapped area.

These soils are used as range. They have low potential for range production. The climax plant community is a mixture of short and mid grasses in a post oak savannah that includes scattered elm trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low as cropland and pastureland. Large stones and slow water intake are limitations that are very difficult to overcome.

Potential for most urban uses is low. Large stones, clay content, low strength, and slope are limitations that are very difficult to overcome. Capability subclass VIs; Tight Sandy Loam range site.

53—Venus loam, 1 to 3 percent slopes. This deep, well drained, gently sloping soil is on geologic terraces along small streams. Areas are long and narrow and range from 10 to 100 acres in size.

Typically, the surface layer is dark grayish brown, calcareous loam about 13 inches thick. The subsoil is brown and pale brown, calcareous loam to a depth of 42 inches. The underlying material to a depth of 60 inches is pale brown, calcareous loam (fig. 9).

This is a productive soil. Organic matter content is high. Permeability is moderate, and available water capacity is high. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with this soil in mapping are small areas of Bosque, Frio, and Seawillow soils. Bosque and Frio soils are on flood plains. Seawillow soils are on the upper parts of slopes or on convex knolls. Included soils make up less than 20 percent of any mapped area.

The soil is dominantly used as cropland. It has high potential for row crops and small grains. Crop residues left on the surface help conserve moisture, slow runoff, reduce soil temperature, and maintain soil tilth and productivity. This soil has high potential as pastureland. Improved grasses such as Kleingrass, bermudagrass, and lovegrass are well suited.

Potential is high as range. The climax plant community is a mixture of tall and mid grasses with scattered live oak, elm, and hackberry trees.

This soil has high potential for most urban uses. Seepage and low strength are limitations, but these limitations can be easily overcome by good design and careful installation. Capability subclass IIe; Clay Loam range site.

54—Windthorst loamy fine sand, 1 to 5 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to 300 acres in size, but average about 30 acres.

Typically, the surface layer is pale brown, neutral loamy fine sand about 10 inches thick. The upper part of the subsoil is yellowish red, slightly acid sandy clay that extends to a depth of 22 inches. The middle part is yellowish red, slightly acid sandy clay that has faint mottles of strong brown and red and that extends to a depth of

34 inches. The lower part is reddish yellow, slightly acid sandy clay loam that has mottles of red and pale brown and extends to a depth of 46 inches. The underlying material to a depth of 62 inches is very pale brown, neutral fine sandy loam that contains pockets and lenses of reddish yellow sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is medium. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, but root movement is somewhat restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Chaney, Duffau, and Pedernales soils. Chaney soils are in low-lying areas where extra moisture has accumulated. Duffau soils are in a random pattern. Pedernales soils are in circular areas on low knolls and at higher elevations. Also included are areas of Windthorst fine sandy loam that have been eroded or in which the surface layer and subsoil have been mixed by tillage. Included soils make up less than 15 percent of any mapped area.

This soil is dominantly used as cropland. It has medium potential for row crops, and it is well suited to peanuts. Soil blowing is a hazard. Minimum tillage, stripcropping, and the use of cover crops, including grasses and legumes, help reduce runoff and control soil blowing. This soil has high potential as pastureland. Bermudagrass and lovegrass are well suited.

Potential as range is high. The climax plant community is a mixture of tall and mid grasses with post oak and blackjack oak trees.

This soil has medium potential for most urban uses. Slow water intake is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Low strength is a limitation for local roads and streets, but this limitation can easily be overcome by good design and careful installation. Capability subclass IIIe; Loamy Sand range site.

55—Windthorst fine sandy loam, 1 to 3 percent slopes. This deep, moderately well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 5 to 50 acres in size.

Typically, the surface layer is grayish brown, neutral fine sandy loam about 4 inches thick. The subsurface layer is very pale brown, slightly acid fine sandy loam that extends to a depth of 14 inches. The upper part of the subsoil is red, slightly acid sandy clay that extends to a depth of 25 inches. The middle part is red, medium acid sandy clay that has brownish yellow mottles and that extends to a depth of 40 inches. The lower part is mottled pale brown, yellowish red, and red, medium acid sandy clay that extends to a depth of 58 inches. The underlying material to a depth of 72 inches is mottled reddish yellow and white fine sandy loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is high. The soil has fair tilth and can be worked throughout a wide range of moisture content. The root zone is deep, but root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Chaney, Duffau, and Pedernales soils. Chaney soils are in slightly concave areas. Duffau soils are in a random pattern. Pedernales soils are in circular to oblong areas on low knolls or in areas that are adjacent to soils over limestone. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as cropland. It has high potential for row crops and small grains. Soil blowing is a hazard. Minimum tillage and the use of cover crops, including grasses and legumes, help reduce runoff and control soil blowing. Terraces and contour cultivation also help control erosion. This soil has high potential as pastureland. Bermudagrass and lovegrass are well suited.

Potential for range is high. The climax plant community is a mixture of tall and mid grasses with post oak and blackjack oak trees.

This soil has medium potential for most urban uses. Slow water intake is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Low strength is a limitation for local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIe; Sandy Loam range site.

56—Windthorst fine sandy loam, 3 to 5 percent slopes. This deep, well drained, gently sloping soil is on uplands. It has a plane to convex surface. Areas are irregular in shape and range from 10 to 120 acres in size, but average about 20 acres.

Typically, the surface layer is grayish brown, slightly acid fine sandy loam about 4 inches thick. The subsurface layer is pale brown, slightly acid fine sandy loam that extends to a depth of 14 inches. The upper part of the subsoil is red, slightly acid sandy clay that extends to a depth of 20 inches. The middle part is red, medium acid sandy clay that has mottles of strong brown and that extends to a depth of 38 inches. The lower part is yellowish red, medium acid sandy clay that has pale brown and red mottles and that extends to a depth of 49 inches. The underlying material to a depth of 62 inches is reddish yellow, neutral sandy clay loam that has mottles of yellowish brown, pale brown, and red.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is high. The soil has fair tilth and can be worked throughout a wide range of moisture content. The root zone is deep, but root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Duffau, Pedernales, and Seawillow soils. Duffau soils are in a random pattern. Pedernales soils are in circular to oblong areas on convex knolls and ridges. Seawillow soils are on the upper parts of slopes adjacent to soils over limestone. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as range. It has medium potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has medium potential as pastureland. Improved grasses, such as bermudagrass and lovegrass, are suited.

Potential as cropland is medium. Terraces and contour cultivation are needed to control erosion.

This soil has medium potential for most urban uses. Slow water intake is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Low strength is a limitation for local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIIe; Sandy Loam range site.

57—Windthorst fine sandy loam, 1 to 5 percent slopes, eroded. This deep, well drained, gently sloping soil is on uplands. Areas are irregular in shape and range from 6 to 150 acres in size. Sheet erosion has removed about 75 percent of the original surface layer. There are a few shallow gullies about 6 to 10 inches deep, but they can be crossed with farm machinery.

Typically, the surface layer is brown, slightly acid fine sandy loam about 5 inches thick. The upper part of the subsoil is red, slightly acid sandy clay that extends to a depth of 18 inches. The middle part is yellowish red, slightly acid sandy clay that has yellow mottles and that extends to a depth of 28 inches. The lower part is yellowish red, medium acid sandy clay that has very pale brown, red, and pale brown mottles and that extends to a depth of 38 inches. The underlying material to a depth of 56 inches is mottled yellow, brownish yellow, and very pale brown, slightly acid fine sandy loam. To a depth of 62 inches it is white, neutral, weakly cemented sandstone that contains lenses of yellowish sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is high. The soil has poor tilth and can be worked best under a narrow range of moisture content. The root zone is deep, but root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Chaney and Pedernales soils. Chaney soils are in shallow depressions. Pedernales soils are on high knolls. Also included are areas in which the surface layer has been mixed with the sandy clay lower layers to form a surface layer of loam and sandy clay loam. Included soils make up less than 20 percent of any mapped area.

This soil is dominantly used as pastureland. It has medium potential for improved grasses such as bermudagrass, lovegrass, and Kleingrass. Management concerns include proper grazing to maintain adequate stubble height, fertilization to replace soil nutrients, and spraying or shredding to control weeds. This soil has low potential as cropland. Terraces and contour cultivation are needed to control erosion.

Potential as range is low. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees.

This soil has medium potential for most urban uses. Slow water intake is a limitation for septic tank absorption fields, but this limitation can be overcome by increasing the size of the absorption area or by modifying the filter field. Low strength is a limitation for local roads and streets, but this limitation can be overcome by good design and careful installation. Capability subclass IIIe; Sandy Loam range site.

58—Windthorst fine sandy loam, 5 to 8 percent slopes, eroded. This deep, well drained, sloping soil is on foot slopes and convex ridges of uplands. Areas are irregular in shape and range from 15 to 60 acres in size. Sheet erosion has removed about 75 percent of the original surface layer. There are shallow rills and a few very shallow gullies about 6 to 14 inches deep.

Typically, the surface layer is brown, slightly acid fine sandy loam about 5 inches thick. The upper part of the subsoil is red, slightly acid sandy clay that extends to a depth of 19 inches; the middle part is red, medium acid sandy clay that has strong brown mottles and that extends to a depth of 36 inches. The lower part is mottled yellowish red, pale brown, and yellowish brown, medium acid sandy clay loam that extends to a depth of 42 inches. The underlying material to a depth of 62 inches is very pale brown, neutral, weakly cemented sandstone that contains lenses of yellowish sandy clay loam.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately slow, and available water capacity is high. The root zone is deep, but some root movement is restricted by the sandy clay lower layers.

Included with this soil in mapping are small areas of Duffau, Pedernales, and Seawillow soils. Duffau soils are on the lower parts of slopes. Pedernales soils are on the upper parts of slopes and on convex knolls. Seawillow soils are on the upper parts of slopes near areas of shallow limestone soils. Some soils have a surface layer of loam or sandy clay loam caused by the mixing of the lower layers with the surface layer. Included soils make up less than 30 percent of any mapped area.

This soil is dominantly used as range. It has low potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management.

Potential is low as pastureland and cropland. Erosion is a hazard if the native vegetation is disturbed or removed.

This soil has medium potential for most urban uses. Slow water intake, low strength, and slope are limitations. Capability subclass VIe; Sandy Loam range site.

59—Windthorst complex, gullied. This map unit consists of deep, well drained, undulating soils on erosional uplands. Areas are irregular in shape and range from 5 to 100 acres in size. Slopes range from 1 to 8 percent.

About 60 percent of this unit is Windthorst soils, 10 percent is gullies at intervals of about 30 to 180 feet, and about 30 percent is minor soils. The gullies are about 3 to 6 feet deep and 6 to 12 feet wide. Areas between gullies are Windthorst soils that have surface texture of fine sandy loam, sandy clay, clay loam, or sandy clay loam. These gullies and the Windthorst soils are so intricately mixed or in such small areas that they cannnot be shown separately at the scale mapped.

Typically, the surface layer is brown, neutral fine sandy loam about 4 inches thick. The upper part of the subsoil is yellowish red, slightly acid sandy clay that extends to a depth of 16 inches. The middle part is yellowish red, slightly acid sandy clay that has mottles of strong brown and red and that extends to a depth of 34 inches. The lower part is yellowish red, slightly acid sandy clay loam that has mottles of pale brown, yellowish brown, and red and that extends to a depth of 43 inches. The underlying material to a depth of 62 inches is reddish yellow, neutral fine sandy loam.

Permeability is moderately slow, and available water capacity is high. The root zone is deep, but root movement is restricted by the sandy clay lower layers.

Included with these soils in mapping are small areas of Chaney, Duffau, Pedernales, and Seawillow soils. Chaney soils are on the lower parts of slopes. Duffau soils, which form a U-shaped, straight-sided gully, are in the same positions as Windthorst soils. Pedernales soils are on the upper parts of slopes and below to convex knolls. Seawillow soils are on the upper parts of slopes adjacent to shallow limestone soils. Included soils make up less than 30 percent of any mapped area.

This soil is dominantly used as range. It has low potential for range production. The climax plant community is a mixture of tall and mid grasses with scattered post oak and blackjack oak trees. Management concerns include proper grazing use, adequate rest periods, and brush management. This soil has low potential as pastureland. Areas can be sodded to improved bermudagrass after gullies have been shaped and sloped.

This soil has low potential as cropland and for most urban uses because of common deep gullies in most areas. Capability subclass VIe; Sandy Loam range site.

60—Yahola-Gaddy complex, occasionally flooded. This unit consists of nearly level to gently undulating soils on flood plains of major streams. Areas are oblong and range from 20 to 300 acres in size.

About 65 percent of this map unit is Yahola soils, 20 percent is Gaddy soils, and 15 percent is other soils, gravel bars, and water. Yahola soils occur on the edges of the unit. They border soils on uplands and are in areas of smooth to undulating topography. Gaddy soils are adjacent to stream channels. The topography is typically undulating, but some areas have low mounds or hummocks. These soils are so intricately mixed that they cannot be shown separately at the scale mapped.

Typically, Yahola soils have a surface layer of brown, calcareous, stratified fine sandy loam about 18 inches thick. The upper part of the underlying material is light brown, calcareous loam that extends to a depth of 28 inches. The middle part is reddish yellow, calcareous, stratified fine sandy loam that extends to a depth of 48 inches. The lower part to a depth of 62 inches is pink, calcareous, stratified loamy fine sand.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately rapid, and available water capacity is medium. The soil is flooded occasionally, mainly during the period May to September, and water is sometimes ponded on the surface for short periods. The soil has good tilth and can be worked throughout a wide range of moisture content. The root zone is deep, and the soil is easily penetrated by plant roots.

Typically, Gaddy soils have a surface layer of pale brown, calcareous, stratified loamy fine sand about 14 inches thick. The upper part of the underlying material, to a depth of 48 inches, is pink, calcareous, stratified fine sand. The lower part, to a depth of 62 inches or more, is light brown, calcareous, stratified loamy fine sand.

Crops on this soil respond well to fertilization. Organic matter content is low. Permeability is moderately rapid to rapid, and available water capacity is low. The soil is flooded occasionally during the period May through September, and water is sometimes ponded on the surface for short periods. The soil has good tilth but can be worked well under only a narrow range of moisture content because it is loose when dry. The root zone is deep, and the soil is easily penetrated by plant roots.

Included with these soils in mapping are small areas of Bastrop and Paluxy soils. Bastrop and Paluxy soils are on steeper slopes above the flood plain. Included areas are usually less than 10 acres in size and make up less than 20 percent of any mapped area.

These soils are dominantly used as range. They have high potential for range production. The climax plant community is a mixture of tall and mid grasses with pecan, elm, hackberry, cottonwood, and willow trees scattered throughout. This native range provides good habitat for many animals. This soil has high potential as pastureland (fig. 10); bermudagrass is suited.

Potential is low for most urban uses. Flooding is the main limitation. Yahola part in capability subclass IIw, Loamy Bottomland range site; Gaddy part in capability subclass IIIs, Sandy Bottomland range site.

Use and management of the soils

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

While a soil survey is in progress, soil scientists, conservationists, engineers, and others keep extensive notes about the nature of the soils and about unique aspects of behavior of the soils. These notes include data on erosion, drought damage to specific crops, yield estimates, flooding, the functioning of septic 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, pasture, and rangeland; 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 specified land uses can be determined, soil limitations to these land uses can be identified, and costly failures in houses and other structures, caused by unfavorable soil properties, can be avoided. A site where soil properties are favorable can be selected, or practices that will overcome the soil limitations can be planned.

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

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

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

Crops and pasture

ZACK B. EVANS, district conservationist, Soil Conservation Service, helped 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.

About 102,000 acres in the survey area is used for crops and pasture. Of this total about 11,000 acres is used for peanuts; 7,000 acres, for sorghums; 16,000 acres, for oats; and 68,000 acres is pasture or idle cropland.

The soils in Hood and Somervell County have high potential for increased production of food. Of the 211,000 acres of arable land in the survey area, only about 34,000 acres is farmed. 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 survey area. This soil survey can greatly facilitate the application of such technology.

Acreage in crops and pasture has gradually been decreasing as more and more land is used for urban development. In 1967 about 9,000 acres was urban or built-up land in the survey area (*4*). About 2,000 more acres is being converted to urban uses annually. The use of this soil survey to help make land use decisions that will influence the future role of farming in the counties is discussed in the section "General soil map for broad land use planning."

Soil erosion is the major concern on the cropland in the survey area. If slope is more than 1 percent on the cultivated loamy and clayey soils, erosion is a hazard. Bolar, Denton, Seawillow, Sunev, and Truce soils, for example, have slopes of more than 1 percent.

If the soil has a sandy surface layer, soil blowing is a hazard. Bastrop, Chaney, Decordova, Demona, Nimrod, and Patilo soils, for example, have a sandy surface layer and are subject to soil blowing.

Loss of the surface layer through water erosion or soil blowing 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 are clayey in their lower layers, such as Chaney, Pedernales, Truce, and Windthorst soils, and on soils that have rock at a shallow depth and, consequently, a limited root zone, such as Purves soils. Second, soil erosion on farmland results in sedimentation of streams. Control of erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation, and for fish and wildlife.

In many sloping fields, tilling or preparing a good seedbed is difficult on clayey spots because the original friable surface soil has been eroded away. Such spots are common in areas of moderately eroded Pedernales and Windthorst soils.

Erosion control practices provide protective surface cover, reduce runoff, and increase infiltration. A cropping system that keeps vegetative cover on the soil for extended periods can hold soil erosion losses to amounts that will not reduce the productive capacity of the soils. On livestock farms, which require pasture and hay, the legume and grass forage crops in the cropping system reduce erosion on sloping land, provide nitrogen, and improve tilth for the following crop.

Minimizing tillage and leaving crop residue on the surface help increase infiltration and reduce the hazards of runoff and erosion. These practices can be adapted to most soils in the survey area.

Terraces and diversions reduce the length of slope and reduce runoff and erosion. They are more practical on deep, well drained soils that have regular slopes. Bastrop, Duffau, Krum, Pedernales, Sunev, and Windthorst soils are suitable for terraces. The other soils are less suitable for terraces and diversions because of irregular slopes, a thick sandy surface layer, or bedrock at a depth of less than 40 inches.

Contour farming is a widespread erosion control practice in the survey area. It is best suited on soils that have smooth, uniform slopes.

Soil blowing is a hazard on the sandy soils and can cause damage in a few hours if winds are strong and the soils are dry and bare of vegetation. Maintaining plant cover or a rough surface through proper tillage minimizes soil blowing. Cover cropping, wind stripcropping, and returning crop residue to the soils help reduce soil blowing.

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

Soil fertility is naturally low in most of the sandy or loamy, light colored soils on uplands in the survey area. They are mainly slightly acid to neutral, and crops on them respond readily to commercial or organic fertilizers. The soils on flood plains, such as Bosque, Frio, and Yahola soils, are alkaline and are naturally higher in plant nutrients than most soils on uplands. The dark colored, alkaline soils on uplands, such as Bolar, Denton, Krum, Sunev, and Venus soils, are naturally high in content of plant nutrients. These alkaline soils, however, in places hold the nutrients in forms unavailable for plant use.

On all soils, additions of lime and fertilizer need to be based on the results of soil tests, on the need of the crop, and on the expected level of yields. The Agricultural Extension Service can help in determining the kinds and amounts of fertilizer to be applied.

Field crops suited to the soils and climate of the survey area include many that are not now commonly grown. Peanuts and sorghums are the main row crops. Cotton, corn, guar, sunflowers, potatoes, and castor beans can be grown if economic conditions are favorable.

Oats and rye are the common close-growing crops, and a small acreage of wheat and barley is grown. Grass seed can be produced from Kleingrass and lovegrass.

Special crops grown commercially in the survey area are watermelon, cantaloupe, tomatoes, black-eyed peas, cabbage, okra, English peas, squash, peaches, pears, and pecans. Special crops such as onions, peppers, beets, cucumbers, sweet potatoes, grapes, and apples can be grown in large areas if economic conditions are favorable. Peaches and pecans are the most important tree fruits grown in the survey area. Peach trees grow best on well drained, sandy soils on uplands, and pecan trees grow best on moderately well drained, sandy soils on uplands or on the flood plains of major streams.

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

Improved pasture grasses include several varieties of bermudagrass, several varieties of lovegrass, and Kleingrass. Major management practices needed on pastureland are fertilization, weed control, and controlled grazing. Fertilizers need to be applied according to plant needs, the level of production desired, and the results of soil tests. Weeds can be controlled mechanically or chemically. Weed control is less of a concern on well managed pasture than on overused, poorly managed pasture.

Temporary pasture is used in many places to supplement permanent pasture or to produce hay. Sudangrass, johnsongrass, and sorghum-sudan grasses make good supplemental summer pasture. Small grains provide good supplemental winter forage.

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

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

The yields were estimated assuming that the latest soil and crop management practices were used. Pasture yields were estimated for 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 6.

The management needed to achieve the indicated yields of the various crops depends on the kind of soil and the crop. Such management provides erosion control and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate tillage practices, including time of tillage and seedbed preparation and tilling when soil moisture is favorable; control of weeds, plant diseases, and harmful insects;

favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residues, barnyard manure, and green-manure crops; harvesting crops with the smallest possible loss; and timeliness of all fieldwork.

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

Crops other than those shown in table 6 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 Agricultural Extension Service can provide information about the management concerns and productivity of the soils for these crops.

Capability classes and subclasses

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

In the capability system as used in this survey area, 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, wildlife habitat, or recreation.

The acreage of soils in each capability class and subclass is indicated in table 7. All soils in the survey area except those named at a level higher than the series are included. Some of the soils that are well suited to crops and pasture may be in low-intensity use, for example, soils in capability classes I and II. Data in this table can be used to determine the farming potential of such soils.

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

Rangeland

Native rangeland covers approximately 260,000 acres in Hood and Somervell Counties, or about 66 percent of the survey area. Cattle and a few small herds of sheep and goats graze this rangeland. Most of the ranches in the survey area are cow-calf enterprises, and many supplement their operation with winter stockers or carryover calves. Most ranches include some cropland and pastureland. The cropland is used to raise supplemental forage that is either grazed or stored for hay. The main crops are small grains, forage sorghums, and johnsongrass. In areas where peanuts are grown, the peanut vines are baled for hay after harvest. Improved pastures consist mainly of improved bermudagrass, Kleingrass, and lovegrass.

The native rangeland has been heavily grazed for several generations. As a result, the clayey soils are covered mostly by short and mid grasses, annual weeds, juniper, mesquite, and sumac. The loamy soils mostly support mid grasses, oak, mesquite, and scattered juniper brush. The sandy soils still support tall grasses such as bluestems, but the dominant vegetation is scrub shinnery oak, dropseeds, threeawns, and silver bluestem. A close look at these soils, however, reveals remnants of the original grasses and desirable adapted plants. Generally, these plants will increase if the range is given proper care and treatment.

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 8 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 predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. The following are explanations of column headings in table 8.

A *range site* is a distinctive kind of rangeland that differs from other kinds of rangeland in its ability to produce a characteristic natural plant community. Soils that produce a similar kind, amount, and proportion of range plants are grouped into range sites. For those areas where the relationship between soils and vegetation has been established, range sites can be interpreted directly from the soil map. Properties that determine the capacity of the soil to supply moisture and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

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

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

Common plant names of grasses, grasslike plants, forbs, and shrubs that make up most of the potential natural plant community on each soil are listed. 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.

The soils in rangeland vary throughout the survey area from shallow, clayey soils over limestone to deep sands. Most of the rangeland in both counties consists of stony, shallow soils over limestone. The climax vegetation on these soils is an open tall and mid grass prairie. Potential productivity is only medium, but the vegetation produced is high in nutritive value. There are scattered areas in both counties of sandy loams and sands that support tall grass in an oak forest. Potential productivity is greater on the sandier soils, but the nutritive value of sandy soils is lower.

The major management concern on most of the rangeland is control of grazing so that the kinds and amounts of plants that make up the potential plant community are reestablished. This can be done by proper stocking and a deferred grazing system. Controlling brush is also important. This can be done mechanically, chemically, or biologically. Seeding adapted grasses, such as little bluestem, sideoats grama, indiangrass, and King Ranch bluestem, in areas of inadequate vegetation prevents excessive runoff and erosion and furnishes desirable forage. If sound range management based on soil survey information and range inventories is applied, potential is good for increasing the productivity of rangeland in the area.

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, and open ditches. 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, and shrink-swell potential are indicators of the traffic supporting capacity used in making the ratings. Soil wetness, flooding, slope, depth to hard rock or very compact layers, and content of large stones affect stability and ease of excavation.

Sanitary facilities

Favorable soil properties and site features are needed for proper functioning of septic tank absorption fields, sewage lagoons, and sanitary landfills. The nature of the soil is important in selecting sites for these facilities and in identifying limiting soil properties and site features to be considered in design and installation. Also, those soil properties that affect ease of excavation or installation of these facilities will be of interest to contractors and local officials. Table 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 16 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 16.

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

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

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

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

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

Although a rating of *good* is not based entirely on high content of organic matter, a surface horizon is generally preferred for topsoil because of its organic-matter content. This horizon is designated as A1 or Ap in the soil series descriptions. The absorption and retention of moisture and nutrients for plant growth are greatly increased by organic matter.

Water management

Many soil properties and site features that affect water management practices have been identified in this soil survey. In table 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.

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.

Town and country planning

In Hood and Somervell Counties, rapid population growth has placed more people in situations where soil conditions directly affect them. This is especially true in the Lake Granbury area, near the Brazos River, and in outlying areas of both Granbury and Glen Rose, where people are moving from the Dallas-Fort Worth Metroplex. The population will continue to grow with the construction of the Comanche Peak Power Generating Station.

Residential subdivision development and the accompanying extension of public utilities create a need for soils information somewhat different from the information needed for farming. Many people need soils information for individual residential tracts that are well beyond public utilities—for example, people who are building summer homes or recreational facilities.

Land appraisers, realtors, city planners, builders, and individuals need to have facts that will help them know what sites are suitable for homes or other buildings and what areas are more suitable for other uses. Most soil properties that are important for town and country planning are also important for engineering. Information in the engineering sections of this soil survey, however, does not eliminate the need for more detailed onsite studies when soils are used intensively. Most soil map units contain areas of contrasting soils; these areas are too small to show separately on the soil map.

In this section site selection, foundation problems, sewage disposal systems, underground utility lines, and erosion and runoff are described in terms of their effect on urban and residential development.

Site selection

When a site is selected for the construction of urban works and structures, the soil needs to be carefully investigated. Planners, builders, and maintenance personnel have encountered costly failures that can be traced to mistakes made in selecting soils for proposed structures or to lack of information about the soils that were used. If a soil is poorly suited to any intended use, little can be done without great expense to change it. In some instances a structure can be designed to combat the limitations of the soil, but the problem must be known prior to construction.

One of the first considerations is whether or not a soil is subject to flooding. The alluvial Bosque, Bunyan, Frio, Gaddy, and Yahola soils, for example, are subject to occasional flooding and are poorly suited as sites for permanent structures. They are better suited to green belts, sound barriers, wildlife habitat, and recreation areas.

Another important consideration in the survey area is the shrink-swell potential of the soils. Some are clayey in the surface layer, and others are clayey in the lower layers. Many soils have a perched water table during wet seasons. These are Chaney, Demona, Hassee, Nimrod, and Patilo soils (see table 18).

Other soil features that affect site selection are permeability, available water capacity, drainage, reaction (pH), corrosivity to steel and concrete, and hydrologic classification. Other factors include suitability as a septic tank absorption field, suitability as a site for foundations and low cost streets and roads, erosion and runoff problems, potential for recreational uses, and suitability for grasses, flowers, vines, shrubs, and trees.

Foundations

The soils of Hood and Somervell Counties warrant special attention when considered as sites for foundations. In some parts of the survey area are areas of clay soils, which are high in the clay mineral montmorillonite. Soils of this kind swell when wet and shrink and crack when dry. This action creates such pressure that walls and foundations crack unless, and sometimes even if, specially reinforced. This change in volume in a soil material as moisture content changes is called shrink-swell potential (see table 17).

Denton and Krum soils are most likely to cause damage, and the lower layers of Hassee, Purves, Tarrant, and Thurber soils are also high in content of montmorillonite. Soils likely to swell and shrink enough to damage foundations are those that have a high liquid limit and high plasticity index, or the soils classified as CH in the Unified system of classification (see tables 16 and 19). Soils that are flooded, poorly drained, or have low strength or high corrosivity also merit special attention.

Sewage disposal systems

Many new houses are being built annually in areas beyond existing municipal sewerlines. These areas must have onsite sewage disposal systems. The effectiveness of these systems depends largely on the absorptive capacity, permeability, percolation rate, wetness, flooding, seepage, and slope of the soils in the filter field.

The soils of Hood and Somervell Counties generally have severe limitations as sites for septic tank absorption fields. Most areas of the survey area have shallow depth to rock or clayey lower layers that take in water slowly.

In table 10 the soils are rated for sanitary facilities. By using the soil map to identify the soils and then referring to the ratings in table 10, a user of this soil survey can get a general idea on how well a septic tank system is likely to function in a selected area. It is nevertheless advisable to make a detailed inspection of the soils at the exact site that is to be used as a filter field.

Underground utility lines

Water mains, gas pipelines, communication lines, and sewer pipes that are buried in the soil can corrode and break unless protected against certain electrobiochemical reactions resulting from the inherent properties of the soil.

All metals corrode to some degree when buried in the soil, and some metals corrode more rapidly in some soils than in others. Corrosion potential depends on the physical, chemical, electrical, and biological characteristics of the soil. For example, concentrations of oxygen, concentrations of anaerobic bacteria, moisture content, and external factors, such as manmade electrical currents, influence corrosion potential. Design and construction also have an influence. Corrosion is intensified where two dissimilar metals are connected, where metal structures are buried at varying depths, and where pipelines extend through different kinds of soils.

Although electrical resistivity is only one factor in corrosion, measurements of that property permit a classification of probable corrosion potential. Electrical resistivity is a measure of the resistivity of a soil to the flow of an electrical current when the soil is wetted to field capacity. It is measured in ohms per cubic centimeter. A low value indicates low resistivity (or high conductivity) and high corrosion potential.

In soils that have high shrink-swell potential (see table 17), stress created by volume changes can break cast iron pipe. To prevent breakage, it may be necessary to cushion the pipes with sand.

Control of erosion and runoff

During urban construction the natural vegetation is generally removed and large areas are covered with pavement, concrete, and buildings. The amount of runoff from construction areas generally increases, and the pattern of runoff changes. Runoff after a heavy rain can be several times as great as when the same land was used for farming. The runoff concentrates in streets and gutters, instead of flowing into natural waterways, and the result is flooding, erosion, and deposition of sediments on lower lying areas (see table 12).

The control of erosion and runoff begins at the planning and design stage. With a good development plan, the problems brought on by soil erosion, runoff, and sedimentation can usually be avoided or lessened.

Special care is needed in planning and applying erosion-control and runoff-control measures. These measures should be designed to fit well with the esthetic surrounding of a homesite.

Potential for urbanization

The potential of a soil is the ability of that soil to produce, yield, or support a given structure or activity at a cost expressed in economic, social, or environmental units of value.

The soils of Hood and Somervell Counties have been rated in table 13 for their potential for urbanization. The elements considered are: (1) excavations in which to place utilities, (2) dwellings without basements but with public sewer systems, (3) streets, and (4) uncoated steel pipe.

The soils that have the highest potential for urbanization are those on which streets and structural foundations can be placed and not deteriorate because of adverse soil factors. In general, these same soils are easy to dig in, easy to grow plants in, and present a well drained, nonflooding landscape that is pleasing to the eye.

The factors to consider in rating a soil's potential for each element of urbanization are: (1) flooding, (2) depth to rock, (3) shrink-swell potential, (4) soil strength, (5) soil texture, (6) slope, and (7) corrosivity to uncoated steel.

Soils that are subject to flooding have very low potential for urbanization because of the difficulty and expense involved in controlling floodwaters. In most cases, the watershed includes an area much larger than any area a single land developer has control over.

Soils that are shallow over rock have low potential for urbanization. The rock is mostly hard in the survey area and requires blasting or the use of excavators larger than 200 to 300 horsepower. A few of the soils have rock that is rippable or that can be excavated using a single-tooth ripping attachment mounted on a 200- to 300-horsepower tractor.

Soils that have high shrink-swell potential or low soil strength have a medium potential for urbanization. These factors can be partially overcome by increasing the strength of the structures. In Hood and Somervell Counties these soils often have additional factors, such as steep slopes, clay textures, surface stoniness, and high corrosivity to uncoated steel, that further lower their potential for urbanization.

Clay soils are difficult to excavate and move or manipulate. This adds additional cost to development and maintenance.

Soils that are highly corrosive to uncoated steel pipes generally have other factors that lower their potential. The corrosive effect of the soil on uncoated pipes can be partially overcome by using protective coatings, by attaching anodes to the metal, or by using more resistant metals or materials such as plastics or concrete.

In table 9 the limitation of a soil for building site development may be based on the rating of a single factor. For example, a soil having high shrink-swell potential is rated as having a severe limitation because of this single factor.

In table 13 the rating factors are cumulative, that is, a wet soil that shrinks and swells greatly and is highly corrosive is rated lower than a soil that is only wet. Further, the ratings of elements of urbanization, that is, shallow excavations, dwellings, streets, and uncoated steel pipe, are also cumulative; they have been combined to create an overall potential of the soil for urbanization.

The potential of the soils for urbanization is divided into five classes: very high, high, medium, low, and very low. Definitions are:

Very High.—Soils with very few factors that are likely to cause problems during construction or after development. The factors can be easily and economically corrected.

High.—Soils with a few factors that will cause problems during construction or after development. The factors can be economically overcome.

Medium.—Soils with several factors that will cause problems during construction or after development. Some factors can be easily overcome, but one or more factors will be difficult or expensive to overcome.

Low.—Soils with several factors that will cause problems, both during construction and after development. Factors can only be overcome with difficulty and the use of very expensive measures.

Very Low.—Soils that are subject to flooding. Most soils have other factors as well that are very difficult to overcome. These soils are best suited to uses other than urbanization.

Recreation

EDWARD M. SCHWILLE, biologist, Soil Conservation Service, helped prepare this section.

About 75 to 80 percent of the area that has high potential for recreational development is used for some form of recreation. Facilities for fishing, vacation cabins, cottages, homesites, camping, picnicking, and other water-related activities are located adjacent to Lake Granbury and the Brazos and Paluxy Rivers. Existing water areas of one-fourth acre to 100 acres are abundant.

Dinosaur Valley State Park provides excellent recreatonal facilities. Tracks of several species of dinosaur are preserved in the limestone riverbed. Facilities include several picnic sites and a modern camping area.

About 50 historical markers and sites are located throughout the survey area. One of these is a historical monument at the gravesite of Elizabeth Crockett, the second wife of the Alamo hero Davy Crockett, at Acton State Park.

The soils of the survey area are rated in table 14 according to limitations that affect their suitability for recreation uses. The ratings are based on such restrictive soil features as flooding, wetness, slope, and texture of the surface layer. Not considered in these ratings, but important in evaluating a site, are location and accessibility of the area, size and shape of the area and its scenic quality, the ability of the soil to support vegetation, access to water, potential water impoundment sites available, and either access to public sewerlines or capacity of the soil to absorb septic tank effluent. Soils subject to flooding are limited, in varying degree, for recreation use by the duration and intensity of flooding and the season when flooding occurs. Onsite assessment of height, duration, intensity, and frequency of flooding is essential in planning recreation facilities.

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

The information in table 14 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

EDWARD M. SCHWILLE, biologist, Soil Conservation Service, helped prepare this section.

Through management and manipulation of the habitat, wildlife in the survey area is increasing. Special emphasis is being given to the improvement of habitat for game species (fig. 11).

Major kinds of wildlife in the survey area are white-tailed deer, mourning dove, bobwhite quail, turkey, raccoon, opossum, striped skunk, ringtail cat, bobcat, coyote, red and grey fox, armadillo, fox and grey squirrel, and numerous songbirds. During the migration period, waterfowl such as northern mallard, pintail, teal, and canvasback ducks use existing water areas. Fishery resources abound in these water areas.

The golden-cheeked warbler, which is on the list of threatened and endangered species, lives in mature stands of Ashe juniper in the survey area. No other species on the list lives in this area.

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 15, 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 lovegrass, 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 and goldenrod.

Shrubs and trees 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 and trees are depth of the root zone, available water capacity, salinity, and moisture. Examples are oak, Russian-olive, pecan, elm, mesquite, live oak, sumac, foresteria, bumelia, and hackberry.

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

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

Rangeland habitat consists of areas of wild herbaceous plants, shrubs, and trees. Wildlife attracted to rangeland include white-tailed deer, red fox, raccoon, tree squirrel, dove, bobwhite quail, turkey, and meadowlark.

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 16 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 16 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 16 in the standard terms used by the U.S. Department of Agriculture (*5*). These terms are defined according to percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loam." Other texture terms are defined in the Glossary.

The two systems commonly used in classifying soils for engineering use are the Unified Soil Classification System (Unified) (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) (*1*).

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

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

When laboratory data are available, the A-1, A-2, and A-7 groups are further classified as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the desirability of soils as subgrade material can be indicated by a group index number. These numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested in the survey area, with group index numbers in parentheses, is given in table 19. The estimated classification, without group index numbers, is given in table 16. Also in table 16 the percentage, by weight, of rock fragments more than 3 inches in diameter is estimated for each major horizon. These estimates are determined mainly by observing volume percentage in the field and then converting that, by formula, to weight percentage.

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

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

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

Physical and chemical properties

Table 17 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.

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.

Wind erodibility groups are made up of soils that have similar properties that affect their resistance to soil blowing if cultivated. The groups are used to predict the susceptibility of soil to blowing and the amount of soil lost as a result of blowing. Soils are grouped according to the following distinctions:

1. Sands, coarse sands, fine sands, and very fine sands. These soils are extremely erodible, so vegetation is difficult to establish. They are generally not suitable for crops.

2. Loamy sands, loamy fine sands, and loamy very fine sands. These soils are very highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

3. Sandy loams, coarse sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible, but crops can be grown if intensive measures to control soil blowing are used.

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible, but crops can be grown if intensive measures to control soil blowing are used.

4. Clays, silty clays, clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible, but crops can be grown if measures to control soil blowing are used.

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible, but crops can be grown if measures to control soil blowing are used.

6. Loamy soils that are 18 to 35 percent clay and less than 5 percent finely divided calcium carbonate, except silty clay loams. These soils are very slightly erodible, and crops can easily be grown.

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate. These soils are very slightly erodible, and crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to soil blowing.

Soil and water features

Table 18 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 18 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

Table 19 contains the results of engineering tests performed by the Texas Highway Department on several important soils in Hood and Somervell Counties. The table shows the depth to which sampling was done and the results of tests to determine particle-size distribution and other properties significant in soil engineering.

The shrinkage limit is that point of moisture content of a drying soil at which shrinkage stops. As moisture leaves a soil, the soil shrinks. Volume decreases in direct proportion to the loss in moisture until a condition of equilibrium is reached where shrinkage stops although additional moisture is removed. The shrinkage limit is reported as the moisture content, as a percentage of the oven-dry weight of the soil, when shrinkage stops.

Linear shrinkage is the decrease in one dimention, expressed as a percentage of the original dimention, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit. The data are used to give some indication of the amount of cracking that will take place in such soils and subgrades as a result of drying.

Shrinkage ratio is determined by taking the volume change of a soil from a wet stage to the shrinkage limit, and dividing this by the weight change of the soil during the same drying period. For this calculation, volume and weight changes are expressed as percentages of the volume and weight of the oven dry soil sample.

For explanations of the AASHTO and Unified classification systems, see the section "Engineering properties."

Mechanical analysis shows the percentages, by weight, of soil particles passing through sieves of specified sizes. Gravel ranges from 3 inches in diameter to just over 2 millimeters, the size of the No. 10 sieve. Sand ranges from 2 millimeters to just over 0.074 millimeter, the size of the No. 200 sieve. AASHTO standards define silt as soil particles between 0.074 millimeter and 0.005 millimeter in size, and clay as soil particles smaller than 0.005 millimeter. USDA definitions of silt and clay, given in the Glossary, have slightly different boundaries. Clay fraction in these tests was determined by the hydrometer method.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a solid to a plastic state. If the moisture content is further increased, the material changes from plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from solid to plastic. The liquid limit is the moisture content at which the material changes from plastic to liquid. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic.

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 dry soil.

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

Aledo series

The Aledo series consists of very shallow to shallow, loamy soils that formed in interbedded limestone and marl on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Aledo gravelly clay loam in an area of Aledo-Bolar association, undulating; from the intersection of Texas Highway 144 and U.S. Highway 377 in Granbury, about 7.6 miles east on U.S. Highway 377, and 600 feet south of highway in range:

A11—0 to 4 inches; dark grayish brown (10YR 4/2) gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; many fine roots; common fine pores; common wormcasts; about 20 percent by volume limestone fragments mostly about 1 to 3 inches across the long axis; fragments of limestone 1 to 8 inches across the long axis cover about 5 percent of the surface; about 48 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear irregular boundary.

A12—4 to 14 inches; dark grayish brown (10YR 4/2) very gravelly clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; common fine roots; common fine pores; few wormcasts; about 75 percent by volume limestone fragments mostly 1 to 6 inches across the long axis; fragments have coatings of secondary calcium carbonate; about 54 percent calcium carbonate equivalent; calcareous; moderately alkaline; abrupt wavy boundary.

R—14 to 18 inches; coarsely fractured limestone.

Solum thickness and depth to hard, coarsely fractured limestone ranges from 8 to 20 inches. Average content of limestone fragments ranges from 5 to 50 percent in the A11 horizon and from 40 to 80 percent in the A12 horizon. These fragments are mostly less than 6 inches across the long axis. The calcium carbonate equivalent throughout the solum ranges from 40 to 80 percent.

The A horizon is grayish brown, dark grayish brown, very dark grayish brown, brown, or dark brown. The A11 horizon is clay loam, loam, gravelly clay loam, or gravelly loam, and the A12 horizon is gravelly loam, gravelly clay loam, very gravelly loam, or very gravelly clay loam.

Bastrop series

The Bastrop series consists of deep, loamy soils that formed in thick reddish beds of loamy sediments on geologic terraces. Slopes range from 0 to 8 percent.

Typical pedon of Bastrop fine sandy loam, 1 to 3 percent slopes; from the intersection of Texas Highway 144 and U.S. Highway 67 in Glen Rose, about 4.2 miles east on U.S. Highway 67, and 350 feet south in a cultivated field:

Ap—0 to 5 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; hard, friable; many fine roots; few siliceous pebbles; slightly acid; abrupt smooth boundary.

A1—5 to 13 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; hard, friable; many fine roots; medium acid; clear smooth boundary.

B21t—13 to 34 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; moderate medium subangular blocky structure; hard, firm; common fine roots; many fine pores; patchy clay films on surfaces of peds and in pores; common wormcasts; few siliceous pebbles; slightly acid; gradual smooth boundary.

B22t—34 to 80 inches; yellowish red (5YR 5/8) sandy clay loam, yellowish red (5YR 4/8) moist; weak fine subangular blocky structure; hard, firm; few fine roots; patchy clay films on surfaces of peds; few siliceous pebbles; slightly acid; gradual smooth boundary.

Solum thickness ranges from 60 to about 80 inches. Content of small siliceous pebbles ranges from none to about 15 percent, by volume.

The A horizon is light brownish gray, pale brown, light brown, grayish brown, dark grayish brown, strong brown, yellowish brown, brown, light reddish brown or reddish brown fine sandy loam or loamy fine sand. It is medium acid, slightly acid, or neutral.

The Bt horizon is reddish brown, red, yellowish red, reddish yellow, light reddish brown, brown, or strong brown sandy clay loam, loam, or clay loam and has clay content of about 20 to 30 percent. The B21t horizon is slightly acid or neutral. The B22t horizon is slightly acid through moderately alkaline and in some pedons is calcareous below a depth of 60 inches.

The C horizon, where present, is light brown, reddish yellow, light reddish brown, or yellowish red sandy clay loam, clay loam, or loam. In some pedons the C horizon contains strata of sandy loam or loamy sand. Some pedons have secondary lime in the form of films, threads, and concretions below a depth of 60 inches.

Blanket series

The Blanket series consists of deep, loamy soils that formed in calcareous ancient stream alluvium or interbedded marls and calcareous clays on uplands. Slopes range from 1 to 3 percent.

Typical pedon of Blanket clay loam, 1 to 3 percent slopes; from the intersection of Farm Road 4 and Farm Road 2580 in Thorp Springs, about 10.2 miles west on Farm Road 4, and 500 feet northeast of field gate in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, firm; many fine roots; few fine pores; neutral; clear smooth boundary.

A1—6 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; hard, firm; many fine roots; mildly alkaline; gradual smooth boundary.

B21t—12 to 30 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; moderate medium blocky structure; very hard, very firm; few fine roots; mildly alkaline; gradual smooth boundary.

B22t—30 to 42 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; very hard, very firm; few thin clay films on surfaces of peds; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—42 to 54 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; weak medium blocky structure; very hard, very firm; common films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—54 to 62 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; very hard, very firm; many films and threads of calcium carbonate; calcareous; moderately alkaline.

Solum thickness is 40 to 80 inches. Secondary carbonates in the form of films, threads, or soft bodies are at a depth of more than 28 inches. Some pedons contain a few siliceous pebbles throughout.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, very dark grayish brown, or very dark brown. It is slightly acid through mildly alkaline.

The B21t horizon is brown, dark brown, grayish brown, dark grayish brown, very dark grayish brown, or very dark brown clay loam or clay and has clay content of 35 to about 50 percent. Reaction is slightly acid through mildly alkaline. The B22t horizon has the same color range as the B21t horizon except that some pedons have moist color value of 4. The B22t horizon is slightly acid through moderately alkaline. The B3ca and Cca horizons are light gray, light brownish gray, grayish brown, very pale brown, pale brown, yellowish brown, dark brown, or brown.

More than 20 percent of the Cca horizon is calcium carbonate in the form of films, threads, soft bodies, or concretions.

Bolar series

The Bolar series consists of moderately deep, loamy soils that formed in interbedded limestone and calcareous marl on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Bolar stony clay loam in an area of Aledo-Bolar association, undulating; from the intersection of U.S. Highway 377 and Texas Highway 144 in Granbury, about 8.1 miles east on U.S. Highway 377, and 200 feet south of highway in range:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) stony clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; many fine roots; common fine pores; many wormcasts; fragments of limestone 1 to 10 inches across the long axis cover about 5 percent of the surface; few gravel-sized fragments of limestone; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 13 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; hard, friable; common fine roots; common fine pores; many wormcasts; few gravel-sized fragments of limestone; few weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; clear smooth boundary.

B21ca—13 to 22 inches; light brownish gray (10YR 6/2) clay loam, grayish brown (10YR 5/2) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; few wormcasts; few soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—22 to 28 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; moderate fine subangular blocky structrue; hard, firm; common soft bodies and few concretions of calcium carbonate; few fragments of limestone in lower part; calcareous; moderately alkaline; abrupt smooth boundary.

R—28 to 32 inches; fractured limestone bedrock interbedded with calcareous clayey marl.

The solum ranges from 20 to 40 inches in thickness. Noncarbonate clay content of the 10- to 40-inch control section ranges from 20 to 35 percent. Content of fragments of limestone and strongly cemented or indurated concretions of calcium carbonate of gravel to stone size in the upper part of the solum ranges from a few to 35 percent, by volume. The B3ca horizon, where present, has coarse fragment content of as much as 50 percent. The fragments are scattered throughout the pedon or exist as discontinuous remnant stone lines of limestone or petrocalcic horizons. Calcium carbonate content of the 10- to 40-inch control section is 40 to 75 percent.

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

The B horizon is light brown, brown, pale brown, very pale brown, grayish brown, light brownish gray, light gray, yellowish brown, light yellowish brown, light olive brown, yellow, or pale yellow loam, silty clay loam, or clay loam. Some pedons have a B3ca horizon.

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

Bosque series

The Bosque series consists of deep, loamy soils that formed in calcareous alluvial sediments on bottom lands. Slopes range from 0 to 1 percent.

Typical pedon of Bosque loam, occasionally flooded; from the south end of the Paluxy River Bridge in Paluxy, about 1 mile south on Farm Road 204, and 150 feet west of road in pasture:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular and moderate fine subangular blocky structure; slightly hard, friable; many fine roots; calcareous; moderately alkaline; clear smooth boundary.

A12—6 to 20 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; slightly hard, friable; common fine roots; many very fine pores; many wormcasts; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

A13—20 to 30 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate fine subangular blocky structure; hard, firm; common fine roots; many fine pores; many films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B2—30 to 46 inches; light brownish gray (10YR 6/2) clay loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, firm; many films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—46 to 62 inches; pale brown (10YR 6/3) clay loam, dark brown (10YR 4/3) moist; massive; hard, firm; many films and threads of calcium carbonate; calcareous; moderately alkaline.

The average texture of the 10- to 40-inch control section ranges from loam to clay loam, and clay content ranges from 20 to 35 percent. Some pedons contain a few fine siliceous or limestone pebbles.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. It is mildly alkaline or moderately alkaline and is calcareous.

The B horizon is light brown, brown, pale brown, very pale brown, grayish brown, light brownish gray, or light yellowish brown loam or clay loam and has lenses of fine sandy loam in some pedons.

The C horizon ranges from fine sandy loam to clay. Some pedons include a buried horizon of dark grayish brown through very pale brown.

Brackett series

The Brackett series consists of shallow, loamy soils that formed in interbedded soft limestone and marly earth on uplands. Slopes range from 10 to 30 percent.

Typical pedon of Brackett loam, in an area of Brackett soils, hilly; from the intersection of U.S. Highway 67 and Farm Road 205 in Glen Rose, about 10 miles west on U.S. Highway 67, 0.6 mile north on Farm Road 204, and 150 feet south of road in range:

A1—0 to 4 inches; light brownish gray (2.5Y 6/2) loam, grayish brown (2.5Y 5/2) moist; moderate fine granular and subangular blocky structure; hard, friable; many fine roots and few medium roots; many wormcasts; many calcium carbonate concretions; about 30 percent fragments of limestone mostly less than 3 inches across occurring as a pavement on the surface; calcareous; moderately alkaline; clear wavy boundary.

B2—4 to 16 inches; very pale brown (10YR 8/4) clay loam, very pale brown (10YR 7/4) moist; moderate fine subangular blocky structure; hard, friable; few fine and medium roots; tongues of darker material from layer above in worm tunnels and root channels; many films and threads of calcium carbonate; common calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

Cr—16 to 40 inches; interbedded very pale brown (10YR 8/3) clay loam and weakly cemented, platy limestone fragments less than 3 inches across; massive; hard, friable; cleavage planes of rock structure evident in clay loam; few medium roots; calcareous; moderately alkaline.

Solum thickness ranges from 10 to 20 inches. Content of coarse fragments in the solum ranges from a few pieces of gravel-sized limestone to 35 percent, by volume, platy, weakly to strongly cemented fragments of limestone as much as 5 inches across the long axis. The soil, including the C horizon, has calcium carbonate content of 40 to more than 80 percent excluding fragments coarser than 20 millimeters.

The A horizon is brown, grayish brown, light yellowish brown, light brownish gray, pale brown, very pale brown, or light gray loam, gravelly loam, gravelly clay loam, or clay loam.

The B horizon is grayish brown, brown, yellowish brown, light brownish gray, pale brown, light yellowish brown, light gray, very pale brown, or pale yellow loam, gravelly loam, clay loam, or gravelly clay loam.

The C horizon is light brownish gray, olive yellow, very pale brown, pale yellow, or white. Content of fragments of limestone is 25 to 50 percent, by volume. The C horizon is limy earths intermingled with limestone, calcareous silty shales, or marl.

Bunyan series

The Bunyan series consists of deep, loamy soils that formed in stratified alluvial sediments on bottom lands. Slopes range from 0 to 1 percent.

Typical pedon of Bunyan fine sandy loam, occasionally flooded; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 2.6 miles east on U.S. Highway 67, 3.1 miles south on Farm Road 200, and 825 feet north in pasture:

A1—0 to 8 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; hard, friable; many fine roots; many fine pores; few strata about 0.5 inch thick of dark brown clay loam material; slightly acid; abrupt smooth boundary.

C1—8 to 20 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; massive; hard, firm; many fine roots; thin strata of darker material with evident bedding planes; neutral; gradual smooth boundary.

C2—20 to 34 inches; grayish brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; massive; hard, firm; few fine roots; mildly alkaline; abrupt smooth boundary.

C3—34 to 45 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; hard, friable; few fine roots; calcareous; moderately alkaline; clear smooth boundary.

C4—45 to 58 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few soft bodies of calcium carbonate in lower part; calcareous; moderately alkaline; abrupt smooth boundary.

C5—58 to 62 inches; light brownish gray (2.5Y 6/2) clay loam, grayish brown (2.5Y 5/2) moist; few fine faint yellowish mottles; massive;

very hard, very firm; common soft bodies of calcium carbonate; few black concretions; calcareous; moderately alkaline.

The 10- to 40-inch control section is fine sandy loam, loam, sandy clay loam, or clay loam. Clay content is 18 to 35 percent, and content of material coarser than very fine sand is more than 15 percent. Stratification varies from scarcely evident to pronounced.

The A horizon is dark grayish brown, grayish brown, light brownish gray, brown, or pale brown. Below a depth of 10 inches, some pedons contain thin layers that are darker than the allowable range of the surface layer. The A horizon is neutral or slightly acid.

The C horizon, in the 10- to 40-inch control section, is brown, light brown, grayish brown, light grayish brown, pale brown, light yellowish brown, light brownish gray, or yellowish brown. Thin strata of very dark grayish brown, dark grayish brown, or dark brown also occur in the 10- to 40-inch control section. Reaction of the C horizon ranges from medium acid in the upper part through moderately alkaline in the lower part. The lower part of the C horizon is calcareous. Interbedded calcareous and noncalcareous strata are common.

Chaney series

The Chaney series consists of deep, sandy soils that formed in sandy, sandy clay, and shaly clay materials on uplands. Slopes range from 1 to 5 percent.

Typical pedon of Chaney loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 4 and Farm Road 1189 in Lipan, about 3.4 miles north on paved county road, 0.1 mile west on county road, and 50 feet south of road in a field:

Ap—0 to 12 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine granular structure; slightly hard, friable; few fine roots; few siliceous pebbles; slightly acid; abrupt wavy boundary.

B21t—12 to 17 inches; yellowish brown (10YR 5/4) sandy clay, dark yellowish brown (10YR 4/4) moist; common medium prominent mottles of red (2.5YR 4/8) and yellowish brown (10YR 5/6); weak medium blocky structure; very hard, very firm; few fine roots; few thin clay films on surfaces of peds; slightly acid; gradual smooth boundary.

B22t—17 to 34 inches; brownish yellow (10YR 6/8) sandy clay, yellowish brown (10YR 5/8) moist; many medium prominent mottles of red (2.5YR 4/8) and light gray (10YR 7/2); weak medium blocky structure; very hard, very firm; few fine roots; medium acid; gradual smooth boundary.

B3—34 to 44 inches; light gray (10YR 7/1) sandy clay, light gray (10YR 7/1) moist; many coarse prominent mottles of yellowish brown (10YR 5/8), brownish yellow (10YR 6/8), and red (2.5YR 4/6); pockets of fine sandy loam in the red mottles; weak coarse blocky structure; very hard, firm; strongly acid; gradual smooth boundary.

C1—44 to 56 inches; mottled light gray (10YR 7/1), yellowish brown (10YR 5/8), brownish yellow (10YR 6/8), red (2.5YR 4/6), and dark red (2.5YR 3/6) sandy clay loam; massive; very hard, firm; small bodies of soft calcium carbonate in lower part; slightly acid; gradual wavy boundary.

C2—56 to 72 inches; light olive gray (5Y 6/2) shaly clay; faint yellowish mottles; massive; very hard, very firm; many fine black concretions; common soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. The A horizon is 6 to 20 inches thick. Reaction is neutral through medium acid.

The A1 horizon is light brown, brown, grayish brown, dark grayish brown, pale brown, very pale brown, yellowish brown, light yellowish brown, or light brownish gray. The A2 horizon is 1 to 3 units of value lighter in color than the A1 horizon. Cultivation usually mixes the A1 and A2 horizons.

The Bt horizon is reddish brown, red, dark red, yellowish red, reddish yellow, light brown, light gray, white, yellowish brown, or brownish yellow. It has prominent grayish or brownish mottles, and in some pedons the Bt horizon has a mottled matrix of reds, yellows, browns, and grays. Texture is sandy clay or clay, and clay content is 35 to 50 percent. Reaction is slightly acid or medium acid. The B3 horizon is mottled with brownish yellow, yellowish brown, red, pale brown, light gray, or gray. It is sandy clay loam or sandy clay.

The C horizon ranges from sandy loam through shaly clay. Some pedons have thin, weakly cemented, discontinuous sandstone layers in the C horizon. Reaction is moderately alkaline through medium acid. Some pedons contain a few films, threads, or soft bodies of calcium carbonate in the C horizon.

Decordova series

The Decordova series consists of deep, sandy soils of ancient river terraces on uplands. These soils formed in sandy alluvial deposits from the Brazos River, and the deposits had been reworked by wind. Slopes range from 0 to 5 percent.

Typical pedon of Decordova loamy fine sand, 0 to 5 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 5.7 miles east on U.S. Highway 67, 4.8 miles north on Farm Road 199 to its end, 0.1 mile on county road curving to west, and 200 feet north of fence row in a cultivated field:

Ap—0 to 14 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; weak fine granular structure; loose, very friable; few fine roots; slightly acid; clear smooth boundary.

B21t—14 to 58 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine granular; slightly hard, friable; few fine roots; common fine pores; few clean grains of sand; few siliceous pebbles; few insect burrows in upper part; slightly acid; gradual smooth boundary.

B22t—58 to 78 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure; slightly hard, friable; few pockets of clean grains of sand; slightly acid; gradual smooth boundary.

B3—78 to 80 inches; yellowish red (5YR 5/8) fine sandy loam, yellowish red (5YR 4/8) moist; weak medium subangular blocky structure; slightly hard, friable; few pockets of clean grains of sand; neutral.

Solum thickness ranges from 60 to more than 80 inches. Content of small siliceous pebbles ranges from 0 to about 10 percent.

The A horizon is light brown, brown, light yellowish brown, or dark brown. It is medium acid through neutral.

The Bt and B3 horizons are yellowish red, reddish yellow, strong brown, red, or reddish brown. Texture is fine sandy loam or loam, and clay content is less than 18 percent. The Bt and B3 horizons are medium acid through neutral, and some pedons are moderately alkaline and calcareous in the lower part.

Demona series

The Demona series consists of deep, sandy soils that formed in basal sands and sandy clays on uplands. Slopes range from 1 to 5 percent.

Typical pedon of Demona loamy fine sand, 1 to 5 percent slopes; from the intersection of Farm Road 4 and Farm Road 1189 in Lipan, about 3.4 miles north on paved county road, 0.8 mile east on county road, and 410 feet south in woods:

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

A2—4 to 34 inches; very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; slightly hard, loose; common fine and medium roots; few siliceous pebbles; slightly acid; abrupt wavy boundary.

B21t—34 to 40 inches; brownish yellow (10YR 6/8) sandy clay, yellowish brown (10YR 5/8) moist; common medium distinct mottles of red (2.5YR 4/8), yellowish brown (10YR 5/4), brownish yellow (10YR 6/6), and light brownish gray (10YR 6/2); weak coarse blocky structure; very hard, very firm; medium acid; gradual smooth boundary.

B22t—40 to 48 inches; light gray (10YR 7/2) sandy clay, light brownish gray (10YR 6/2) moist; common coarse prominent mottles of yellowish brown (10YR 5/8) and red (2.5YR 4/8); weak coarse blocky structure; very hard, very firm; medium acid; gradual smooth boundary.

B3—48 to 56 inches; light gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) moist; common coarse prominent mottles of red (2.5YR 4/8, 5/8), yellowish brown (10YR 5/6), and brownish yellow (10YR 6/6); weak coarse blocky structure; very hard, very firm; medium acid; gradual wavy boundary.

C—56 to 80 inches; white (10YR 8/1) sandy clay loam, light gray (10YR 7/1) moist; few medium prominent mottles of light red (2.5YR 6/8), red (2.5YR 5/8), yellowish brown (10YR 5/6), and brownish yellow (10YR 6/6); massive; very hard, firm; strongly acid.

Solum thickness ranges from 50 to 80 inches. A temporary water table is perched on the clayey subsoil following periods of heavy rainfall.

The A horizon ranges in thickness from 20 to 40 inches. It is light brown, brown, grayish brown, dark grayish brown, or very pale brown. Reaction is slightly acid to mildly alkaline. The A2 horizon is pale brown, very pale brown, light brown, or reddish yellow. Reaction is neutral to medium acid.

The B2t horizon is red, light gray, or brownish yellow and has red, yellow, brown, or gray mottles. The B2t horizon ranges in texture from sandy clay to clay and in structure from weak coarse blocky to moderate fine blocky. The B2t horizon is strongly acid to slightly acid. The B3 horizon is red, light gray, brownish yellow, or reddish yellow and has red, yellow, or gray mottles. It is sandy clay loam or sandy clay.

Texture of the C horizon is sandy clay loam or sandy clay.

The Demona soils in this survey area are taxadjuncts to the Demona series because they do not have low-chroma mottles within 75 cm of the surface; otherwise, they are similar in morphology, use, behavior, and management.

Denton series

The Denton series consists of moderately deep, clayey soils that formed over fractured indurated limestone and interbedded marls on uplands. Slopes range from 1 to 5 percent.

Typical pedon of Denton clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 5.7 miles east on U.S. Highway 67, 1.6 miles south on Farm Road 199, 1.8 miles southeast on Farm Road 200, and 1,920 feet east of highway in range:

A11—0 to 10 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; hard, firm; many fine roots; common calcium carbonate concretions; calcareous; moderately alkaline; clear smooth boundary.

A12—10 to 24 inches; brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate medium subangular blocky structure; very hard, very firm; common fine roots; common calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

A13—24 to 32 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; moderate medium angular blocky structure; very hard, very firm; few fine roots; common calcium carbonate concretions; few shell fragments; calcareous; moderately alkaline; abrupt irregular boundary.

Cca—32 to 38 inches; brown (10YR 5/3) very gravelly clay, brown (10YR 4/3) moist; massive; very hard, firm; about 60 percent by volume limestone fragments 0.5 inch to 4 inches across the long axis; many calcium carbonate concretions; calcareous; moderately alkaline; abrupt irregular boundary.

R—38 to 40 inches; fractured limestone.

Solum thickness ranges from 22 to 40 inches over limestone bedrock or over limestone bedrock interbedded with marly clay. Fragments of limestone smaller than 3 inches across make up from 0 to 20 percent of the soil mass. Silicate clay content ranges from 35 to 55 percent.

The A horizon is dark brown, brown, very dark brown, dark grayish brown, or very dark grayish brown. Chromas of 2 are caused not by wetness but by lime. The mollic epipedon ranges from 16 to 35 inches in thickness. Structure of the A horizon ranges from moderate medium subangular blocky to moderate medium fine angular blocky.

Some pedons have a B horizon of brown, yellowish brown, light olive brown, dark yellowish brown, dark brown, pale brown, or light yellowish brown clay, silty clay, or silty clay loam. Some pedons have stone lines in the B horizon.

The R layer ranges from fractured limestone bedrock interbedded with calcareous clayey marl to beds of limestone rubble with clayey marl in the interstices.

Duffau series

The Duffau series consists of deep, loamy and sandy soils that formed in sands, sandy clay loams, fine sandy loams, and weakly cemented sandstone on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Duffau fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 2.7 miles east on U.S. Highway 67, 1.8 miles south on Farm Road 200, 0.2 mile south on county road, and 330 feet east of road in a cultivated field:

Ap—0 to 12 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; hard, friable; common fine roots; slightly acid; clear smooth boundary.

B21t—12 to 32 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; common fine tubular pores; patchy clay films on surface of peds; neutral; gradual smooth boundary.

B22t—32 to 40 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak coarse subangular blocky structure; hard, firm; few patchy clay films on surfaces of peds; few black concretions; neutral; gradual smooth boundary.

B23t—40 to 64 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common coarse prominent mottles of brownish yellow (10YR 6/6) and red (2.5YR 4/8); weak coarse subangular blocky structure; hard, firm; neutral; gradual wavy boundary.

C—64 to 80 inches; mottled reddish yellow (7.5YR 6/6), very pale brown (10YR 7/3), and yellowish red (5YR 5/8) fine sandy loam; pockets of sandy clay loam and thin discontinuous bands of weakly cemented sandstone; massive; slightly hard, friable; neutral.

Solum thickness ranges from 60 to about 80 inches. Content of fine siliceous or ironstone pebbles ranges from none to few throughout the solum.

The A1 horizon is light yellowish brown, yellowish brown, pale brown, light brown, brown, dark grayish brown, or grayish brown. The A2 horizon, where present, is 1 to 3 units of color value lighter than the A1 horizon. The A horizon is fine sandy loam or loamy fine sand. It ranges from slightly acid through mildly alkaline.

The B2t horizon is reddish brown, yellowish red, reddish yellow, red, very pale brown, or strong brown. The B23t horizon contains none to common reddish brown, brownish yellow, red, yellowish red, or strong brown mottles. The B2t horizon is sandy clay loam or clay loam and has clay content of about 20 to 35 percent. It is slightly acid through mildly alkaline.

The C horizon is sandy clay loam, fine sandy loam, or weakly cemented sandstone.

Frio series

The Frio series consists of deep, clayey soils that formed in calcareous silty clay loam and silty clay alluvium on bottom lands. Slopes ranges from 0 to 1 percent.

Typical pedon of Frio silty clay, occasionally flooded; from the intersection of U.S. Highway 67 and Farm Road 205 in Glen Rose, about 4.1 miles north on Farm Road 205, 4.5 miles north on county road, and 1,070 feet south in pasture:

Ap—0 to 8 inches; dark grayish brown (10YR 4/2) silty clay, very dark grayish brown (10YR 3/2) moist; strong fine granular and moderate fine subangular blocky structure; hard, firm; common fine roots; common wormcasts; 15 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

A1—8 to 26 inches; very dark grayish brown (10YR 3/2) silty clay, very dark brown (10YR 2/2) moist; strong fine subangular blocky structure; hard, firm; common fine roots; few wormcasts; 17 percent calcium carbonate equivalent; few films and threads of calcium carbonate and shell fragments; calcareous; moderately alkaline; diffuse smooth boundary.

B2—26 to 38 inches; grayish brown (10YR 5/2) silty clay, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; hard, firm; few fine roots; 20 percent calcium carbonate equivalent; common calcium carbonate concretions and soft bodies; calcareous; moderately alkaline; gradual smooth boundary.

Cca—38 to 62 inches; pale brown (10YR 6/3) silty clay, brown (10YR 5/3) moist; massive; hard, firm; 25 percent calcium carbonate equivalent; many calcium carbonate concretions; common shell fragments; calcareous; moderately alkaline.

The calcium carbonate equivalent of the 10- to 40-inch control section ranges from 10 to 40 percent. Between depths of 30 and 50 inches, some pedons have strata of more loamy or more clayey sediments. Five to 15 percent, by volume, of the control section of some pedons is pebbles and cobbles of limestone and chert.

The Ap and A1 horizons are brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown. The A horizon is silty clay, silty clay loam, or clay loam and has clay content of 35 to 50 percent.

The B2 horizon, where present, has higher color value or chroma than the A horizon.

The Cca horizon is pale brown, light yellowish brown, or brown. It is silty clay loam or silty clay.

Gaddy series

The Gaddy series consists of deep, sandy soils that formed in recent sandy alluvial sediments on bottom lands. Slopes range from 0 to 2 percent.

Typical pedon of Gaddy loamy fine sand, in an area of Yahola-Gaddy complex, occasionally flooded; from the intersection of Texas Highway 144 and U.S. Highway 67 in Glen Rose, about 2.6 miles east on U.S. Highway 67, 1.1 miles south on Farm Road 200, 0.5 mile west on paved county road, 2.3 miles west on private road, and 50 feet west in native pasture:

A1—0 to 14 inches; pale brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; weak fine granular structure; soft, very friable; common fine roots; few thin strata of darker colored fine sandy loam and loam; calcareous; moderately alkaline; clear smooth boundary.

C1—14 to 48 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; single grained; loose, very friable; few fine roots; few thin strata of fine sandy loam; calcareous; moderately alkaline; clear smooth boundary.

C2—48 to 62 inches; light brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; soft, very friable; few strata of fine sandy loam; calcareous; moderately alkaline.

The Ap or A1 horizon is brown, light brown, reddish yellow, grayish brown, pale brown, dark yellowish brown, or light yellowish brown. It is loamy fine sand or fine sandy loam. It is mildly alkaline or moderately alkaline above a depth of 10 inches and calcareous and moderately alkaline below a depth of 10 inches. Where moist colors and values are less than 3.5, organic matter content is less than 1 percent.

The C horizon is light brown, pink, reddish yellow, pale brown, light yellowish brown, very pale brown, brownish yellow, or yellow loamy fine sand or fine sand that contains thin strata of finer or coarser textured material.

Hassee series

The Hassee series consists of deep, loamy soils that formed in alkaline clayey sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Hassee fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 1.0 mile east on U.S. Highway 67, 8.7 miles north on Texas Highway 144, 2.0 miles east on Farm Road 2425, 1.1 miles east on paved county road, and 450 feet south of road in a cultivated field:

Ap—0 to 11 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; massive; very hard, friable; common fine roots; slightly acid; clear smooth boundary.

A2g—11 to 14 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; massive; very hard, friable; common fine roots; neutral; abrupt smooth boundary.

B21tg—14 to 20 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; common fine faint reddish mottles; strong coarse blocky structure; extremely hard, extremely firm; few fine roots along faces of peds; continuous clay films on faces of peds; neutral; gradual smooth boundary.

B22tg—20 to 30 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few fine faint reddish mottles; moderate coarse blocky structure; extremely hard, extremely firm; few fine roots in upper part along faces of peds; continuous clay films on faces of peds; neutral; gradual smooth boundary.

B3gca—30 to 49 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; extremely hard, extremely firm; common fine calcium carbonate concretions; few soft bodies of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

Cca—49 to 62 inches; light brownish gray (10YR 6/2) clay, grayish brown (10YR 5/2) moist; massive; hard, firm; common soft bodies and concretions of calcium carbonate; calcareous; moderately alkaline.

Solum thickness is 40 to 72 inches. Calcium carbonate bodies and concretions are at depths of 28 to 50 inches. The A horizon averages more than 10 inches in thickness in more than 50 percent of the pedon but is as thin as 8 inches in places. The soil is massive and hard or very hard when dry. Reaction is slightly acid or neutral.

The A1 or Ap horizon is very dark grayish brown, dark grayish brown, or grayish brown. Moist color values are 1 or 2 units of value lower than dry values. The A2g horizon is light gray, gray, grayish brown, or light brownish gray.

The B2tg horizon is dark gray, very dark gray, very dark grayish brown, or dark grayish brown. Some pedons have few to common fine reddish or yellowish mottles. Clay content in the B2tg horizon ranges from about 45 to 60 percent. The B2tg horizon is slightly acid through moderately alkaline.

The B3g and Cca horizons are light gray, gray, light brownish gray, grayish brown, dark grayish brown, very dark grayish brown, brown, dark brown, pale brown, or yellowish brown clay or clay loam. Reaction ranges from neutral through moderately alkaline. Some pedons contain a few fine pebbles of quartz in the B3g and Cca horizons.

Hensley series

The Hensley series consists of shallow, loamy soils that formed over indurated, fractured limestone on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Hensley stony clay loam, 0 to 3 percent slopes; from the intersection of U.S. Highway 67 and Farm Road 205 in Glen Rose, about 10 miles west on U.S. Highway 67, 330 feet south of highway along fence line, and 150 feet east in range:

A1—0 to 4 inches; brown (7.5YR 4/2) stony clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; very hard, firm; many fine roots; fragments of limestone 3 to 6 inches across make up about 1 percent of this horizon and fragments of limestone from 3 inches to 10 feet across cover 15 percent of the surface; neutral; clear smooth boundary.

B2t—4 to 18 inches; reddish brown (2.5YR 4/4) clay, dark reddish brown (2.5YR 3/4) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; few thin continuous clay films on faces of peds; 2 percent by volume limestone fragments 4 to 8 inches across in lower part; neutral; abrupt smooth boundary.

R—18 to 20 inches; limestone bedrock with a few fractures.

Solum thickness to the lithic contact ranges from 10 to 20 inches. Content of limestone and ironstone fragments and gravel sized ferruginous pebbles in the A horizon ranges from 0 to about 25 percent, by volume. Limestone fragments of gravel to stone size cover from 0 to about 40 percent of the surface.

The A horizon is dark reddish gray, reddish brown, or brown. It is loam, clay loam, stony loam, or stony clay loam. It is slightly acid through mildly alkaline.

The Bt horizon is reddish brown, dark reddish brown, red, or dark red. Texture of the Bt horizon, exclusive of limestone or ferruginous pebbles, is clay loam or clay, and clay content is 35 to 55 percent. Content of coarse fragments of gravel to cobble size ranges from 0 to 15 percent, by volume. The Bt horizon is neutral through moderately alkaline.

Krum series

The Krum series consists of deep, clayey soils that formed in calcareous, clayey sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Krum clay, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 1.0 mile east on U.S. Highway 67, 2.6 miles north on Texas Highway 144, and 150 feet east of highway in a cultivated field:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine subangular blocky structure; very hard, very firm; common fine roots; few fine tubular pores; few calcium carbonate concretions; few siliceous pebbles; calcareous; moderately alkaline; clear smooth boundary.

A1—7 to 29 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong medium angular blocky structure; very hard, very firm; few fine roots; shiny pressure faces on peds; common calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

B2—29 to 48 inches; brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate medium angular blocky structure; very hard, very firm; streaks of darker material from horizon above in partially sealed cracks; few calcium carbonate concretions; calcareous; moderately alkaline; gradual smooth boundary.

C—48 to 62 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; massive; very hard, very firm; few calcium carbonate concretions; calcareous; moderately alkaline.

Solum thickness is 40 to 70 inches. The soils, when dry, have cracks 0.4 inch to 1.2 inches wide. These cracks extend from the surface to a depth of about 24 to 48 inches. The 10- to 40-inch control section is silty clay or clay, and clay content is 40 to 60 percent. Content of pebbles of limestone is 0 to 10 percent, and calcium carbonate equivalent is 5 to 25 percent.

The A horizon is very dark grayish brown, dark grayish brown, grayish brown, dark gray, brown, or dark brown. Thickness of an A horizon having moist color value and chroma of less than 3.5 is 14 to 36 inches. Texture is clay, silty clay, or silty clay loam, and the loamy textures are at a depth of less than 12 inches or in an Ap horizon. The A horizon is mildly alkaline or moderately alkaline, and the upper 10 inches is noncalcareous in some pedons.

The B horizon is brown, grayish brown, pale brown, yellowish brown, light yellowish brown, or light brown. Content of visible concretions and powdery bodies of calcium carbonate ranges from less than 1 percent to about 10 percent, by volume.

The C horizon is pale brown, light yellowish brown, brownish yellow, light brown, brown, reddish yellow, or light reddish brown silty clay loam, silty clay, or clay. Content of calcium carbonate concretions ranges from 2 to 20 percent, by volume.

Maloterre series

The Maloterre series consists of very shallow, loamy soils that formed over indurated limestone containing many imbedded fossil shells on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Maloterre gravelly clay loam, 1 to 8 percent slopes; from the intersection of Texas Highway 144 and Farm Road 56 in Glen Rose, about 6 miles south on Texas Highway 144, about 1.9 miles west on county road, and 960 feet southwest in range:

A1—0 to 5 inches; light brownish gray (10YR 6/2) gravelly clay loam, grayish brown (10YR 5/2) moist; moderate fine subangular blocky and granular structure; hard, firm; few fine roots; about 20 percent by volume fossil shells and fragments of limestone 1 to 5 inches across; few fragments of limestone from 1 to 10 inches across are on the surface; calcareous; moderately alkaline; abrupt smooth boundary.

R—5 to 8 inches; limestone that contains many imbedded fossil shells.

Solum thickness ranges from 3 to 10 inches. Total clay content ranges from 30 to 45 percent, and the noncarbonate clay fraction is less than 35 percent. Content of fragments of limestone, commonly of gravel size, ranges from 5 to 35 percent, by volume. Calcium carbonate content in the fraction less than 20 millimeters ranges from 40 to 80 percent.

The A horizon is dark grayish brown, grayish brown, brown, light brownish gray, pale brown, or very pale brown. Where the A horizon has moist color value and chroma of less than 3.5, it is less than 4 inches thick. The A horizon is gravelly clay loam, gravelly clay, clay loam, or clay.

The R layer ranges from indurated white limestone to conglomerate limestone that contains many imbedded fossil shells.

Nimrod series

The Nimrod series consists of deep, sandy soils that formed in sands, sandy loams, and sandy clay loams on uplands. In some places the materials have been reworked by wind. Slopes range from 1 to 5 percent.

Typical pedon of Nimrod fine sand, 1 to 5 percent slopes; from the intersection of U.S. Highway 377 and Farm Road 201 in Tolar, about 4.2 miles south on Farm Road 201, 1.2 miles west on paved county road, and 400 feet north in a cultivated field:

Ap—0 to 8 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; neutral; clear smooth boundary.

A2—8 to 26 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine roots; neutral; abrupt wavy boundary.

B21t—26 to 34 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common coarse prominent mottles of light brownish gray (10YR 6/2) and red (2.5YR 4/8); weak fine blocky structure; extremely hard, firm; few fine roots; common fine tubular pores; few thin clay films on faces of peds; medium acid; gradual wavy boundary.

B22t—34 to 50 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; common coarse prominent mottles of light gray (10YR 7/2), very pale brown (10YR 7/4), yellowish red (5YR 5/8), and red (2.5YR 4/8); weak fine blocky structure; extremely hard, firm; few thin clay films on faces of peds; medium acid; gradual wavy boundary.

B3—50 to 72 inches; light gray (10YR 7/1) sandy clay loam, gray (10YR 6/1) moist; common coarse prominent mottles of yellow (10YR 7/6), brownish yellow (10YR 6/6), yellowish red (5YR 4/8), and red (2.5YR 4/8); weak coarse blocky structure; extremely hard, firm; strongly acid; gradual wavy boundary.

C—72 to 80 inches; white (10YR 8/2) loamy fine sand, light gray (10YR 7/2) moist; few medium distinct mottles of reddish yellow (5YR 6/8, 7.5YR 8/6); massive; hard, friable; strongly acid.

Thickness of the solum ranges from 60 to 80 inches or more.

Thickness of the A horizon ranges from 20 to 40 inches. The Ap or A1 horizon is light gray, light brown, brown, grayish brown, dark grayish brown, yellowish brown, pale brown, or light yellowish brown. The A2 horizon is pale brown, very pale brown, or light yellowish brown. The A horizon is medium acid through neutral.

The Bt horizon is light gray, reddish yellow, or brownish yellow and is mottled in shades of brown, red, yellow, or gray. In other pedons the matrix is yellowish brown and is mottled with red and gray. The upper 20 inches of the Bt horizon is sandy clay loam. The average clay content ranges from 20 to 35 percent. The Bt horizon is strongly acid or medium acid.

The C horizon ranges from mottled sandy clay loam to sand. It is strongly acid through slightly acid.

Paluxy series

The Paluxy series consists of deep, loamy soils on uplands. These soils formed in medium textured eolian or alluvial material on terraces adjacent to the flood plain of the Brazos River and its tributaries. Slopes range from 0 to 8 percent.

Typical pedon of Paluxy very fine sandy loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 2.6 miles east on U.S. Highway 67, 1.1 miles south on Farm Road 200, 1.1 miles west on paved county road to gate, 0.2 mile west on farm lane, and 90 feet south in a cultivated field:

Ap—0 to 10 inches; brown (7.5YR 5/4) very fine sandy loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine roots; slightly acid; clear smooth boundary.

B21—10 to 34 inches; reddish brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, friable; few fine roots in upper part; few fine pores; few wormcasts; slightly acid; gradual smooth boundary.

B22—34 to 46 inches; yellowish red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure; slightly hard, friable; few insect burrows of darker color; neutral; gradual smooth boundary.

C—46 to 62 inches; reddish yellow (5YR 6/8) very fine sandy loam, yellowish red (5YR 5/8) moist; massive; slightly hard, friable; calcareous; moderately alkaline.

Depth to secondary calcium carbonate is 36 to 80 inches. Texture is very fine sandy loam or loam throughout, and the content of fine sand or coarser textured material ranges from 15 to 30 percent.

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

The B horizon is reddish brown, yellowish red, or reddish yellow. It is slightly acid, neutral, or mildly alkaline.

The C horizon is reddish yellow, yellowish red, or strong brown. Visible calcium carbonate in the C horizon is in the form of films, threads, and soft bodies.

Patilo series

The Patilo series consists of deep, sandy soils that formed in thick sandy beds on uplands. These sandy beds have been reworked somewhat by wind. Slopes range from 0 to 3 percent.

Typical pedon of Patilo fine sand, 0 to 3 percent slopes; from the intersection of Spur 426 (U.S. Highway 377) and Farm Road 51 in Granbury, about 5 miles east on U.S. Highway 377, 5.3 miles north on Farm Road 167, 0.4 mile west on private road to gate, and 120 feet northwest in idle field:

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

A2—10 to 48 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; very friable; few fine roots; neutral; clear wavy boundary.

B21t—48 to 54 inches; brownish yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; common coarse prominent mottles of yellowish red (5YR 5/8), pale brown (10YR 6/3), and light brownish gray (10YR 6/2); weak coarse blocky structure; very hard, firm; few fragments of ironstone; strongly acid; gradual smooth boundary.

B22t—54 to 68 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; common coarse prominent mottles of reddish yellow (7.5YR 6/8), strong brown (7.5YR 5/8), and red (2.5YR 4/8); weak coarse blocky structure; very hard, firm; strongly acid; gradual smooth boundary.

C—68 to 80 inches; coarsely mottled reddish yellow (5YR 6/8), red (2.5YR 4/8), and light gray (10YR 7/2) fine sandy loam; massive; extremely hard, friable; strongly acid.

Solum thickness ranges from 65 to more than 100 inches.

The A horizon ranges from 40 to 80 inches in thickness. It is fine sand or loamy fine sand and is neutral through medium acid. The Ap horizon is dark grayish brown, dark brown, grayish brown, brown, light brownish gray, pale brown, very pale brown, light yellowish brown, or yellowish brown. The A2 horizon is brown, very pale brown, light gray, white, light yellowish brown, or reddish yellow. The boundary between the A2 and B2t horizons is wavy to irregular.

The Bt horizon is dominantly sandy clay loam and has clay content ranging from 18 to 35 percent. Reaction ranges from slightly acid through strongly acid. Base saturation ranges from 40 to 75 percent throughout the argillic horizon. The Bt horizon is light gray, white, very pale brown, pale brown, light yellowish brown, brownish yellow, reddish yellow, yellowish red, or yellow and has red, yellow, gray, and brown mottles in varying sizes and amounts.

The C horizon, where present, is fine sandy loam, loamy sand, or sand.

Pedernales series

The Pedernales series consists of deep, loamy soils that formed in calcareous sandy loam, sandy clay loam, or clay materials on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Pedernales fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 4 and Farm Road 1189 in Lipan, about 1.1 miles south on Farm Road 1189, and 120 feet east in pasture:

A1—0 to 12 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; hard, friable; many fine roots; neutral; abrupt smooth boundary.

B21t—12 to 30 inches; yellowish red (5YR 5/6) sandy clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; very hard, very firm; common fine roots; common patchy clay films on faces of peds; few very fine pebbles of chert; neutral; gradual smooth boundary.

B22t—30 to 42 inches; yellowish red (5YR 5/8) sandy clay, yellowish red (5YR 4/8) moist; few fine faint yellowish mottles in lower part; moderate medium blocky structure; very hard, very firm; common patchy clay films on faces of peds; few fine pebbles of chert and black concretions; neutral; gradual smooth boundary.

B3ca—42 to 49 inches; reddish yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; weak coarse blocky structure; hard, firm; many soft bodies and concretions of calcium carbonate; few fragments of limestone; calcareous; moderately alkaline; gradual smooth boundary.

Cca—49 to 62 inches; very pale brown (10YR 8/4) sandy clay loam, very pale brown (10YR 7/4) moist; massive; hard, firm; many soft bodies and concretions of calcium carbonate; common fragments of limestone 0.5 inch to 3 inches across the long axis; calcareous; moderately alkaline.

Solum thickness ranges from 35 to 60 inches. Secondary carbonates are at a depth of 28 to 50 inches.

The A horizon is reddish brown, yellowish red, brown, light brown, pale brown, or light yellowish brown. It is slightly acid through mildly alkaline.

The Bt and B3ca horizons are red, reddish brown, yellowish red, or reddish yellow. Some pedons have yellowish and brownish mottles in the lower part of the Bt horizon. The Bt horizon is sandy clay or clay, and clay content ranges from 35 to 55 percent. Reaction of the Bt horizon ranges from slightly acid through mildly alkaline, and some pedons are moderately alkaline in the lower part. The B3ca horizon is sandy clay loam, clay loam, or sandy clay.

The Cca horizon is sandy clay loam or sandy clay that, in some places, contains thin strata of soft limestone. The Cca horizon is pinkish gray, light red, light reddish brown, pink, light brown, reddish brown, very pale brown, or reddish yellow. Content of calcium carbonate concretions and soft powdery forms ranges from 5 to 30 percent, by volume, and does not decrease with depth in the C horizon.

Purves series

The Purves series consists of shallow, clayey soils that formed over interbedded limestone and calcareous marls on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Purves clay, 3 to 5 percent slopes; from the intersection of U.S. Highway 67 and Farm Road 205 in Glen Rose, about 7.6 miles north on Farm Road 205 to its end, 2.1 miles south on county road, and 210 feet south in range:

A11—0 to 7 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; strong fine granular and subangular blocky structure; very hard, firm; many fine roots; common fine pores; few calcium carbonate concretions; calcareous; moderately alkaline; clear smooth boundary.

A12ca—7 to 12 inches; brown (10YR 4/3) clay, dark brown (10YR 3/3) moist; strong fine subangular blocky and granular structure; hard, firm; common fine roots; few fine pores; common calcium carbonate concretions; many films and threads of calcium carbonate; common wormcasts; calcareous; moderately alkaline; clear smooth boundary.

A13ca—12 to 17 inches; brown (10YR 5/3) very gravelly clay, dark brown (10YR 4/3) moist; strong fine granular structure; hard, firm; about 60 percent by volume of limestone fragments 0.5 inch to 4 inches across the long axis; fragments have secondary coatings of calcium carbonate; many calcium carbonate concretions; calcareous; moderately alkaline; abrupt smooth boundary.

R—17 to 19 inches; fractured limestone.

Solum thickness ranges from 8 to 20 inches. The amount of limestone fragments 1 inch to 10 inches across the long axis ranges from 0 to 35 percent, by volume, of the material above bedrock. Secondary carbonates occur as concretions, soft bodies, coatings, and pendants on fragments.

The A horizon is very dark grayish brown, dark grayish brown, brown, very dark gray, dark gray, or grayish brown. The texture of the fine earth is clay loam, clay, silty clay loam, or silty clay, and clay content ranges from 35 to 55 percent.

Seawillow series

The Seawillow series consists of deep, loamy soils that formed in calcareous, loamy alluvial sediments on uplands. Slopes range from 3 to 8 percent.

Typical pedon of Seawillow loam, 3 to 5 percent slopes; from the intersection of U.S. Highway 377 and Farm Road 201 in Tolar, about 5.3 miles west on U.S. Highway 377, 1.1 miles south on county road, and 75 feet east in range:

A1—0 to 12 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; moderate fine granular structure; hard, friable; many fine roots; many fine tubular pores; many wormcasts; few calcium carbonate concretions; about 18 percent calcium carbonate equivalent; calcareous; moderately alkaline; clear smooth boundary.

Bca—12 to 38 inches; very pale brown (10YR 7/4) clay loam, light yellowish brown (10YR 6/4) moist; moderate fine subangular blocky structure; hard, firm; few fine roots; common wormcasts; common to many soft bodies and concretions of calcium carbonate; about 52 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

Cca—38 to 62 inches; very pale brown (10YR 8/4) clay loam, very pale brown (10YR 7/4) moist; massive; hard, friable; many concretions and soft bodies of calcium carbonate; about 55 percent calcium carbonate equivalent; calcareous; moderately alkaline.

Solum thickness ranges from 20 to 40 inches. The soil, including the C horizon, is loam, clay loam, or silty clay loam and is 40 to 70 percent calcium carbonate equivalent. Content of limestone pebbles is 0 to 15 percent, and content of silicate clay is 20 to 30 percent.

The A horizon is yellowish brown, brown, or grayish brown.

The B and C horizons are brown, yellowish brown, light yellowish brown, brownish yellow, pale brown, or very pale brown. The C horizon is 0 to 10 percent calcium carbonate concretions.

Sunev series

The Sunev series consists of deep, loamy soils that formed in ancient loamy alluvial sediments. Slopes range from 3 to 8 percent.

Typical pedon of Sunev clay loam, 3 to 5 percent slopes; from the intersection of Farm Road 51 and Farm Road 4 in Granbury, about 6.2 miles west on Farm Road 4, 0.7 mile north on ranch road, and 160 feet west in range:

A1—0 to 12 inches; brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine and medium granular structure; hard, friable; common fine roots; common wormcasts; few films, threads, and concretions of calcium carbonate; calcium carbonate equivalent of about 34 percent; calcareous; moderately alkaline; gradual smooth boundary.

B2ca—12 to 26 inches; brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; strong medium subangular blocky and granular structure; hard, firm; few fine roots; common wormcasts; many films, threads, and concretions of calcium carbonate; calcium carbonate equivalent of about 42 percent; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—26 to 42 inches; yellowish brown (10YR 5/4) clay loam, dark yellowish brown (10YR 4/4) moist; strong fine granular structure; hard, firm; few fine roots; few wormcasts; many fine and medium concretions, films, and threads of calcium carbonate; calcium carbonate equivalent of about 47 percent; calcareous; moderately alkaline; diffuse smooth boundary.

Cca—42 to 62 inches; very pale brown (10YR 8/3) clay loam, very pale brown (10YR 7/3) moist; massive; hard, friable; many concretions and soft bodies of calcium carbonate; few fragments of limestone 0.5 inch to 2 inches across the long axis; calcium carbonate equivalent of about 60 percent; calcareous; moderately alkaline.

Solum thickness ranges from 40 to 70 inches. Calcium carbonate equivalent in the 10- to 40-inch control section is 40 to 70 percent. The silicate clay content is 18 to 30 percent. Content of limestone pebbles is 0 to 15 percent. Films and threads of calcium carbonate are evident in all horizons and increase in amount with depth. Below a depth of 6 feet, the material is clay loam, loam, gravelly loam, or gravel.

The A horizon is dark grayish brown, very dark grayish brown, dark brown, grayish brown, or brown.

The Bca horizon is brown, pale brown, grayish brown, very pale brown, dark yellowish brown, yellowish brown, reddish yellow, or light yellowish brown loam, clay loam, or silty clay loam.

The C horizon is very pale brown or reddish yellow fine sandy loam, loam, clay loam, or silty clay loam.

Tarrant series

The Tarrant series consists of very shallow to shallow, cobbly and clayey soils that formed over indurated, fractured limestone on uplands. Slopes range from 1 to 30 percent.

Typical pedon of Tarrant cobbly clay, in an area of Tarrant-Purves association, undulating; from the intersection of U.S. Highway 67 and Farm Road 205 in Glen Rose, about 7.6 miles north on Farm Road 205 to its end, 1.0 mile south on county road, and 75 feet south in range:

A11—0 to 6 inches; dark grayish brown (10YR 4/2) cobbly clay, very dark grayish brown (10YR 3/2) moist; strong fine granular and subangular blocky structure; very hard, firm; common fine roots; few fine pores; about 35 percent by volume limestone fragments of cobble size and about 5 percent of pebble size; fragments are randomly spaced throughout the horizon and are coated with secondary calcium carbonate; calcareous; moderately alkaline; clear irregular boundary.

A12ca—6 to 14 inches; brown (10YR 4/3) very cobbly clay, dark brown (10YR 3/3) moist; moderate medium subangular blocky and granular structure; very hard, firm; few fine roots; about 75 percent by volume limestone fragments that are coated with calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

R—14 to 18 inches; fractured and platy limestone bedrock; about 1 percent by volume brown (10YR 4/3) clay, dark brown (10YR 3/3) moist, in vertical and horizontal cracks in limestone.

Thickness of solum ranges from 6 to 20 inches and corresponds with depth to indurated limestone. Content of coarse fragments in the solum is 35 to 85 percent; it ranges from 10 to 60 percent in the A11 horizon and from 70 to 90 percent in the A12 horizon. The content of coarse fragments greater than 3 inches across ranges from 25 to 70 percent. Fragments less than 3 inches across are still mostly larger than 0.75 inch across. In some pedons, limestone fragments in the upper 4 inches are not coated with secondary calcium carbonate, but coatings are 1 centimeter thick or more on some fragments immediately above the R layer. Carbonates are in the form of coatings and pendants.

The A horizon is dark brown, brown, dark grayish brown, very dark grayish brown, or very dark brown. It is cobbly clay, very cobbly clay, or cobbly silty clay and has clay content of 45 to 60 percent in the fine earth fraction.

The strata of the underlying bedrock ranges in thickness from 2 to 24 inches. In some pedons, massive powdery lime is interbedded with bedrock.

Thurber series

The Thurber series consists of deep loamy soils that formed in calcareous clayey sediments on uplands. Slopes range from 1 to 3 percent.

Typical pedon of Thurber clay loam, 1 to 3 percent slopes; from the intersection of Farm Road 4 and Farm Road 1189 in Lipan, about 1.2 miles north on Farm Road 1189, 1.2 miles north on county road, and 960 feet west in pasture:

A1—0 to 10 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; massive; very hard, firm; many fine roots; slightly acid; abrupt smooth boundary.

B21t—10 to 26 inches; very dark grayish brown (10YR 3/2) clay, very dark brown (10YR 2/2) moist; strong medium blocky structure; very hard, very firm; few fine roots; continuous clay films on faces of peds; few siliceous pebbles; neutral; gradual smooth boundary.

B22t—26 to 35 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine blocky structure; very hard, very firm; common clay films on faces of peds; common concretions, films, and threads of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

Cca—35 to 44 inches; grayish brown (10YR 5/2) clay, dark grayish brown (10YR 4/2) moist; massive; hard, firm; many concretions, soft bodies, films, and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—44 to 62 inches; light brownish gray (2.5Y 6/2) clay, grayish brown (2.5Y 5/2) moist; massive; very hard, very firm; common concretions and soft bodies of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness. Depth to films, threads, or soft bodies of calcium carbonate ranges from 15 to 28 inches.

The A horizon is brown, dark brown, dark grayish brown, grayish brown, or very dark grayish brown. Reaction is slightly acid through mildly alkaline.

The Bt horizon is very dark grayish brown, dark grayish brown, grayish brown, brown, dark brown, yellowish brown, dark yellowish brown, olive brown, or light olive brown. It is clay or clay loam, and clay content ranges from 35 to 55 percent. Reaction is neutral or mildly alkaline in the B21t horizon and mildly alkaline or moderately alkaline in the

B22t horizon. Structure ranges from moderate fine blocky to strong medium blocky.

The Cca and C horizons range from brownish calcareous clay loam to olive gray clay or shaly clay.

Truce series

The Truce series consists of deep, loamy soils that formed in materials weathered from shales and sandstones on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Truce stony fine sandy loam, in an area of Truce stony soils, 1 to 8 percent slopes; from the intersection of Farm Road 4 and Farm Road 1189 in Lipan, about 1.5 miles north on paved county road, and 850 feet west in range:

A1—0 to 4 inches; brown (10YR 4/3) stony fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; very hard, friable; many fine roots; few siliceous pebbles; about 15 percent of the surface is covered with fragments of sandstone a few inches to 5 feet across the long axis; a few sandstone fragments throughout; neutral; abrupt smooth boundary.

A2—4 to 6 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; common fine roots; common siliceous pebbles; common fragments of sandstone; neutral; abrupt smooth boundary.

B21t—6 to 24 inches; yellowish red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; moderate medium blocky structure; extremely hard, very firm; few fine roots; many clay films on faces of peds; few siliceous pebbles; slightly acid; gradual smooth boundary.

B22t—24 to 35 inches; brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate medium blocky structure; extremely hard, very firm; common clay films on faces of peds; neutral; gradual wavy boundary.

B3—35 to 42 inches; yellowish brown (10YR 5/8) clay, yellowish brown (10YR 5/8) moist; weak coarse blocky structure; extremely hard, very firm; few calcium carbonate concretions; noncalcareous matrix; mildly alkaline; clear wavy boundary.

C—42 to 62 inches; light gray (5Y 7/1) shaly clay, light gray (5Y 7/1) moist; interbedded with light reddish brown (5YR 6/4) shaly clay; massive; few concretions, films, and threads of calcium carbonate; calcareous; moderately alkaline.

Solum thickness ranges from 40 to 60 inches. Content of fragments of sandstone in the A horizon ranges from 0 to 25 percent, by volume. The fragments range from 1 inch to about 18 inches across.

The A horizon is fine sandy loam or stony fine sandy loam. It ranges from medium acid through neutral. The A1 horizon is brown, pale brown, yellowish brown, or dark grayish brown. The A2 horizon is 1 or 2 units of value lighter in color than the A1 horizon.

The B horizon is clay, sandy clay, or clay loam, and clay content ranges from 35 to about 50 percent. The B21t horizon is reddish brown, dark reddish brown, red, or yellowish red. Reaction is slightly acid through mildly alkaline. The B22t horizon is brown, strong brown, yellowish red, yellowish brown, reddish yellow, or reddish brown. Reaction is neutral through moderately alkaline. The B3 horizon ranges from yellowish brown through light olive brown in hues of 10YR and 2.5Y. In some pedons, the B3 horizon has faint reddish or olive mottles. Reaction is mildly alkaline or moderately alkaline, and the B3 horizon is calcareous.

The C horizon is clayey shale, partially weathered shale, or brittle shaly clay. Colors include pale olive, olive, olive yellow, light yellowish brown, light reddish brown, light gray, gray, light olive brown, brownish yellow, and weak red. The C horizon is mildly alkaline or moderately alkaline, and it is calcareous.

Venus series

The Venus series consists of deep, loamy soils that formed in thick beds of unconsolidated, calcareous, loamy sediments on uplands. Slopes range from 1 to 3 percent.

Typical pedon of Venus loam, 1 to 3 percent slopes; from the intersection of Texas Highway 144 and Barnard Street in Glen Rose, about 0.8 mile southwest on Barnard Street, and 40 feet north in a cultivated field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; hard, friable; common fine roots; few wormcasts; few siliceous pebbles; calcareous; moderately alkaline; abrupt smooth boundary.

A1—6 to 13 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure; hard, friable; few fine roots; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B21ca—13 to 34 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine granular structure; hard, friable; few fine roots; few wormcasts; common films and threads of calcium carbonate; few calcium carbonate concretions; few shell fragments; 20 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—34 to 42 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate fine granular structure; hard, friable; common films and threads of calcium carbonate; many concretions and soft bodies of calcium carbonate; few fragments of limestone 1 to 8 inches across; 26 percent calcium carbonate equivalent; calcareous; moderately alkaline; gradual smooth boundary.

Cca—42 to 60 inches; pale brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable; many concretions and soft bodies of calcium carbonate; many pebbles and fragments of limestone 1 to 10 inches across; 38 percent calcium carbonate equivalent; calcareous; moderately alkaline.

The solum ranges from 40 to 70 inches in thickness. Some pedons are underlain by gravel at a depth of about 3 to 8 feet.

The A horizon is brown, dark brown, grayish brown, dark grayish brown, or very dark grayish brown.

The B2ca horizon is brown, grayish brown, light brownish gray, pale brown, very pale brown, yellowish brown, and light yellowish brown loam, sandy clay loam, or clay loam. Silicate clay content is 18 to about 30 percent, and content of material coarser than very fine sand is more than 15 percent. Content of calcium carbonate concretions, films, threads, or soft bodies ranges from 5 to 20 percent, by volume. Calcium carbonate equivalent in the B2ca horizons is 15 to 40 percent.

The C horizon is fine sandy loam, loam, sandy clay loam, or clay loam. Calcium carbonate equivalent is 10 to 60 percent.

Windthorst series

The Windthorst series consists of deep, loamy and sandy soils that formed in stratified clay, weakly cemented sandstone, and loamy materials on uplands. Slopes range from 1 to 8 percent.

Typical pedon of Windthorst fine sandy loam, 1 to 5 percent slopes, eroded; from the intersection of U. S. Highway 67 and Farm Road 201 in Glen Rose, about 6.6 miles north on Farm Road 201, and 525 feet south in an idle cultivated field:

Ap—0 to 5 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, friable; many fine roots; slightly acid; abrupt smooth boundary.

B21t—5 to 18 inches; red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; strong medium blocky structure; extremely hard, very firm; few fine roots; nearly continuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B22t—18 to 28 inches; yellowish red (5YR 5/8) sandy clay, yellowish red (5YR 4/8) moist; few fine faint yellowish mottles; moderate medium blocky structure; extremely hard, very firm; common discontinuous clay films on faces of peds; slightly acid; gradual smooth boundary.

B3—28 to 38 inches; yellowish red (5YR 5/8) sandy clay, yellowish red (5YR 4/8) moist; many medium prominent very pale brown (10YR 7/3), pale brown (10YR 6/3), and red (2.5YR 4/6) mottles; weak coarse blocky structure; hard, firm; thin lenses of fine sandy loam; medium acid; gradual wavy boundary.

C1—38 to 56 inches; mottled yellow (10YR 7/6), brownish yellow (10YR 6/6), and very pale brown (10YR 7/4) fine sandy loam; massive; slightly hard, very friable; slightly acid; abrupt smooth boundary.

C2—56 to 62 inches; white (10YR 8/2) weakly cemented sandstone that contains lenses of yellowish sandy clay loam; neutral.

Solum thickness ranges from 35 to 60 inches. Base saturation ranges from 75 to 90 percent, by sum of cations, in some part of the Bt horizon.

The A1 horizon is brown, pale brown, light brownish gray, grayish brown, dark grayish brown, yellowish brown, reddish yellow, or light yellowish brown. The A2 horizon, where present, has color value and chroma of 1 to 2 units higher than the A1 horizon. The A horizon is fine sandy loam or loamy fine sand. It is neutral through medium acid.

The B21t horizon is red, reddish brown, or yellowish red. It is clay, sandy clay, or clay loam, and clay content ranges from 35 to 50 percent. The B21t horizon is slightly acid or medium acid. The B22t horizon is red or yellowish red and has faint through prominent red, brownish yellow, yellowish brown, reddish yellow, strong brown, light gray, or very pale brown mottles. It is clay, sandy clay, or sandy clay loam. It is neutral, slightly acid, or medium acid. The B3 horizon is prominently mottled with red, yellowish red, reddish yellow, pale brown, very pale brown, or yellow. It is clay, sandy clay, sandy clay loam, or clay loam. Lenses or pockets of sandy loam and fragments of weakly cemented sandstone are in some pedons. The B3 horizon is moderately alkaline through medium acid, and some pedons contain films and threads or soft bodies of calcium carbonate in the lower part.

The C horizon is massive clay, sandy clay, sandy clay loam, fine sandy loam, or weakly cemented, fine grained sandstone. Reaction is medium acid through moderately alkaline.

Yahola series

The Yahola series consists of deep, loamy soils that formed in calcareous, loamy alluvium on bottom lands. Slopes range from 0 to 2 percent.

Typical pedon of Yahola fine sandy loam, in an area of Yahola-Gaddy complex, occasionally flooded; from the intersection of U.S. Highway 67 and Texas Highway 144 in Glen Rose, about 5.7 miles east on U.S. Highway 67, 3.3 miles south on Farm Road 199, 1.0 mile south on county road, 1.3 miles south on private road, and 1,450 feet east on the flood plains of the Brazos River:

A1—0 to 18 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak fine granular structure; slightly hard, very friable; common fine roots; thin strata of loam and loamy fine sand throughout; calcareous; moderately alkaline; gradual smooth boundary.

C1—18 to 28 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; slightly hard, very friable; few fine roots; few fine tubular pores; evident bedding planes; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C2—28 to 48 inches; reddish yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) moist; massive; slightly hard, very friable; few fine roots; thin strata of loam and silt loam material throughout; calcareous; moderately alkaline; gradual smooth boundary.

C3—48 to 62 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; massive; loose, very friable; thin strata of fine sandy loam, loam, and silt loam; calcareous; moderately alkaline.

Buried soils occur below a depth of 30 inches in some areas.

The A horizon is brown, pinkish gray, light brown, pink, strong brown, reddish yellow, dark reddish gray, reddish gray, reddish brown, light reddish brown, or yellowish red. It is mildly alkaline or moderately alkaline in the upper 10 inches and moderately alkaline and calcareous below.

The C horizon is brown, light brown, strong brown, reddish yellow, reddish brown, light reddish brown, pink, or yellowish red. It is fine sandy loam or loam and has clay content of 5 to 18 percent above a depth of 40 inches. It is fine sandy loam, loam, or loamy fine sand below a depth of 40 inches. Thin strata of coarser or finer textured materials occur throughout the C horizon.

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 20, the soils of the survey area are classified according to the system. Categories of the system are discussed in the following paragraphs.

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

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

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of expression of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and a prefix that suggests something about the properties of the soil. An example is Calciustolls (*Calc*, meaning calcareous, plus *ustoll*, the suborder of Mollisols that has an ustic moisture regime).

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

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

SERIES. The series consists of soils that formed in a particular kind of material and have horizons that, except for texture of the surface soil or of the underlying substratum, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, texture, structure, reaction, consistence, and mineral and chemical composition. An example is the Venus series, which is a member of the fine-loamy, mixed, thermic family of Typic Calciustolls.

Formation of the soils

In this section the factors of soil formation are described and related to the soils in the survey area. The processes of soil formation are explained.

Factors of soil formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil at any given place are determined by (1) the physical and mineral composition of the parent material; (2) the climate under which the soil material has accumulated and existed since accumulation; (3) the plant and animal life on and in the soil; (4) the relief, or lay of the land; and (5) the length of time these forces have acted on the material. All five factors influence the present characteristics of every soil, but the significance of each factor varies from one place to another. In one area one factor may dominate soil formation; in another area a different factor may be important.

The interrelationships of these factors is complex, and the effects of any one factor cannot be isolated and completely evaluated. It is convenient, however, to discuss each factor separately and to indicate the probable effects of each.

Parent material

Parent material is the unconsolidated mass from which a soil is formed. It determines the limits of the chemical and mineral composition of the soil. The soils of Hood and Somervell Counties have developed from parent material of three geologic periods. These are the Pennsylvanian, Cretaceous, and Quaternary Periods. The Quaternary can be subdivided into Pleistocene and Recent ages.

Pennsylvanian age materials are mainly interbedded sandstones and shales of the Strawn Group. These materials are in the northwest corner of Hood County. Truce soils were developed from these materials.

Cretaceous age materials are mainly interbedded limestone, calcareous marls, and sands of the Fredericksburg and Trinity Groups (*3*). These materials are found throughout most of both counties. The limestone and marls are mainly from the Glen Rose, Walnut, and Comanche Peak Formations. Tarrant, Purves, Maloterre, and Brackett soils are gently sloping to steep and are on limestone hills. Krum and Denton soils are in shallow valleys where the interbeds of calcareous clayey marl occur. Sandier soils formed in the Paluxy and Trinity Sand Formations (*3*). Nimrod, Windthorst, and Duffau soils developed in the Paluxy Sand Formation, and Demona and Chaney soils developed in the Trinity Sand Formation. These soils are more acid and have more distinct soil horizons than the soils developed from limestone and marl.

Pleistocene age materials formed the fluviatile terrace deposits of the major streams. Bastrop, Decordova, and Paluxy soils formed in these deposits.

Recent age materials are alkaline deposits from the calcareous prairie areas, and some have mixtures of clayey and sandy sediments. They are on flood plains of the rivers and along drainageways. Bosque, Frio, Yahola, and Gaddy soils formed in Recent calcareous alluvium. Bunyan soils are of mixed origin.

Climate

Hood and Somervell Counties have dry winters and hot, humid summers. This climate contributes to the formation of soils in several ways. The expansion that occurs at high temperatures and the contraction that occurs at low temperatures fracture parent rock and soil material and hasten weathering. Patterns of rainfall distribution cause the soils to be alternately wet and dry. When clay soils, such as Denton and Krum soils, dry, they crack, and the cracks fill with water when it rains. After they become wet, the clay soils swell enough to close the cracks. This alternate shrinking and swelling causes the soil to churn and prevents the formation of clay accumulations. Other soils, such as Windthorst and Chaney soils, have clayey lower layers. Water moving through the soil carries clay particles downward from the surface layer and deposits them as the water movement slows. As clay accumulates, the water moves even slower and deposition of clay accelerates. Thus, the process tends to speed up, and eventually the lower layers become clayey. Wind also affects the formation of soils in the survey area. Soil material that developed into Decordova, Nimrod, and Patilo soils has been reworked by wind.

Plant and animal life

Plants, animals, insects, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its development. Gains in organic matter and nitrogen, gains or losses in plant nutrients, and changes in structure and porosity are among the changes caused by living organisms. In the Grand Prairie Land Resource Area, tall prairie grasses had more influences on soil development than other plants. These tall grasses provided litter that protected the surface and added organic matter to dark soils, such as Bolar, Tarrant, and Purves soils. As the roots decayed, they fed bacteria and fungi. The network of pores and channels left by decaying roots increased the intake of water and air into the soil.

The Cross Timbers Land Resource Area supported dominantly an oak-savannah plant community. The soils formed under hardwood vegetation are medium to low in organic matter content and have a light-colored surface layer. Some of these soils are Duffau, Pedernales, Nimrod, and Windthorst soils.

In most of the soils, earthworms are the most obvious creatures. They feed on decomposed roots and other matter and help soil structure, aeration, and water intake. Other small burrowing animals, such as gophers, influence the development of soils.

Micro-organisms also are important in soil formation. They help to break down plant residue, to release plant nutrients from the parent material, and to fix nitrogen from the air in the soil.

Man also influenced soil formation. He allowed his animals to graze on the land and he plowed the fields and planted crops.

Relief

Relief, or topography, affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature.

The relief in Hood and Somervell Counties ranges from nearly level along streams and valleys to steep along limestone escarpments. On nearly level to gently sloping soils, such as Chaney, Krum, Venus, and Blanket soils, most of the rainfall enters the soil; relief has therefore aided their development.

Some of the steeper soils in limestone areas, such as Tarrant, Maloterre, and Brackett soils, are thinly developed because geologic erosion has removed the soil material about as fast as soil horizons have developed.

Some soils, such as Gaddy and Yahola soils, are affected by relief in another way. The occasional floods that cover them deposit sediment from the surrounding area.

Time

Time, usually a long time, is required for formation of soils that have distinct horizons. The differences in length of time that parent materials have been in place are generally reflected in the degree of development of the soil profile.

The soils in Hood and Somervell Counties range from young to old. The young soils have very little horizon development, and the older soils have well expressed soil horizons.

Bunyan soils are examples of young soils that show little development. The soil horizons still show the evidence of stratification, and there has been very little change from the original stream-deposited alluvium. Duffau soils are an example of older soils that have well developed soil horizons. The parent materials of Duffau soils have been in place for a long time. There has been a downward movement and accumulation of clay particles resulting in a distinct Bt horizon.

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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.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single mapping unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Medium	6 to 9
High	More than 9

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bench terrace. A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

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.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coat, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles up to 3 inches (2 millimeters to 7.5 centimeters) in diameter.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the bases of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures is difficult.

Complex, soil. A mapping unit of two or more kinds of soil occurring in such an intricate pattern that they cannot be shown separately on a soil map at the selected scale of mapping and publication.

Compressible. Excessive decrease in volume of soft soil under load.

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.

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.

Cutbanks cave. Unstable walls of cuts made by earthmoving equipment. The soil sloughs easily.

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."

Eolian soil material. Earthy percent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by 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.

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.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. 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.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. The major horizons of mineral soil are as follows:

O horizon.—An organic layer, fresh and decaying plant residue, at the surface of a mineral soil.

A horizon.—The mineral horizon, formed or forming at or near the surface, in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon most of which was originally part of a B horizon.

A2 horizon.—A mineral horizon, mainly a residual concentration of sand and silt high in content of resistant minerals as a result of the loss of silicate clay, iron, aluminum, or a combination of these.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or a combination of these; (2) by prismatic or blocky structure; (3) by redder or browner colors than those in the A horizon; or (4) by a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that from which the solum is presumed to have formed. If the material is known to differ from that in the solum the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hummocky. Refers to a landscape of hillocks, separated by low sags, having sharply rounded tops and steep sides. Hummocky relief resembles rolling or undulating relief, but the tops of ridges are narrower and the sides are shorter and less even.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered, but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface.

Large stones. Rock fragments 10 inches (25 centimeters) or more across. Large stones adversely affect the specified use.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. Inadequate strength for supporting loads.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance—*few*, *common*, and *many*; size—*fine*, *medium*, and *coarse*; and contrast—*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three single variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Parent material. The great variety of unconsolidated organic and mineral material in which soil forms. Consolidated bedrock is not yet parent material by this concept.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percs slowly. The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air, measured as the number of inches per hour that water moves through the soil. Terms describing permeability are *very slow* (less than 0.06 inch), *slow* (0.06 to 0.20 inch), *moderately slow* (0.2 to 0.6 inch), *moderate* (0.6 to 2.0 inches), *moderately rapid* (2.0 to 6.0 inches), *rapid* (6.0 to 20 inches), and *very rapid* (more than 20 inches).

Phase, soil. A subdivision of a soil series or other unit in the soil classification system based on differences in the soil that affect its management. A soil series, for example, may be divided into phases on the bases of differences in slope, stoniness, thickness, or some other characterisitc that affects management. These differencees are too small to justify separate series.

pH value. (See Reaction, soil). A numerical designation of acidity and alkalinity in soil.

Piping. Moving water of subsurface tunnels or pipelike cavities in the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

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.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rooting depth. Shallow root zone. The soil is shallow over a layer that greatly restricts roots. See Root zone.

Root zone. The part of the soil that can be penetrated by plant roots.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage. 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.

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.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

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* (0.005 to 0.002 millimeter); and *clay* (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in mature soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristics of the soil are largely confined to the solum.

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.

Topsoil (engineering). Presumably a fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Unstable fill. Risk of caving or sloughing in banks of fill material.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, apparent. A thick zone of free water in the soil. An apparent water table is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

Water table, artesian. A water table under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Illustrations

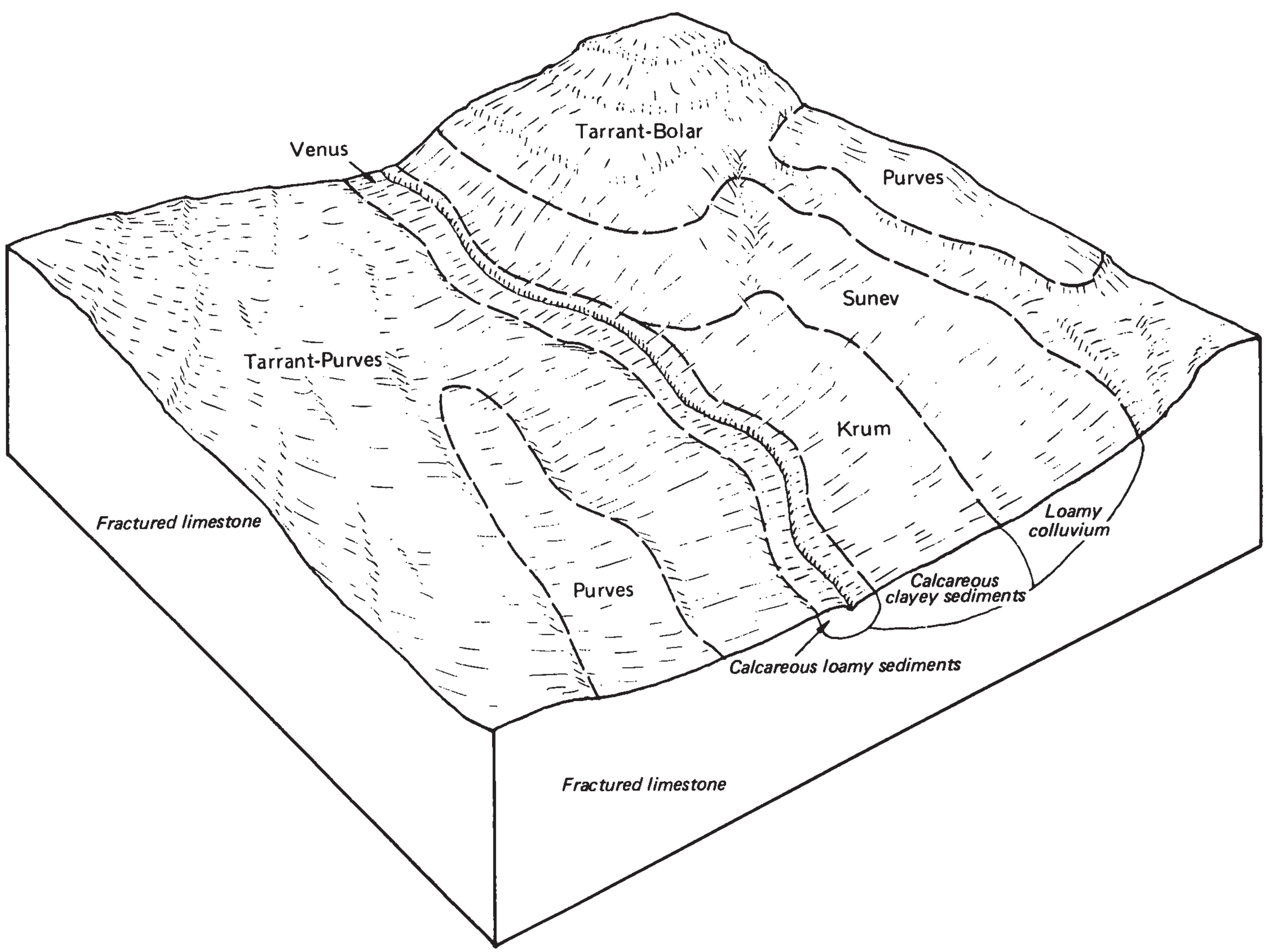

Figure 1.—Pattern of soils in the Tarrant-Purves unit on the general soil map.

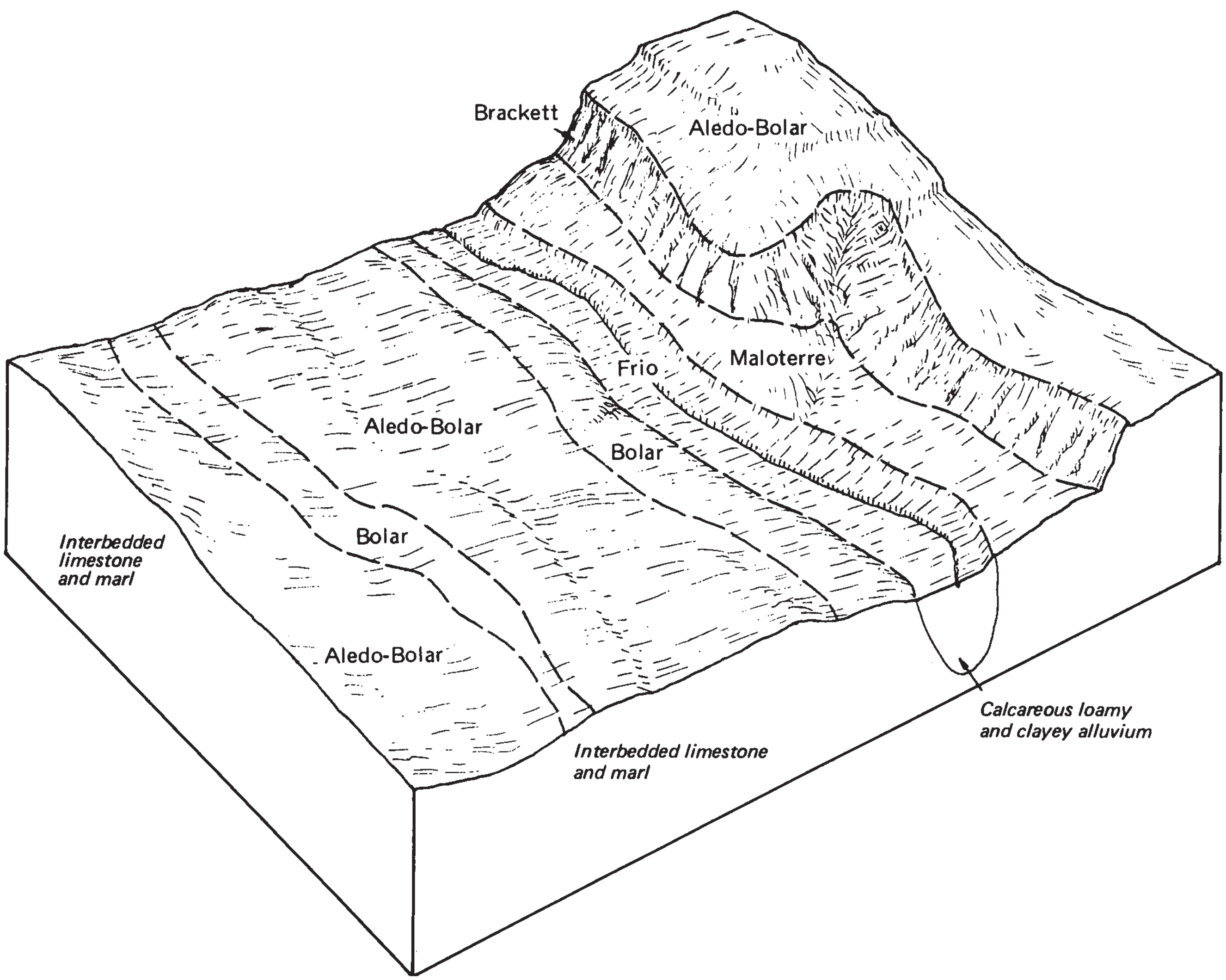

Figure 2.—Pattern of soils in the Aledo-Bolar unit on the general soil map.

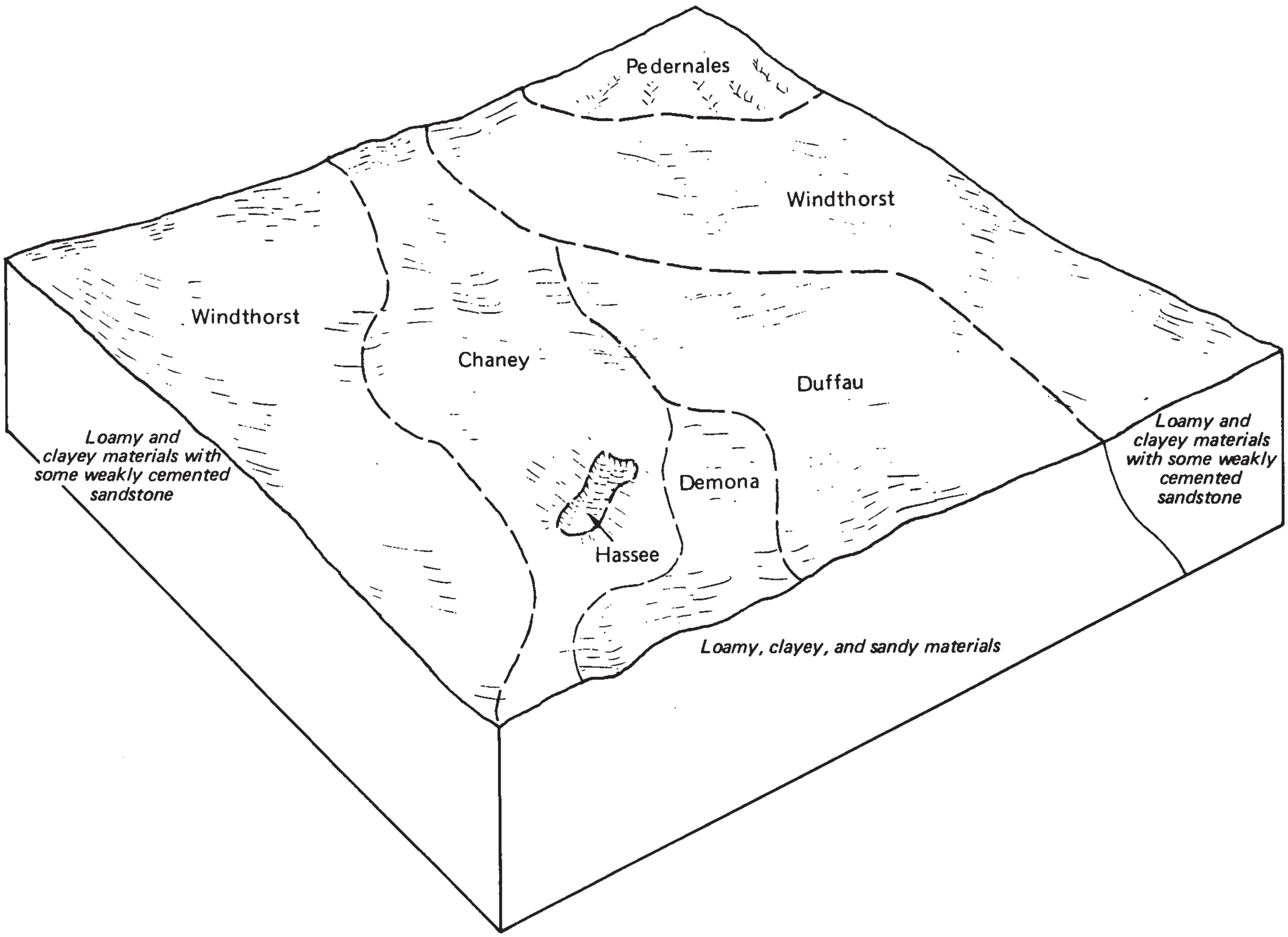

Figure 3.—Pattern of soils in the Windthorst-Duffau unit on the general soil map.

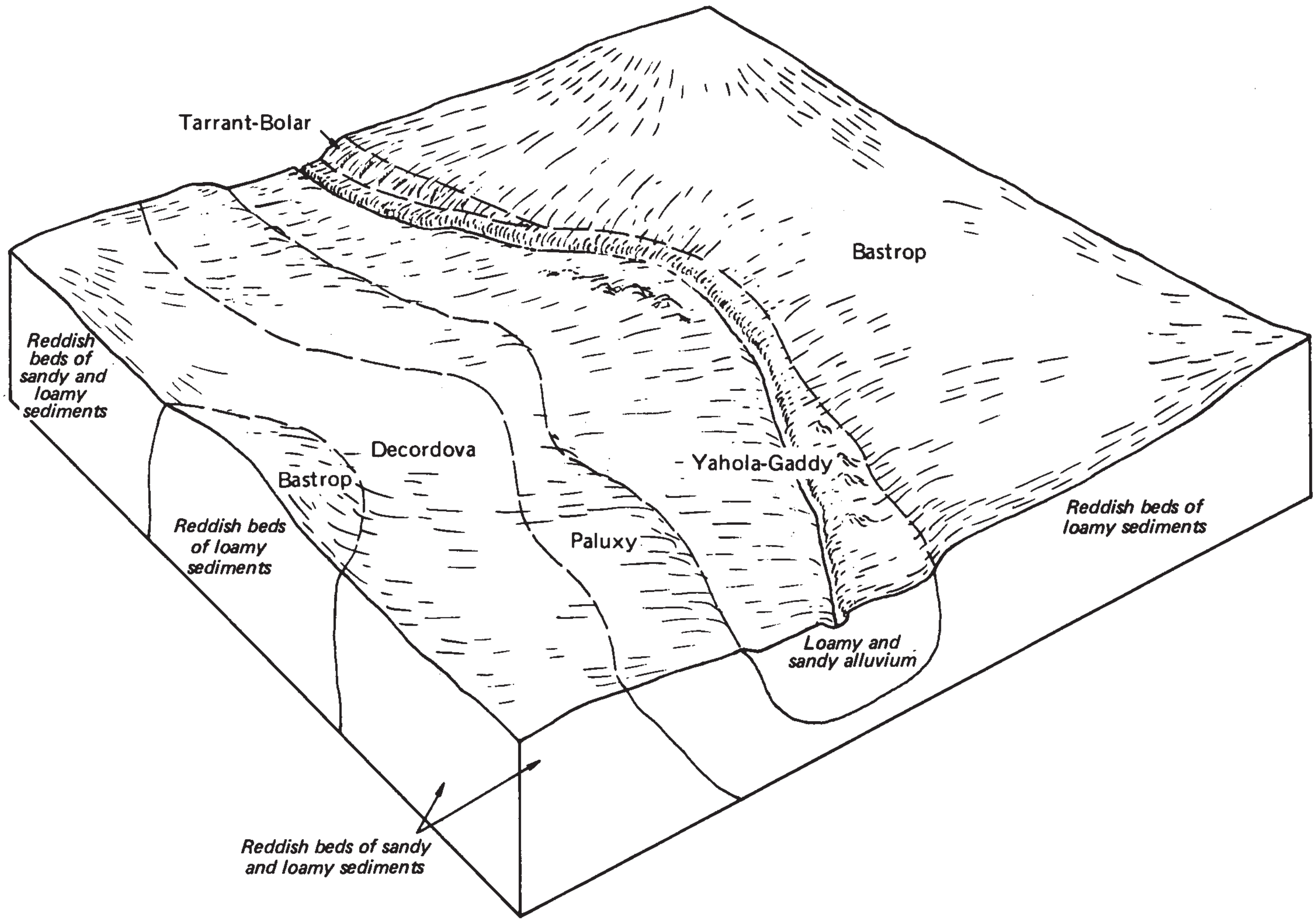

Figure 4.—Pattern of soils in the Bastrop-Yahola unit on the general soil map.

Figure 5.—Landscape of Aledo-Bolar association, undulating. The Aledo part is in the Shallow range site, and the Bolar part is in the Clay loam range site.

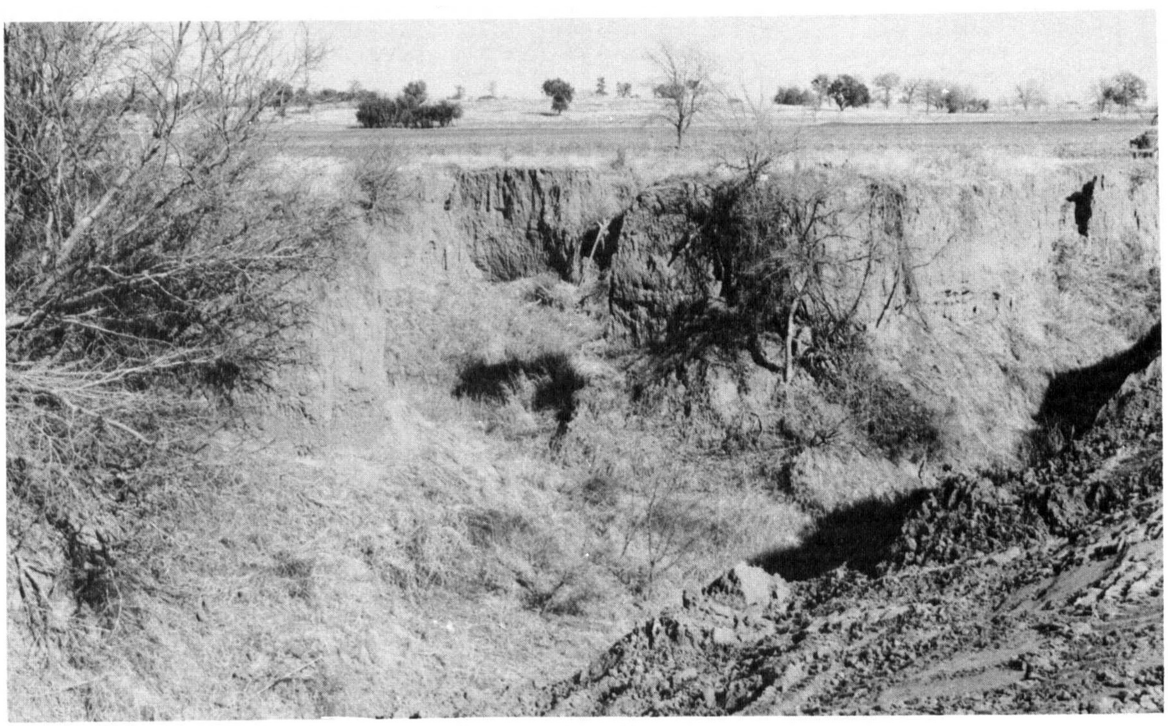

Figure 6.—Typical gully in Bastrop complex, gullied.

Figure 7.—Stripcropping peanuts with grain sorghum to control soil blowing. The soil is Chaney loamy fine sand, 1 to 5 percent slopes.

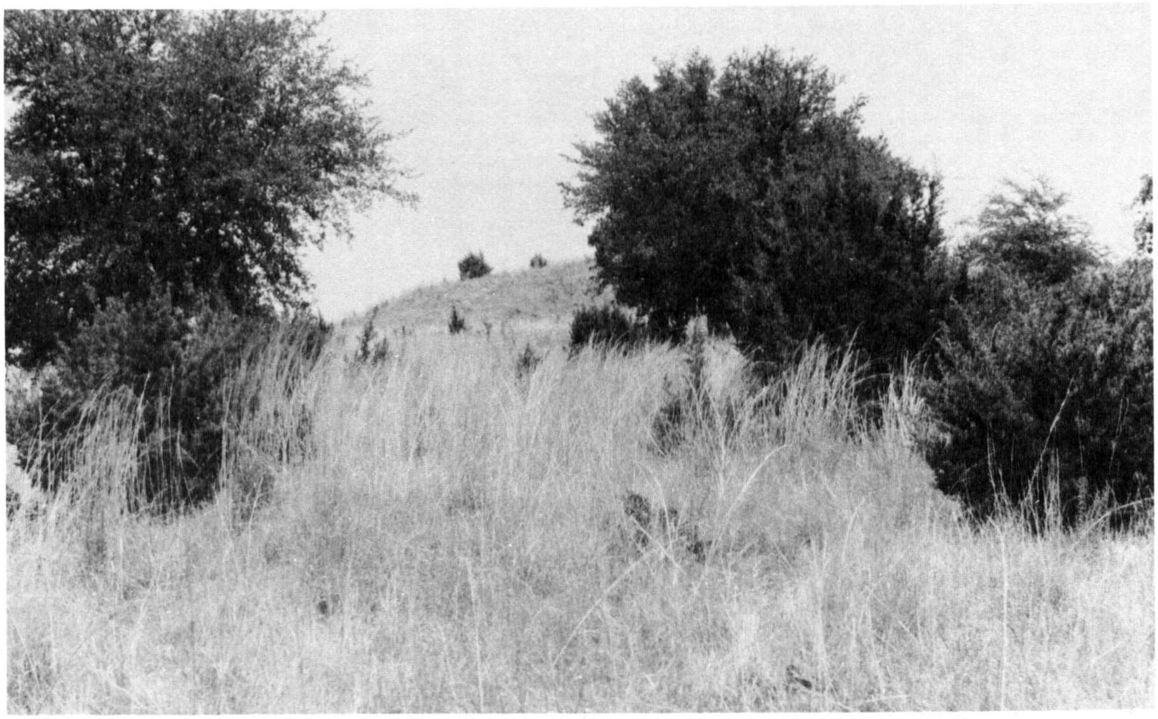

Figure 8.—Area of Tarrant-Bolar association, hilly, with a good cover of little bluestem.

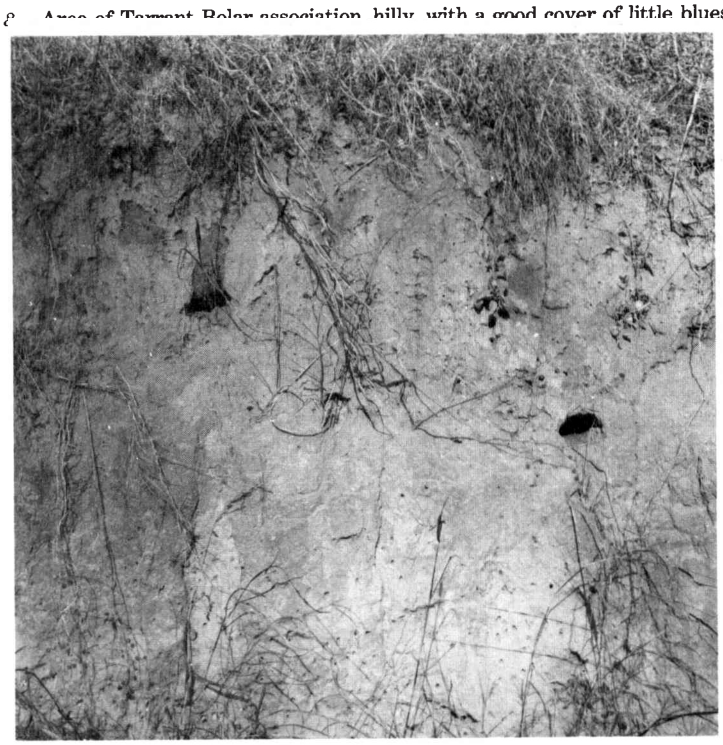

Figure 9.—Profile of Venus loam. This soil is used mainly as cropland and has high potential for row crops and small grains.

Figure 10.—Pastureland of improved bermudagrass on Yahola-Gaddy complex, occasionally flooded.

Figure 11.—Brush piles left unburned as a place for cover for quail and other small animals. The soil is Windthorst fine sandy loam, 1 to 3 percent slopes.

Tables

TABLE 1.—TEMPERATURE AND PRECIPITATION DATA

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average	2 years in 10 will have— Maximum temperature higher than—	2 years in 10 will have— Minimum temperature lower than—	Average number of growing degree days[1]	Average	2 years in 10 will have— Less than—	2 years in 10 will have— More than—	Average number of days with 0.10 inch or more	Average snowfall
	F	F	F	F	F	Units	In	In	In		In
January	58.1	33.0	45.6	83	8	43	1.60	.41	2.54	3	.7
February	62.9	36.8	49.9	88	15	97	1.74	.60	2.64	4	.6
March	70.3	43.9	57.1	94	22	284	1.93	.38	3.12	4	.1
April	79.5	54.7	67.1	95	29	513	3.84	1.88	5.44	6	.0
May	85.6	61.9	73.7	99	44	735	4.31	1.95	6.28	5	.0
June	93.0	69.4	81.2	103	54	936	2.83	.84	4.44	4	.0
July	97.7	72.8	85.3	107	62	1,094	1.73	.47	2.73	3	.0
August	97.1	71.7	84.4	106	58	1,066	2.12	.70	3.26	3	.0
September	90.1	65.8	78.0	102	47	840	3.13	1.30	4.60	5	.0
October	80.8	54.9	67.9	96	34	555	3.52	1.06	5.49	4	.0
November	68.8	43.4	56.1	86	22	214	2.20	.89	3.25	4	.0
December	61.4	36.1	48.7	82	14	96	1.61	.44	2.53	3	.2
Year	78.8	53.7	66.3	108	8	6,473	30.56	24.87	36.47	48	1.6

[1]A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (50 F).

TABLE 2.—FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-75 at Granbury, Texas]

Probability	Temperature		
	24 F or lower	28 F or lower	32 F or lower
Last freezing temperature in spring:			
1 year in 10 later than—	March 18	April 1	April 13
2 years in 10 later than—	March 10	March 25	April 6
5 years in 10 later than—	February 23	March 12	March 26
First freezing temperature in fall:			
1 year in 10 earlier than—	November 17	November 6	October 29
2 years in 10 earlier than—	November 24	November 13	November 3
5 years in 10 earlier than—	December 9	November 26	November 12

TABLE 3.—GROWING SEASON LENGTH

[Recorded in the period 1951-75 at Granbury, Texas]

Probability	Daily minimum temperature during growing season		
	Higher than 24 F	Higher than 28 F	Higher than 32 F
	Days	Days	Days
9 years in 10	262	234	209
8 years in 10	271	242	217
5 years in 10	289	258	231
2 years in 10	306	274	246
1 year in 10	315	283	253

TABLE 4.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP FOR SPECIFIED USES

Map unit	Extent of area	Cultivated farm crops	Pasture grasses	Range grasses	Urban uses	Recreation areas
	Pct					
1. Tarrant-Purves	39	Low: shallow to rock, large stones.	Low: shallow to rock, large stones.	Medium: shallow rooting depth.	Low: depth to rock, large stones.	Low: large stones, too clayey.
2. Aledo-Bolar	18	Low: shallow to rock, small stones.	Low: shallow to rock, small stones.	Medium: shallow rooting depth.	Low: depth to rock.	Medium: small stones, slope.
3. Windthorst-Duffau	15	Medium: erodes easily, percs slowly.	Medium: percs slowly.	High	Medium: stability.	Medium: percs slowly, slope.
4. Bastrop-Yahola	11	High	High	High	Medium: floods, stability.	High.
5. Chaney-Nimrod	10	High	High	Medium: percs slowly.	Medium: stability, wetness.	Medium: percs slowly, soil blowing.
6. Frio-Bosque	4	High	High	High	Low: floods.	High.
7. Krum-Sunev	3	High	Medium: percs slowly.	High	Medium: stability, slope.	Low: too clayey.

TABLE 5.—ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Hood County	Somervell County	Total— Area	Total— Extent
		Acres	Acres	Acres	Pct
1	Aledo-Bolar association, undulating	64,320	10	64,330	16.1
2	Bastrop loamy fine sand, 1 to 5 percent slopes	1,450	2,290	3,740	0.9
3	Bastrop fine sandy loam, 0 to 1 percent slopes	670	130	800	0.2
4	Bastrop fine sandy loam, 1 to 3 percent slopes	5,600	2,040	7,640	1.9
5	Bastrop fine sandy loam, 3 to 5 percent slopes	1,010	600	1,610	0.4
6	Bastrop fine sandy loam, 1 to 5 percent slopes, eroded	1,870	2,480	4,350	1.1
7	Bastrop fine sandy loam, 5 to 8 percent slopes	450	150	600	0.2
8	Bastrop complex, gullied	280	220	500	0.1
9	Blanket clay loam, 1 to 3 percent slopes	2,510	230	2,740	0.7
10	Bolar clay loam, 1 to 3 percent slopes	1,740	210	1,950	0.5
11	Bolar clay loam, 3 to 5 percent slopes	1,670	240	1,910	0.5
12	Bosque loam, occasionally flooded	5,710	1,620	7,330	1.9
13	Brackett soils, hilly	6,940	4,410	11,350	2.8
14	Bunyan fine sandy loam, occasionally flooded	650	180	830	0.2
15	Chaney loamy fine sand, 1 to 5 percent slopes	16,530	2,970	19,500	4.9
16	Chaney loamy fine sand, 1 to 5 percent slopes, eroded	4,540	850	5,390	1.4
17	Decordova loamy fine sand, 0 to 5 percent slopes	5,450	1,340	6,790	1.7
18	Demona loamy fine sand, 1 to 5 percent slopes	1,190	80	1,270	0.3
19	Denton clay, 1 to 3 percent slopes	1,380	390	1,770	0.4
20	Denton clay, 3 to 5 percent slopes	150	290	440	0.1
21	Duffau loamy fine sand, 1 to 5 percent slopes	1,790	800	2,590	0.6
22	Duffau fine sandy loam, 1 to 3 percent slopes	2,080	610	2,690	0.7
23	Duffau fine sandy loam, 3 to 5 percent slopes	1,290	740	2,030	0.5
24	Duffau fine sandy loam, 1 to 5 percent slopes, eroded	1,780	590	2,370	0.6
25	Duffau fine sandy loam, 5 to 8 percent slopes	870	90	960	0.2
26	Frio silty clay, occasionally flooded	6,110	1,280	7,390	1.9
27	Hassee fine sandy loam, 0 to 1 percent slopes	590	30	620	0.2
28	Hassee fine sandy loam, 1 to 3 percent slopes	2,010	290	2,300	0.6
29	Hensley stony clay loam, 0 to 3 percent slopes	490	110	600	0.2
30	Krum clay, 0 to 1 percent slopes	340	390	730	0.2
31	Krum clay, 1 to 3 percent slopes	2,900	3,220	6,120	1.5
32	Maloterre gravelly clay loam, 1 to 8 percent slopes	1,030	1,920	2,950	0.7
33	Nimrod fine sand, 1 to 5 percent slopes	5,930	560	6,490	1.6
34	Paluxy very fine sandy loam, 0 to 1 percent slopes	410	260	670	0.2
35	Paluxy very fine sandy loam, 1 to 3 percent slopes	780	960	1,740	0.4
36	Paluxy very fine sandy loam, 5 to 8 percent slopes	500	360	860	0.2
37	Patilo fine sand, 0 to 3 percent slopes	640	10	650	0.2
38	Pedernales fine sandy loam, 1 to 3 percent slopes	4,300	960	5,260	1.3
39	Pedernales fine sandy loam, 3 to 5 percent slopes	1,580	1,490	3,070	0.8
40	Pedernales fine sandy loam, 1 to 5 percent slopes, eroded	5,350	2,170	7,520	1.9
41	Pedernales fine sandy loam, 5 to 8 percent slopes, eroded	790	180	970	0.2
42	Purves clay, 1 to 3 percent slopes	1,900	1,390	3,290	0.8
43	Purves clay, 3 to 5 percent slopes	1,890	1,230	3,120	0.8
44	Seawillow loam, 3 to 5 percent slopes	770	130	900	0.2
45	Seawillow loam, 5 to 8 percent slopes	560	30	590	0.1
46	Sunev clay loam, 3 to 5 percent slopes	13,330	8,120	21,450	5.4
47	Sunev clay loam, 5 to 8 percent slopes	4,450	470	4,920	1.2
48	Tarrant-Bolar association, hilly	15,960	21,510	37,470	9.4
49	Tarrant-Purves association, undulating	18,610	35,680	54,290	13.6
50	Thurber clay loam, 1 to 3 percent slopes	3,370	60	3,430	0.9
51	Truce fine sandy loam, 1 to 5 percent slopes, eroded	580	0	580	0.2
52	Truce stony soils, 1 to 8 percent slopes	1,210	0	1,210	0.3
53	Venus loam, 1 to 3 percent slopes	5,480	4,830	10,310	2.6
54	Windthorst loamy fine sand, 1 to 5 percent slopes	2,830	1,100	3,930	1.0
55	Windthorst fine sandy loam, 1 to 3 percent slopes	3,410	780	4,190	1.1
56	Windthorst fine sandy loam, 3 to 5 percent slopes	1,480	1,710	3,190	0.8
57	Windthorst fine sandy loam, 1 to 5 percent slopes, eroded	14,030	4,640	18,670	4.7
58	Windthorst fine sandy loam, 5 to 8 percent slopes, eroded	1,470	150	1,620	0.4
59	Windthorst complex, gullied	3,710	3,170	6,880	1.7
60	Yahola-Gaddy complex, occasionally flooded	3,430	3,330	6,760	1.7
	Water	8,500	0	8,500	2.1
	Total	272,640	126,080	398,720	100.0

TABLE 6.--YIELDS PER ACRE OF CROPS AND PASTURE

[All yields were estimated for a high level of management in 1975. Absence of a yield figure indicates the crop is seldom grown or is not suited]

Soil name and map symbol	Grain sorghum	Oats	Peanuts	Improved bermudagrass
	Bu	Bu	Lb	AUM[1]
Aledo:				
1:				
Aledo part	---	---	---	---
Bolar part	---	---	---	---
Bastrop:				
2	55	---	1,400	6.0
3	70	40	1,250	7.0
4	55	40	1,200	7.0
5	45	---	800	5.5
6	40	30	800	5.0
7	40	---	---	5.5
[2]8	---	---	---	4.0
Blanket:				
9	60	65	---	6.0
Bolar:				
10	40	40	---	5.0
11	35	35	---	5.0
Bosque:				
12	65	60	---	6.5
Brackett:				
[2]13	---	---	---	---
Bunyan:				
14	70	50	1,200	8.0
Chaney:				
15	35	---	1,200	6.0
16	30	---	800	5.0
Decordova:				
17	40	---	1,000	5.5
Demona:				
18	40	---	1,200	6.0
Denton:				
19	65	60	---	6.0
20	55	50	---	5.0
Duffau:				
21	40	35	1,400	6.5
22	45	40	1,400	6.5
23	40	35	1,200	6.0
24	30	30	800	5.0
25	30	30	800	5.5
Frio:				
26	75	60	---	7.0

See footnotes at end of table.

TABLE 6.—YIELDS PER ACRE OF CROPS AND PASTURE—Continued

Soil name and map symbol	Grain sorghum	Oats	Peanuts	Improved bermudagrass
	Bu	Bu	Lb	AUM[1]
Hassee:				
27	45	30	---	5.0
28	35	30	---	4.5
Hensley:				
29	---	---	---	---
Krum:				
30	75	70	---	7.5
31	70	70	---	7.5
Maloterre:				
32	---	---	---	---
Nimrod:				
33	40	30	1,200	5.5
Paluxy:				
34	60	45	1,200	7.0
35	50	45	1,100	6.5
36	35	---	---	5.5
Patilo:				
37	---	---	1,000	4.5
Pedernales:				
38	35	60	1,000	4.5
39	35	45	800	4.0
40	20	35	700	3.5
41	---	---	---	3.0
Purves:				
42	35	45	---	4.0
43	25	40	---	3.5
Seawillow:				
44	40	40	---	5.0
45	35	30	---	4.5
Sunev:				
46	35	50	---	5.5
47	30	45	---	5.5
Tarrant:				
[2]48:				
Tarrant part	---	---	---	---
Bolar part	---	---	---	---
[2]49:				
Tarrant part	---	---	---	---
Purves part	---	---	---	---
Thurber:				
50	30	35	---	3.5
Truce:				
51	25	15	---	3.0

See footnotes at end of table.

TABLE 6.—YIELDS PER ACRE OF CROPS AND PASTURE—Continued

Soil name and map symbol	Grain sorghum	Oats	Peanuts	Improved bermudagrass
	Bu	Bu	Lb	AUM[1]
Truce:				
[2]52	—	—	—	—
Venus:				
53	70	60	—	7.0
Windthorst:				
54	35	30	1,200	6.0
55	45	40	1,100	6.0
56	35	35	1,000	5.0
57	35	30	800	4.5
58	—	—	—	3.5
[2]59	—	—	—	3.0
Yahola:				
[2]60:				
Yahola part	45	—	1,600	7.5
Gaddy part	30	—	1,300	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 mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 7.—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	1,470	—	—	—
II	64,422	43,410	20,282	730
III	124,318	121,670	620	2,028
IV	17,840	17,840	—	—
V	—	—	—	—
VI	103,638	9,970	—	93,668
VII	78,532	—	—	78,532
VIII	—	—	—	—

TABLE 8.—RANGE PRODUCTIVITY AND COMPOSITION

[Soils not listed are not in range sites; such soils can be used for grazing if grass cover is established]

Soil name and map symbol	Range site name	Potential production		Common plant name	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
Aledo:					
[1]1:					
Aledo part	Shallow	Favorable	3,000	Little bluestem	30
		Normal	2,000	Yellow indiangrass	15
		Unfavorable	1,800	Sideoats grama	10
				Big bluestem	10
				Switchgrass	5
				Silver bluestem	5
				Hairy grama	5
				Hairy dropseed	5
				Texas wintergrass	5
				Other perennial forbs	5
				Other trees	5
Bolar part	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
Bastrop:					
2	Loamy Sand	Favorable	5,500	Little bluestem	50
		Normal	4,200	Yellow indiangrass	10
		Unfavorable	3,000	Switchgrass	5
				Purpletop	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				American beautyberry	5
				Other perennial forbs	5
				Other annual forbs	5
3, 4, 5, 6, 7, [1]8	Sandy Loam	Favorable	5,500	Little bluestem	50
		Normal	4,500	Yellow indiangrass	10
		Unfavorable	3,000	Switchgrass	5
				Purpletop	5
				Sideoats grama	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				Hackberry	5
				Other perennial forbs	3
				Other annual forbs	2
Blanket:					
9	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5

See footnote at end of table.

TABLE 8.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Bolar: 10, 11	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
Bosque: 12	Loamy Bottomland	Favorable	6,500	Yellow indiangrass	20
		Normal	5,000	Little bluestem	15
		Unfavorable	3,500	Switchgrass	15
				Big bluestem	10
				Sideoats grama	5
				Canada wildrye	5
				Vine-mesquite	5
				Texas wintergrass	5
				Tall dropseed	5
				Other trees	10
				Other perennial forbs	5
Brackett: [1]13	Steep Adobe	Favorable	3,000	Little bluestem	30
		Normal	2,200	Sideoats grama	10
		Unfavorable	1,500	Tall grama	10
				Yellow indiangrass	10
				Tall dropseed	5
				Silver bluestem	5
				Slim tridens	5
				Hairy grama	5
				Other trees	15
				Other perennial forbs	5
Bunyan: 14	Loamy Bottomland	Favorable	6,500	Indiangrass	20
		Normal	5,000	Switchgrass	15
		Unfavorable	1,500	Big bluestem	10
				Little bluestem	10
				Tall dropseed	5
				Texas wintergrass	5
				Sideoats grama	5
				Vine-mesquite	5
				Other perennial grasses	10
				Other trees	10
				Other perennial forbs	5
Chaney: 15, 16	Loamy Sand	Favorable	4,500	Little bluestem	25
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Post oak	10
				Silver bluestem	5
				Scribner panicum	5
				Sand lovegrass	5
				Purpletop	5
				Other perennial grasses	15
				Other trees	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 8.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Decordova:					
17	Loamy sand	Favorable	5,000	Little bluestem	50
		Normal	4,000	Yellow indiangrass	10
		Unfavorable	2,500	Switchgrass	5
				Purpletop	5
				Fall witchgrass	5
				Post oak	5
				Blackjack oak	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other annual forbs	5
Demona:					
18	Sandy	Favorable	4,500	Little bluestem	25
		Normal	3,500	Big bluestem	10
		Unfavorable	2,000	Yellow indiangrass	10
				Post oak	8
				Blackjack oak	7
				Sand lovegrass	5
				Purpletop	5
				Tall dropseed	5
				Silver bluestem	5
				Scribner panicum	5
				Other perennial grasses	5
				Other trees	5
				Other perennial forbs	5
Denton:					
19, 20	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Sideoats grama	10
				Big bluestem	10
				Switchgrass	5
				Silver bluestem	5
				Texas wintergrass	5
				Tall dropseed	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
Duffau:					
21	Loamy Sand	Favorable	5,000	Little bluestem	25
		Normal	4,000	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Post oak	10
				Silver bluestem	5
				Scribner panicum	5
				Sand lovegrass	5
				Tall dropseed	5
				Purpletop	5
				Other perennial grasses	10
				Other trees	5
				Other perennial forbs	5
22, 23, 24, 25	Sandy Loam	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas wintergrass	5
				Arizona cottontop	5
				Post oak	4
				Other perennial forbs	10
				Other trees	6
				Other perennial grasses	5

See footnote at end of table.

TABLE 8.—RANGE PRODUCTIVITY AND COMPOSITION—Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Frio:					
26	Loamy Bottomland	Favorable	6,000	Big bluestem	10
		Normal	4,500	Little bluestem	10
		Unfavorable	3,000	Vine-mesquite	10
				Switchgrass	5
				Indiangrass	5
				Eastern gama	5
				Texas wintergrass	5
				Plains livegrass	5
				Canada wildrye	5
				Cane bluestem	5
				Southwestern bristlegrass	5
				Other trees	15
				Other perennial grasses	10
				Other perennial forbs	5
Hassee:					
27, 28	Claypan Prairie	Favorable	4,000	Vine-mesquite	20
		Normal	3,000	Sideoats grama	10
		Unfavorable	2,000	Arizona cottontop	10
				Buffalograss	5
				Blue grama	5
				Texas wintergrass	5
				Tall dropseed	5
				Sand dropseed	5
				Purple threeawn	5
				Silver bluestem	5
				Other perennial grasses	15
				Other perennial forbs	5
				Other annual grasses	5
Hensley:					
29	Redland	Favorable	5,000	Little bluestem	30
		Normal	4,000	Yellow indiangrass	20
		Unfavorable	2,500	Sideoats grama	10
				Big bluestem	5
				Silver bluestem	5
				Switchgrass	5
				Blue grama	5
				Other perennial forbs	10
				Other perennial grasses	5
				Other shrubs	5
Krum:					
30, 31	Clay Loam	Favorable	6,500	Little bluestem	50
		Normal	5,000	Big bluestem	15
		Unfavorable	3,000	Indiangrass	10
				Eastern gamagrass	4
				Switchgrass	4
				Sideoats grama	4
				Virginia wildrye	4
				Vine-mesquite	4
				Unknowns	5
Maloterre:					
32	Very Shallow	Favorable	1,500	Little bluestem	20
		Normal	1,200	Sideoats grama	15
		Unfavorable	750	Yellow indiangrass	10
				Rough tridens	10
				Tall grama	10
				Tall dropseed	10
				Other perennial grasses	15
				Other perennial forbs	10

See footnote at end of table.

TABLE 8.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Nimrod:					
33	Sandy	Favorable	4,500	Little bluestem	25
		Normal	3,500	Big bluestem	10
		Unfavorable	2,000	Yellow indiangrass	10
				Post oak	8
				Blackjack oak	7
				Sand lovegrass	5
				Purpletop	5
				Tall dropseed	5
				Silver bluestem	5
				Scribner panicum	5
				Other perennial grasses	5
				Other trees	5
				Other perennial forbs	5
Paluxy:					
34, 35, 36	Sandy Loam	Favorable	5,500	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Sideoats grama	10
				Silver bluestem	5
				Scribner panicum	5
				Texas wintergrass	5
				Arizona cottontop	5
				Other trees	10
				Other perennial forbs	10
Patilo:					
37	Deep Sand	Favorable	3,000	Post oak	15
		Normal	2,000	Sand lovegrass	10
		Unfavorable	1,000	Blackjack oak	10
				Purpletop	5
				Little bluestem	5
				Red lovegrass	5
				Scribner panicum	5
				Fringeleaf paspalum	5
				Other perennial forbs	15
				Other trees	15
				Other annual grasses	10
Pedernales:					
38, 39, 40, 41	Tight Sandy Loam	Favorable	3,500	Sideoats grama	25
		Normal	3,000	Little bluestem	15
		Unfavorable	1,500	Pinhole bluestem	10
				Vine-mesquite	10
				Arizona cottontop	5
				Canada wildrye	5
				Texas wintergrass	5
				Other perennial grasses	10
				Other trees	10
				Other perennial forbs	5
Purves:					
42, 43	Shallow	Favorable	3,000	Little bluestem	30
		Normal	2,500	Yellow indiangrass	15
		Unfavorable	1,800	Big bluestem	10
				Sideoats grama	10
				Switchgrass	5
				Hairy grama	5
				Texas wintergrass	5
				Silver bluestem	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other trees	5
Seawillow:					
44, 45	Clay Loam	Favorable	6,000	Little bluestem	45
		Normal	4,500	Yellow indiangrass	13
		Unfavorable	3,000	Big bluestem	12
				Other perennial grasses	20
				Other perennial forbs	5
				Other trees	3
				Other shrubs	2

See footnote at end of table.

TABLE 8.—RANGE PRODUCTIVITY AND COMPOSITION—Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Sunev:					
46, 47	Clay Loam	Favorable	6,500	Little bluestem	50
		Normal	5,500	Yellow indiangrass	15
		Unfavorable	3,500	Big bluestem	10
				Live oak	3
				Eastern gamagrass	2
				Switchgrass	2
				Sideoats grama	2
				Vine-mesquite	2
				Buffalograss	2
				Other perennial forbs	5
				Other annual forbs	5
				Other trees	2
Tarrant:					
148:					
Tarrant part	Steep Rocky	Favorable	1,800	Sideoats grama	20
		Normal	1,400	Silver bluestem	15
		Unfavorable	800	Little bluestem	10
				Green sprangletop	10
				Yellow indiangrass	5
				Fall witchgrass	5
				Live oak	5
				Other perennial grasses	10
				Other shrubs	10
				Other perennial forbs	10
Bolar part	Clay Loam	Favorable	6,000	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
149:					
Tarrant part	Low Stony Hill	Favorable	2,500	Little bluestem	15
		Normal	1,800	Sideoats grama	15
		Unfavorable	1,200	Curlymesquite	10
				Buffalograss	5
				Green sprangletop	5
				Texas wintergrass	5
				Texas cupgrass	5
				Tall dropseed	5
				Silver bluestem	5
				Live oak	5
				Other perennial grasses	10
				Other perennial forbs	10
				Other shrubs	5
Purves part	Shallow	Favorable	3,000	Little bluestem	30
		Normal	2,500	Yellow indiangrass	15
		Unfavorable	1,800	Big bluestem	10
				Sideoats grama	10
				Switchgrass	5
				Hairy grama	5
				Texas wintergrass	5
				Silver bluestem	5
				Other perennial grasses	5
				Other perennial forbs	5
				Other trees	5

See footnote at end of table.

TABLE 8.—RANGE PRODUCTIVITY AND COMPOSITION—Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Composition
			Lb/acre		Pct
Thurber:					
50	Claypan Prairie	Favorable	3,500	Vine-mesquite	20
		Normal	3,000	Sideoats grama	10
		Unfavorable	2,000	Arizona cottontop	10
				Buffalograss	5
				Blue grama	5
				Texas wintergrass	5
				Tall dropseed	5
				Sand dropseed	5
				Purple threeawn	5
				Silver bluestem	5
				Other peennial grasses	15
				Other perennial forbs	5
				Other annual grasses	5
Truce:					
51	Tight Sandy Loam	Favorable	4,000	Sideoats grama	30
		Normal	3,000	Arizona cottontop	15
		Unfavorable	2,000	Vine-mesquite	15
				Little bluestem	5
				Silver bluestem	5
				Buffalograss	5
				Texas wintergrass	5
				Other perennial grasses	10
				Other trees	5
				Other perennial forbs	5
[1]52	Tight Sandy Loam	Favorable	4,000	Sideoats grama	30
		Normal	3,000	Arizona cottontop	15
		Unfavorable	2,000	Vine-mesquite	15
				Little bluestem	5
				Silver bluestem	5
				Buffalograss	5
				Texas wintergrass	5
				Other perennial grasses	10
				Other perennial forbs	5
				Other trees	5
Venus:					
53	Clay Loam	Favorable	6,500	Little bluestem	20
		Normal	5,000	Yellow indiangrass	15
		Unfavorable	3,000	Big bluestem	10
				Sideoats grama	10
				Silver bluestem	5
				Tall dropseed	5
				Texas wintergrass	5
				Canada wildrye	5
				Other perennial forbs	15
				Other perennial grasses	5
				Other trees	5
Windthorst:					
54	Loamy Sand	Favorable	5,000	Little bluestem	25
		Unfavorable	3,000	Yellow indiangrass	10
		Unfavorable	3,000	Yellow indiangrass	10
				Post oak	10
				Silver bluestem	5
				Scribner panicum	5
				Sand lovegrass	5
				Tall dropseed	5
				Purpletop	5
				Other perennial grasses	10
				Other trees	5
				Other perennial forbs	5

See footnote at end of table.

TABLE 8.--RANGE PRODUCTIVITY AND COMPOSITION--Continued

Soil name and map symbol	Range site name	Potential production: Kind of year	Potential production: Dry weight	Common plant name	Compo- sition
			Lb/acre		Pct
Windthorst:					
55, 56, 57, 58, [1]59	Sandy Loam	Favorable	6,000	Little bluestem	30
		Normal	4,500	Big bluestem	10
		Unfavorable	3,000	Yellow indiangrass	10
				Sideoats grama	5
				Silver bluestem	5
				Scribner panicum	5
				Texas wintergrass	5
				Arizona cottontop	5
				Post oak	4
				Other perennial forbs	10
				Other trees	6
				Other perennial grasses	5
Yahola:					
[1]60:					
Yahola part	Loamy Bottomland	Favorable	7,000	Big bluestem	25
		Normal	4,900	Indiangrass	15
		Unfavorable	3,500	Switchgrass	15
				Little bluestem	10
				Eastern gamagrass	5
				Tall dropseed	5
				Beaked panicum	5
				Compassplant	5
				Sedges	5
				Heath aster	5
				Other trees	5
Gaddy part	Sandy Bottomland	Favorable	3,800	Switchgrass	30
		Normal	2,700	Sand bluestem	15
		Unfavorable	2,000	Indiangrass	15
				Little bluestem	5
				Texas bluegrass	5
				Beaked panicum	5
				Purpletop	5
				Goldenrod	5
				Heath aster	5
				Maximilian sunflower	5
				Other trees	5

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

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
Aledo:					
[1]1:					
Aledo part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Bolar part	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Severe: low strength.
Bastrop:					
2, 3, 4, 5, 6	Slight	Slight	Slight	Slight	Moderate: low strength.
7, [1]8	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Blanket:					
9	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength.
Bolar:					
10	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Severe: low strength.
11	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Severe: low strength.
Bosque:					
12	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Brackett:					
[1]13	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Bunyan:					
14	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
Chaney:					
15, 16	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Decordova:					
17	Slight	Slight	Slight	Slight	Slight.
Demona:					
18	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Moderate: shrink-swell.
Denton:					
19, 20	Severe: too clayey.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: low strength, shrink-swell.
Duffau:					
21, 23, 24, 25	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
22	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: 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
Frio:					
26	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods, low strength.
Hassee:					
27, 28	Severe: too clayey, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell, wetness.	Severe: shrink-swell.
Hensley:					
29	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Krum:					
30, 31	Severe: cutbanks cave, too clayey.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.	Severe: low strength, shrink-swell.
Maloterre:					
32	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Nimrod:					
33	Severe: cutbanks cave, wetness.	Moderate: wetness.	Severe: wetness.	Moderate: wetness.	Slight.
Paluxy:					
34, 35	Slight	Slight	Slight	Slight	Moderate: low strength.
36	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Patilo:					
37	Severe: cutbanks cave.	Slight	Moderate: wetness.	Slight	Slight.
Pedernales:					
38, 39, 40, 41	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.
Purves:					
42, 43	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Seawillow:					
44, 45	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Sunev:					
46, 47	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
Tarrant:					
[1]48:					
Tarrant part	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.
Bolar part	Moderate: depth to rock.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength, slope.	Severe: low strength.
[1]49:					
Tarrant part	Severe: depth to rock.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.	Severe: depth to rock, large stones.

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
Tarrant:					
Purves part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.
Thurber:					
50	Severe: too clayey.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.	Severe: shrink-swell.
Truce:					
51	Severe: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
[1]52	Severe: too clayey, large stones.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
Venus:					
53	Slight	Slight	Slight	Slight	Moderate: low strength.
Windthorst:					
54, 55, 57	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: low strength.
56, 58, [1]59	Moderate: too clayey.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, slope.	Severe: low strength.
Yahola:					
[1]60:					
Yahola part	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
Gaddy part	Severe: floods, cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 10.--SANITARY FACILITIES

["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," "good," "fair," and other terms used to rate soils. Absence of an entry means soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
Aledo:					
[1]1:					
Aledo part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, small stones.
Bolar part	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
Bastrop:					
2, 3, 4, 5, 6, 7, 8	Moderate: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
Blanket:					
9	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Bolar:					
10, 11	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
Bosque:					
12	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Brackett:					
[1]13	Severe: percs slowly, depth to rock.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer.
Bunyan:					
14	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.
Chaney:					
15, 16	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Poor: thin layer.
Decordova:					
17	Slight	Severe: seepage.	Severe: too sandy, seepage.	Severe: seepage.	Fair: too sandy.
Demona:					
18	Severe: percs slowly.	Severe: seepage.	Moderate: wetness.	Severe: wetness.	Fair: too sandy.
Denton:					
19, 20	Severe: percs slowly, depth to rock.	Severe: depth to rock.	Severe: too clayey, depth to rock.	Slight	Poor: too clayey.
Duffau:					
21, 23, 24, 25	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
22	Slight	Moderate: seepage.	Slight	Slight	Good.
Frio:					
26	Severe: floods, percs slowly.	Severe: floods.	Severe: floods.	Severe: floods.	Poor: too clayey.

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
Hassee:					
27	Severe: percs slowly.	Slight	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
28	Severe: percs slowly.	Moderate: slope.	Severe: too clayey, wetness.	Severe: wetness.	Poor: thin layer.
Hensley:					
29	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Krum:					
30	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
31	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Maloterre:					
32	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer.
Nimrod:					
33	Severe: percs slowly.	Severe: seepage.	Moderate: wetness.	Severe: wetness.	Fair: too sandy.
Paluxy:					
34, 35, 36	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
Patilo:					
37	Moderate: percs slowly.	Severe: seepage.	Moderate: too sandy, wetness.	Moderate: seepage.	Poor: too sandy.
Pedernales:					
38, 39, 40, 41	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Purves:					
42, 43	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
Seawillow:					
44, 45	Slight	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: area reclaim.
Sunev:					
46, 47	Slight	Severe: seepage.	Slight	Slight	Fair: excess lime.
Tarrant:					
[1]48:					
Tarrant part	Severe: depth to rock, slope.	Severe: depth to rock, slope.	Severe: depth to rock.	Severe: slope.	Poor: thin layer, large stones, too clayey.
Bolar part	Severe: depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Slight	Fair: too clayey.
[1]49:					
Tarrant part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, large stones, too clayey.

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
Tarrant:					
Purves part	Severe: depth to rock.	Severe: depth to rock.	Severe: depth to rock.	Slight	Poor: thin layer, too clayey.
Thurber:					
50	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
Truce:					
51	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: thin layer.
[1]52	Severe: percs slowly.	Moderate: large stones, slope.	Severe: too clayey, large stones.	Slight	Poor: thin layer, large stones.
Venus:					
53	Slight	Moderate: seepage.	Slight	Slight	Good.
Windthorst:					
54, 55, 56, 57, 58, [1]59	Severe: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Yahola:					
[1]60:					
Yahola part	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage.	Severe: floods, seepage.	Good.
Gaddy part	Severe: floods.	Severe: seepage, floods.	Severe: seepage, too sandy, floods.	Severe: floods, seepage.	Fair: too sandy.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

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
Aledo:				
[1]1:				
Aledo part	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Bolar part	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Bastrop:				
2	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
3, 4, 5, 6, 7, [1]8	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Blanket:				
9	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
Bolar:				
10, 11	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Bosque:				
12	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Brackett:				
[1]13	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Bunyan:				
14	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Chaney:				
15, 16	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Decordova:				
17	Good	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Demona:				
18	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Denton:				
19, 20	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Duffau:				
21	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
22, 23, 24, 25	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Frio:				
26	Poor: low strength.	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
Hassee: 27, 28	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Hensley: 29	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Krum: 30, 31	Poor: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
Maloterre: 32	Poor: thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, excess lime.
Nimrod: 33	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Paluxy: 34, 35, 36	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Patilo: 37	Good	Fair: excess fines.	Unsuited: excess fines.	Poor: too sandy.
Pedernales: 38, 39, 40, 41	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Purves: 42, 43	Poor: shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, thin layer.
Seawillow: 44, 45	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: excess lime.
Sunev: 46, 47	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Tarrant:				
[1]48:				
Tarrant part	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Bolar part	Poor: low strength, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
[1]49:				
Tarrant part	Poor: thin layer, large stones.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, large stones.
Purves part	Poor: shrink-swell, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey, thin layer.
Thurber: 50	Poor: shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer.

See footnote at end of table.

TABLE 11.—CONSTRUCTION MATERIALS—Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
Truce:				
51	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
[1]52	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: large stones.
Venus:				
53	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Windthorst:				
54	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
55, 56, 57, 58, [1]59	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
Yahola:				
[1]60:				
Yahola part	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Good.
Gaddy part	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

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-- Pond reservoir areas	Limitations for-- Embankments, dikes and levees	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Aledo:					
[1]1:					
Aledo part	Severe: depth to rock.	Severe: thin layer.	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
Bolar part	Severe: seepage.	Moderate: thin layer.	Excess lime	Large stones	Large stones.
Bastrop:					
2, 3, 4, 5, 6, 7, 8	Moderate: seepage.	Moderate: piping.	Favorable	Favorable	Favorable.
Blanket:					
9	Moderate: seepage.	Moderate: piping, compressible.	Favorable	Favorable	Favorable.
Bolar:					
10, 11	Severe: seepage.	Moderate: thin layer.	Excess lime	Favorable	Favorable.
Bosque:					
12	Moderate: seepage.	Moderate: compressible.	Favorable	Floods	Floods.
Brackett:					
[1]13	Severe: seepage.	Severe: thin layer.	Droughty, excess lime, rooting depth.	Depth to rock, rooting depth.	Droughty, rooting depth.
Bunyan:					
14	Moderate: seepage.	Moderate: piping.	Floods	Not needed	Favorable.
Chaney:					
15, 16	Slight	Moderate: erodes easily.	Percs slowly, soil blowing.	Piping, erodes easily.	Erodes easily.
Decordova:					
17	Severe: seepage.	Severe: piping, seepage.	Fast intake, erodes easily.	Too sandy, erodes easily, piping.	Erodes easily.
Demona:					
18	Moderate: seepage.	Moderate: erodes easily.	Fast intake, soil blowing.	Piping, erodes easily.	Erodes easily.
Denton:					
19, 20	Severe: depth to rock.	Moderate: compressible, shrink-swell.	Percs slowly	Favorable	Favorable.
Duffau:					
21	Moderate: seepage.	Moderate: erodes easily, piping.	Soil blowing, erodes easily.	Soil blowing, erodes easily.	Erodes easily.
22, 23, 24, 25	Moderate: seepage.	Moderate: erodes easily, piping.	Erodes easily	Erodes easily	Erodes easily.
Frio:					
26	Moderate: seepage.	Moderate: compressible.	Floods	Favorable	Favorable.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes and levees	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
Hassee:					
27, 28	Slight	Moderate: unstable fill.	Slow intake	Percs slowly	Droughty, percs slowly.
Hensley:					
29	Severe: depth to rock.	Severe: thin layer.	Rooting depth, slow intake.	Depth to rock	Percs slowly, rooting depth.
Krum:					
30, 31	Moderate: seepage.	Moderate: low strength.	Slow intake	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Maloterre:					
32	Severe: depth to rock.	Severe: thin layer.	Droughty, rooting depth.	Depth to rock	Droughty, rooting depth.
Nimrod:					
33	Moderate: seepage.	Moderate: erodes easily.	Fast intake, soil blowing.	Piping, erodes easily.	Erodes easily.
Paluxy:					
34, 35, 36	Severe: seepage.	Moderate: piping, low strength.	Favorable	Erodes easily	Favorable.
Patilo:					
37	Severe: seepage.	Moderate: seepage, piping.	Fast intake, soil blowing.	Piping, erodes easily.	Droughty.
Pedernales:					
38, 39, 40, 41	Moderate: seepage.	Moderate: compressible.	Percs slowly	Favorable	Favorable.
Purves:					
42, 43	Severe: depth to rock.	Severe: thin layer.	Droughty, rooting depth.	Depth to rock	Rooting depth, droughty.
Seawillow:					
44, 45	Severe: seepage.	Moderate: seepage, compressible.	Excess lime, slope, droughty.	Erodes easily	Droughty.
Sunev:					
46, 47	Severe: seepage.	Moderate: compressible, piping.	Excess lime	Favorable	Favorable.
Tarrant:					
[1]48:					
Tarrant part	Severe: depth to rock.	Severe: thin layer, large stones.	Rooting depth	Depth to rock, large stones.	Rooting depth, large stones.
Bolar part	Severe: seepage.	Moderate: thin layer.	Excess lime	Large stones	Large stones.
[1]49:					
Tarrant part	Severe: depth to rock.	Severe: thin layer, large stones.	Rooting depth	Depth to rock, large stones.	Rooting depth, large stones.
Purves part	Severe: depth to rock.	Severe: thin layer.	Rooting depth, droughty.	Depth to rock, rooting depth.	Droughty, rooting depth.
Thurber:					
50	Slight	Moderate: compressible.	Slow intake	Percs slowly	Droughty, percs slowly.

See footnote at end of table.

TABLE 12.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Limitations for-- Embankments, dikes and levees	Features affecting-- Irrigation	Features affecting-- Terraces and diversions	Features affecting-- Grassed waterways
Truce:					
51	Slight	Moderate: low strength.	Percs slowly	Favorable	Favorable.
[1]52	Slight	Moderate: large stones.	Slow intake, complex slope.	Large stones	Large stones.
Venus:					
53	Severe: seepage.	Moderate: piping.	Favorable	Favorable	Favorable.
Windthorst:					
54, 55, 56, 57, 58, [1]59	Moderate: seepage.	Moderate: compressible.	Percs slowly, erodes easily.	Percs slowly, erodes easily.	Percs slowly, erodes easily.
Yahola:					
[1]60:					
Yahola part	Severe: seepage.	Moderate: unstable fill, seepage, piping.	Floods	Not needed	Not needed.
Gaddy part	Severe: seepage.	Moderate: unstable fill, piping.	Seepage	Erodes easily	Erodes easily.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 13.--POTENTIAL FOR URBANIZATION

Soil name and map symbol	Elements of urbanization: Shallow excavations	Elements of urbanization: Dwellings	Elements of urbanization: Streets	Elements of urbanization: Uncoated steel pipe	Major concerns	Potential for urbanization
Aledo:						
[1]1	Low	Low	Low	Medium	Shallow depth to rock.	Low.
Bastrop:						
2, 3, 4, 5, 6, 7, [1]8	Very high	Very high	High	High	Low strength.	High.
Blanket:						
9	Medium	Medium	Low	Low	Shrink-swell, low strength.	Medium.
Bolar:						
10, 11	Medium	Medium	Low	Low	Low strength, corrosivity.	Medium.
Bosque:						
12	Very low	Very low	Very low	Low	Flooding.	Very low.
Brackett:						
[1]13	Low	Low	Low	Low	Slope, depth to rock.	Low.
Bunyan:						
14	Very low	Very low	Very low	Medium	Flooding.	Very low.
Chaney:						
15, 16	Medium	Medium	Low	Medium	Shrink-swell, low strength.	Medium.
Decordova:						
17	Very high	Very high	Very high	High	Cutbanks cave.	Very high.
Demona:						
18	Low	Medium	Medium	Very high	Cutbanks cave, wetness.	Medium.
Denton:						
19, 20	Low	Low	Low	Low	Shrink-swell, low strength.	Low.
Duffau:						
21, 22, 23, 24, 25	Very high	High	High	High	Low strength.	Very high.
Frio:						
26	Very low	Very low	Very low	Low	Flooding.	Very low.
Hassee:						
27, 28	Low	Low	Low	Low	Shrink-swell, too clayey.	Low.
Hensley:						
29	Low	Low	Low	Low	Depth to rock, corrosivity.	Low.
Krum:						
30, 31	Low	Low	Low	Low	Low strength, shrink-swell.	Low.
Maloterre:						
32	Low	Low	Low	Low	Depth to rock, corrosivity.	Low.
Nimrod:						
33	Low	Medium	High	High	Wetness, cutbanks cave.	Medium.

See footnote at end of table.

TABLE 13.—POTENTIAL FOR URBANIZATION—Continued

Soil name and map symbol	Elements of urbanization: Shallow excavations	Dwellings	Streets	Uncoated steel pipe	Major concerns	Potential for urbanization
Paluxy: 34, 35, 36	Very high	Very high	Medium	High	Low strength.	High.
Patilo: 37	Low	High	High	High	Cutbanks cave.	High.
Pedernales: 38, 39, 40, 41	Medium	Medium	Medium	Low	Shrink-swell, low strength.	Medium.
Purves: 42, 43	Low	Low	Low	Low	Depth to rock, corrosivity.	Low.
Seawillow: 44, 45	Medium	Medium	Low	Medium	Low strength, shrink-swell.	Medium.
Sunev: 46, 47	High	High	Medium	Medium	Low strength, corrosivity.	High.
Tarrant: [1]48, [1]49	Low	Low	Low	Low	Depth to rock, large stones.	Low.
Thurber: 50	Low	Low	Low	Low	Shrink-swell, too clayey.	Low.
Truce: 51, [1]52	Low	Medium	Low	Low	Shrink-swell, low strength.	Low.
Venus: 53	High	High	Medium	Low	Low strength, corrosivity.	High.
Windthorst: 54, 55, 56, 57, 58, [1]59	Medium	Medium	Low	Low	Low strength, shrink-swell.	Medium.
Yahola: [1]60	Very low	Very low	Very low	High	Flooding.	Very low.

[1] This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 14.--RECREATIONAL 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"]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Aledo:				
[1]1:				
Aledo part	Moderate: too clayey.	Moderate: too clayey.	Severe: depth to rock, small stones.	Moderate: too clayey.
Bolar part	Moderate: too clayey, large stones.	Moderate: too clayey, large stones.	Severe: large stones.	Moderate: too clayey, large stones.
Bastrop:				
2	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy, slope.	Moderate: too sandy.
3	Slight	Slight	Slight	Slight.
4, 5, 6, 7, [1]8	Slight	Slight	Moderate: slope.	Slight.
Blanket:				
9	Moderate: percs slowly.	Moderate: too clayey.	Moderate: slope, percs slowly.	Moderate: too clayey.
Bolar:				
10, 11	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.
Bosque:				
12	Severe: floods.	Moderate: floods.	Severe: floods.	Slight.
Brackett:				
[1]13	Severe: slope.	Severe: slope.	Severe: depth to rock.	Moderate: slope.
Bunyan:				
14	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Chaney:				
15, 16	Moderate: percs slowly.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
Decordova:				
17	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
Demona:				
18	Moderate: too sandy.	Moderate: too sandy.	Severe: too sandy, soil blowing.	Moderate: too sandy.
Denton:				
19, 20	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Duffau:				
21	Moderate: too sandy.	Moderate: too sandy.	Severe: soil blowing.	Moderate: too sandy.
22	Slight	Slight	Moderate: slope.	Slight.

See footnote at end of table.

TABLE 14.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Duffau:				
23, 24	Slight	Slight	Moderate: slope.	Slight.
25	Slight	Slight	Severe: slope.	Slight.
Frio:				
26	Severe: floods.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Hassee:				
27, 28	Severe: wetness, percs slowly.	Moderate: wetness.	Severe: wetness, percs slowly.	Moderate: wetness.
Hensley:				
29	Moderate: large stones.	Moderate: too clayey.	Severe: depth to rock.	Moderate: large stones.
Krum:				
30, 31	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.	Severe: too clayey.
Maloterre:				
32	Moderate: too clayey, percs slowly.	Moderate: too clayey.	Severe: depth to rock.	Moderate: too clayey.
Nimrod:				
33	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy, soil blowing.	Severe: too sandy.
Paluxy:				
34	Slight	Slight	Slight	Slight.
35	Slight	Slight	Moderate: slope.	Slight.
36	Slight	Slight	Severe: slope.	Slight.
Patilo:				
37	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
Pedernales:				
38, 39, 40	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
41	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Purves:				
42, 43	Severe: too clayey.	Severe: too clayey.	Severe: depth to rock, too clayey.	Severe: too clayey.
Seawillow:				
44	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Moderate: too clayey, dusty, slope.	Moderate: too clayey, dusty.
45	Moderate: too clayey, dusty.	Moderate: too clayey, dusty.	Severe: slope.	Moderate: too clayey, dusty.

See footnote at end of table.

TABLE 14.—RECREATIONAL DEVELOPMENT—Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
Sunev:				
46	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey, slope.	Moderate: too clayey.
47	Moderate: too clayey.	Moderate: too clayey.	Severe: slope.	Moderate: too clayey.
Tarrant:				
[1]48:				
Tarrant part	Severe: large stones, slope.	Severe: large stones, too clayey.	Severe: depth to rock, slope.	Severe: large stones, too clayey.
Bolar part	Moderate: too clayey, large stones.	Moderate: too clayey, large stones.	Severe: slope, large stones.	Moderate: too clayey, large stones.
[1]49:				
Tarrant part	Severe: large stones, too clayey.	Severe: large stones, too clayey.	Severe: depth to rock, large stones.	Severe: large stones, too clayey.
Purves part	Severe: too clayey.	Severe: too clayey.	Severe: large stones.	Severe: too clayey.
Thurber:				
50	Severe: percs slowly.	Moderate: too clayey.	Severe: percs slowly.	Moderate: too clayey.
Truce:				
51	Moderate: percs slowly.	Slight	Moderate: percs slowly, slope.	Slight.
[1]52	Moderate: large stones, percs slowly.	Slight	Severe: large stones.	Moderate: large stones.
Venus:				
53	Slight	Slight	Moderate: slope.	Slight.
Windthorst:				
54	Moderate: percs slowly.	Moderate: too sandy.	Moderate: percs slowly.	Moderate: too sandy.
55	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
56, 57	Moderate: percs slowly.	Slight	Moderate: percs slowly.	Slight.
58, [1]59	Moderate: percs slowly.	Slight	Severe: slope.	Slight.
Yahola:				
[1]60:				
Yahola part	Severe: floods.	Moderate: floods.	Moderate: floods.	Slight.
Gaddy part	Severe: floods.	Moderate: floods.	Moderate: floods.	Moderate: too sandy.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 15.--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: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Potential as habitat for--: Openland wildlife	Rangeland wildlife
Aledo:						
[1]1:						
Aledo part	Poor	Poor	Poor	Fair	Poor	Poor.
Bolar part	Poor	Poor	Fair	Fair	Poor	Fair.
Bastrop:						
2	Fair	Fair	Good	Good	Fair	Good.
3, 4	Good	Fair	Good	Good	Good	Good.
5, 6, 7, [1]8	Fair	Fair	Good	Good	Fair	Good.
Blanket:						
9	Good	Good	Fair	Good	Good	Fair.
Bolar:						
10	Good	Good	Fair	Fair	Good	Fair.
11	Fair	Good	Fair	Fair	Fair	Fair.
Bosque:						
12	Good	Good	Good	Good	Good	Good.
Brackett:						
[1]13	Very poor.	Very poor.	Fair	Fair	Very poor.	Fair
Bunyan:						
14	Good	Good	Good	Good	Good	Good.
Chaney:						
15, 16	Fair	Good	Good	Good	Good	Good.
Decordova:						
17	Fair	Fair	Good	Good	Fair	Good.
Demona:						
18	Fair	Good	Good	Good	Good	Good.
Denton:						
19	Good	Good	Fair	Fair	Good	Fair
20	Fair	Good	Fair	Fair	Fair	Fair
Duffau:						
21	Fair	Good	Good	Good	Good	Good.
22	Good	Good	Good	Good	Good	Good.
23, 24, 25	Fair	Good	Good	Good	Good	Good.
Frio:						
26	Good	Good	Fair	Good	Good	Fair.
Hassee:						
27, 28	Fair	Fair	Fair	Fair	Fair	Fair.
Hensley:						
29	Poor	Poor	Fair	Fair	Poor	Fair.

See footnote at end of table.

TABLE 15.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for--	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Krum:						
30, 31	Good	Good	Fair	Fair	Good	Fair.
Maloterre:						
32	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.
Nimrod:						
33	Fair	Good	Good	Good	Good	Good.
Paluxy:						
34, 35	Good	Good	Good	Good	Good	Good.
36	Fair	Fair	Good	Good	Fair	Good.
Patilo:						
37	Fair	Good	Fair	Fair	Fair	Fair.
Pedernales:						
38	Good	Good	Good	Good	Good	Good.
39	Fair	Good	Good	Good	Good	Good.
40	Fair	Good	Good	Good	Good	Good.
41	Poor	Fair	Good	Good	Fair	Good.
Purves:						
42, 43	Fair	Good	Poor	Fair	Fair	Poor.
Seawillow:						
44, 45	Fair	Good	Fair	Good	Fair	Fair.
Sunev:						
46, 47	Fair	Good	Good	Good	Good	Good.
Tarrant:						
[1]48:						
Tarrant part	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Bolar part	Poor	Poor	Fair	Fair	Poor	Fair.
[1]49:						
Tarrant part	Very poor.	Very poor.	Fair	Fair	Poor	Fair.
Purves part	Poor	Poor	Poor	Good	Poor	Fair.
Thurber:						
50	Fair	Fair	Fair	Fair	Fair	Fair.
Truce:						
51	Fair	Good	Good	Good	Good	Good.
[1]52	Poor	Poor	Good	Good	Fair	Good.
Venus:						
53	Good	Good	Good	Fair	Good	Fair.
Windthorst:						
54, 56	Fair	Good	Good	Good	Good	Good.

See footnote at end of table.

TABLE 15.—WILDLIFE HABITAT POTENTIALS—Continued

Soil name and map symbol	Potential for habitat elements				Potential as habitat for—	
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Openland wildlife	Rangeland wildlife
Windthorst:						
55	Good	Good	Good	Good	Good	Good.
57	Fair	Good	Good	Good	Good	Good.
58	Poor	Fair	Good	Good	Fair	Good.
[1]59	Poor	Fair	Good	Good	Fair	Good.
Yahola:						
[1]60:						
Yahola part	Good	Good	Good	Good	Good	Good.
Gaddy part	Fair	Fair	Fair	Fair	Fair	Fair.

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 16.—ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means greater than. Absence of an entry means data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number— 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Aledo:											
[1]1:											
Aledo part	0-4	Gravelly clay loam.	CL, GC, GM, SC	A-4, A-6	0-20	65-95	60-90	55-90	40-70	30-40	10-20
	4-14	Very gravelly clay loam, very gravelly loam.	GC, GM, SC	A-2-4, A-2-6	5-30	35-55	30-50	25-50	15-35	30-40	10-20
	14-18	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Bolar part	0-6	Stony clay loam	CL, SC	A-6, A-7, A-4	8-20	75-90	75-90	70-85	36-65	25-42	9-25
	6-28	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	28-32	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Bastrop:											
2	0-10	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	95-100	80-100	75-95	20-50	<20	NP-4
	10-80	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
3, 4, 5, 6, 7, [1]8	0-13	Fine sandy loam	ML, SM, CL-ML, SM-SC	A-4	0	95-100	80-100	80-100	36-70	18-25	2-7
	13-80	Sandy clay loam, clay loam, loam.	CL, SC	A-6	0	95-100	80-100	80-100	40-70	26-40	11-22
Blanket:											
9	0-12	Clay loam	CL	A-6	0	95-100	95-100	90-100	60-80	28-40	12-24
	12-42	Clay loam, clay, silty clay.	CL, CH	A-7	0	95-100	95-100	85-100	70-90	41-55	20-35
	42-62	Clay loam, clay, silty clay loam.	CL	A-6, A-7	0	85-100	80-100	70-90	51-85	30-45	15-30
Bolar:											
10, 11	0-13	Clay loam	CL, SC	A-6, A-7, A-4	0-5	75-100	75-100	70-98	40-80	25-42	9-25
	13-28	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	28-32	Weathered bedrock.	—	—	—	—	—	—	—	—	—
Bosque:											
12	0-20	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	80-100	55-95	24-40	7-22
	20-46	Loam, clay loam	CL	A-4, A-6, A-7-6	0	100	95-100	95-100	55-80	26-45	10-25
	46-62	Loam, clay loam, clay.	CL, CL-ML	A-4, A-6, A-7-6	0	98-100	95-100	80-100	55-95	24-45	7-25
Brackett:											
[1]13	0-16	Loam	CL, SC	A-6, A-4	0-20	70-100	60-100	55-95	40-85	28-40	10-20
	16-40	Weathered bedrock.	—	—	—	—	—	—	—	—	—

See footnote at end of table.

TABLE 16.—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	
Bunyan:											
14	0-8	Fine sandy loam	SM-SC, SC, CL, CL-ML	A-4, A-6	0	100	95-100	70-95	40-75	20-35	3-16
	8-58	Stratified clay loam to fine sandy loam.	SC, CL, ML	A-4, A-6	0	100	95-100	80-100	40-95	20-40	8-25
	58-62	Stratified clay loam to fine sandy loam.	SC, CL, ML	A-6, A-7	0	100	95-100	80-95	45-95	30-45	11-25
Chaney:											
15, 16	0-12	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4, A-4, A-3	0	80-100	80-100	65-98	7-45	<25	NP-4
	12-44	Clay, sandy clay	CL, CH, SC	A-7-6	0	90-100	90-100	90-100	45-85	42-60	24-42
	44-56	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-6, A-7-6, A-2-6	0	90-100	90-100	80-100	30-70	25-55	11-40
	56-72	Clay, sandy clay loam, shaly clay.	CL, CH, SC, SM-SC	A-6, A-7-6, A-2	0	90-100	90-100	80-100	25-85	25-60	6-40
Decordova:											
17	0-14	Loamy fine sand	SM, SP-SM	A-2-4	0	85-100	85-100	80-95	10-25	<20	NP-3
	14-80	Fine sandy loam, loam.	SM, SM-SC	A-2-4, A-4	0	90-100	90-100	80-95	15-40	<25	NP-7
Demona:											
18	0-34	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4, A-4, A-3	0	80-100	75-100	60-98	7-45	<25	NP-5
	34-48	Sandy clay, clay	CH, CL	A-7-6	0	80-100	80-100	80-100	50-85	42-60	24-40
	48-80	Sandy clay, clay, sandy clay loam.	CL, CH, SC	A-2-6, A-7-6, A-6	0	80-100	80-100	80-100	25-85	25-60	11-40
Denton:											
19, 20	0-32	Clay	CH, MH	A-7	0-10	80-100	80-100	80-100	75-95	51-70	26-45
	32-40	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Duffau:											
21	0-12	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	95-100	95-100	75-98	15-40	<22	NP-4
	12-80	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-65	30-40	15-24
22, 23, 24, 25	0-12	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4, A-2-4	0	95-100	95-100	75-90	30-60	<25	NP-7
	12-64	Sandy clay loam, clay loam, loam.	SC, CL	A-6	0	95-100	95-100	80-100	36-65	30-40	15-24
	64-80	Sandy clay loam, loam, fine sandy loam.	SC, CL, CL-ML, SM	A-4, A-6	0	95-100	95-100	80-100	40-65	20-36	2-18
Frio:											
26	0-38	Silty clay	CL, CH	A-6, A-7	0-2	80-100	80-100	70-100	60-95	35-52	20-34
	38-62	Silty clay, clay loam, gravelly clay loam.	CL, CH	A-6, A-7	0-2	65-100	65-100	60-100	55-95	35-52	20-34

See footnote at end of table.

TABLE 16.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
Hassee: 27, 28	0-14	Fine sandy loam	CL	A-4, A-6	0	95-100	95-100	80-100	50-80	20-35	8-16
	14-30	Clay	CH, CL	A-7-6	0	95-100	95-100	95-100	75-95	41-60	24-40
	30-62	Clay, clay loam	CH, CL	A-7-6, A-6	0	95-100	95-100	90-100	70-95	35-52	20-35
Hensley: 29	0-4	Stony clay loam	CL, SC, GC, GM-GC	A-6, A-4	8-25	65-95	60-95	55-95	36-80	20-40	5-20
	4-18	Clay, clay loam	CL, CH	A-6, A-7	0-10	80-100	75-100	70-100	60-95	35-55	18-35
	18-20	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Krum: 30, 31	0-7	Clay	CH	A-7-6	0	95-100	85-100	85-100	85-95	51-65	25-45
	7-48	Silty clay, clay	CH	A-7-6	0	95-100	85-100	80-100	65-95	51-74	28-50
	48-62	Silty clay loam, silty clay, clay.	CH, CL	A-7-6	0	85-100	75-100	70-95	65-95	48-60	28-38
Maloterre: 32	0-5	Gravelly clay loam.	SC, CL, GC	A-6	0-10	60-95	50-95	45-90	36-80	30-40	11-20
	5-8	Weathered bedrock.	---	---	---	---	---	---	---	---	---
Nimrod: 33	0-26	Fine sand	SP-SM, SM, SM-SC	A-2-4, A-3	0	95-100	95-100	90-100	8-28	<25	NP-4
	26-72	Sandy clay loam	SC, CL	A-6, A-2-6	0	95-100	95-100	90-100	25-55	20-35	11-20
	72-80	Sandy loam, sandy clay loam, loamy fine sand.	SC, CL, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	95-100	90-100	15-55	20-30	4-16
Paluxy: 34, 35, 36	0-46	Very fine sandy loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	0	100	98-100	70-100	30-60	<25	NP-7
	46-62	Very fine sandy loam, loam.	SM, SM-SC, CL-ML, ML	A-4, A-2-4	0	100	98-100	70-100	30-60	<25	NP-7
Patilo: 37	0-48	Fine sand	SM, SP-SM, SM-SC	A-2-4, A-3	0	100	95-100	85-100	8-28	<25	NP-5
	48-80	Sandy clay loam, fine sandy loam.	SC	A-2, A-4, A-6	0	90-100	90-100	90-100	25-50	22-36	8-20
Pedernales: 38, 39, 40, 41	0-12	Fine sandy loam	SM, ML, CL-ML, SM-SC	A-4, A-2-4	0	95-100	90-100	75-100	33-55	<25	NP-7
	12-42	Sandy clay, clay	CH, CL, SC	A-7, A-6	0	90-100	90-100	85-100	45-75	38-60	20-36
	42-62	Sandy clay loam, clay loam, sandy clay.	SC, CL, CH	A-6, A-7	0-5	90-100	90-100	80-100	36-75	32-55	13-30

See footnote at end of table.

TABLE 16.—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	
Purves:											
42, 43	0-12	Clay	CH	A-7-6	0-5	90-100	80-100	80-95	70-95	51-65	30-40
	12-17	Gravelly clay, very gravelly clay, gravelly clay loam.	CH, SC	A-7-6	0-35	60-100	60-100	55-95	45-90	51-65	30-40
	17-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Seawillow:											
44, 45	0-38	Loam, clay loam	CL	A-7-6, A-6	0-5	80-100	75-100	75-100	51-90	29-46	14-30
	38-62	Clay loam, loam, silty clay loam.	CL, ML	A-4, A-6	0-5	75-100	65-100	60-100	51-75	27-41	10-25
Sunev:											
46, 47	0-12	Clay loam	CL, SC	A-4, A-6	0	90-100	80-100	80-100	45-60	25-40	8-18
	12-26	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	90-100	80-100	80-100	51-65	28-40	8-18
	26-62	Loam, clay loam, silty clay loam.	CL	A-4, A-6	0	90-100	75-100	75-100	51-61	25-40	8-18
Tarrant:											
148:											
Tarrant part	0-14	Cobbly clay	CH, GC	A-7-6	33-77	55-100	51-100	51-95	45-95	55-76	31-49
	14-18	Indurated, unweathered bedrock.	---	---	---	---	---	---	---	---	---
Bolar part	0-13	Stony clay loam	CL, SC	A-6, A-7, A-4	8-20	75-90	75-90	70-85	36-65	25-42	9-25
	13-28	Clay loam, loam, silty clay loam.	CL, SC	A-6, A-7	0-10	75-95	75-95	70-90	40-75	25-42	11-25
	28-32	Weathered bedrock.	---	---	---	---	---	---	---	---	---
149:											
Tarrant part	0-14	Cobbly clay	CH, GC	A-7-6	33-77	55-100	51-100	51-95	45-95	55-76	31-49
	14-18	Indurated, unweathered bedrock.	---	---	---	---	---	---	---	---	---
Purves part	0-12	Stony clay	CH, GC, SC	A-7-6	5-25	55-95	55-95	45-95	36-90	51-65	30-40
	12-17	Gravelly clay, very gravelly clay, stony clay.	GC, CH, SC	A-7-6	5-35	55-95	55-95	45-90	36-65	51-65	30-40
	17-19	Unweathered bedrock.	---	---	---	---	---	---	---	---	---
Thurber:											
50	0-10	Clay loam	CL	A-4, A-6	0	95-100	95-100	90-100	60-90	25-35	8-20
	10-35	Clay, clay loam	CL, CH	A-7-6	0	95-100	95-100	90-100	70-95	41-65	25-45
	35-62	Clay, clay loam	CL	A-6, A-7-6	0	95-100	85-100	75-100	50-85	35-50	20-35
Truce:											
51	0-6	Fine sandy loam	CL-ML, CL, SM-SC, SC	A-4	0	75-100	75-100	70-100	40-75	18-30	5-10
	6-42	Clay, sandy clay, clay loam.	CL	A-6, A-7	0	80-100	80-100	80-100	50-80	30-45	20-30
	42-62	Shaly weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 16.—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	
Truce:											
[1]52	0-6	Stony fine sandy loam.	SC, CL-ML, SC	A-4	5-20	70-90	70-85	65-85	36-60	18-30	5-10
	6-42	Clay, sandy clay, clay loam.	CL	A-6, A-7	0-10	80-100	80-100	80-100	50-80	30-45	20-30
	42-62	Shaly weathered bedrock.	—	—	—	—	—	—	—	—	—
Venus:											
53	0-13	Loam	CL, CL-ML	A-4, A-6	0	100	95-100	85-100	50-80	20-40	5-20
	13-42	Loam, clay loam, sandy clay loam.	CL, CL-ML	A-4, A-6	0	95-100	95-100	85-100	50-80	20-40	5-20
	42-60	Fine sandy loam, loam, sandy clay loam.	SC, SM-SC, CL, CL-ML	A-4, A-6	0	80-100	70-100	65-100	40-80	20-40	5-20
Windthorst:											
54	0-10	Loamy fine sand	SM, SM-SC	A-4, A-2-4	0	95-100	90-100	80-100	15-40	<24	NP-4
	10-34	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	34-46	Sandy clay loam, clay, fine sandy loam.	SC, CL	A-4, A-6, A-7-6	0	85-100	80-100	75-100	36-90	25-45	8-28
	46-62	Stratified variable.	—	—	—	—	—	—	—	—	—
55, 56, 57, 58, [1]59	0-5	Fine sandy loam	SM, SM-SC, CL-ML	A-4	0	95-100	90-100	75-100	36-75	<28	NP-7
	5-38	Clay, sandy clay, clay loam.	CL, CH	A-6, A-7-6	0	95-100	95-100	85-100	51-90	35-53	20-35
	38-56	Sandy clay loam, clay, fine sandy loam.	SC, CL	A-4, A-6, A-7-6	0	85-100	80-100	75-100	36-90	25-45	8-28
	56-62	Stratified variable.	—	—	—	—	—	—	—	—	—
Yahola:											
[1]60:											
Yahola part	0-18	Fine sandy loam	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	18-48	Fine sandy loam, loam.	SM, SC, ML, CL	A-4	0	100	95-100	90-100	36-85	<30	NP-10
	48-62	Fine sandy loam, loam, loamy fine sand.	SM, SC, ML, CL	A-4, A-2	0	100	95-100	90-100	15-85	<30	NP-10
Gaddy part	0-14	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	—	NP
	14-62	Loamy fine sand, fine sand.	SM	A-2	0	100	98-100	90-100	15-35	—	NP

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 17.—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	Permea- bility	Available water capacity	Soil reaction	Shrink- swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodi- bility group
	In	In/hr	In/in	pH						
Aledo:										
[1]1:										
Aledo part	0-4	0.6-2.0	0.07-0.18	7.9-8.4	Moderate	Moderate	Low	0.32	1	8
	4-14	0.6-2.0	0.05-0.12	7.9-8.4	Low	Moderate	Low	---		
	14-18	---	---	---	---	---	---	---		
Bolar part	0-13	0.6-2.0	0.10-0.18	7.9-8.4	Moderate	High	Low	0.32	2	8
	13-28	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	---		
	28-32	---	---	---	---	---	---	---		
Bastrop:										
2	0-10	2.0-6.0	0.07-0.11	5.6-7.3	Very low	Low	Low	0.20	5	2
	10-80	0.6-2.0	0.15-0.19	6.1-8.4	Low	Moderate	Low	0.32		
3, 4, 5, 6, 7, [1]8	0-13	2.0-6.0	0.11-0.17	5.6-7.3	Low	Low	Low	0.24	5	3
	13-80	0.6-2.0	0.15-0.19	6.1-8.4	Low	Moderate	Low	0.32		
Blanket:										
9	0-12	0.6-2.0	0.15-0.20	6.1-7.8	Moderate	High	Low	0.37	5	6
	12-42	0.2-0.6	0.12-0.18	6.1-8.4	Moderate	High	Low	0.28		
	42-62	0.6-2.0	0.12-0.18	7.9-8.4	Moderate	High	Low	0.28		
Bolar:										
10, 11	0-13	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	0.32	2	6
	13-28	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	---		
	28-32	---	---	---	---	---	---	---		
Bosque:										
12	0-20	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	Low	0.28	5	4L
	20-46	0.6-2.0	0.15-0.20	7.4-8.4	Low	High	Low	0.28		
	46-62	0.6-2.0	0.11-0.18	7.9-8.4	Low	High	Moderate	0.28		
Brackett:										
[1]13	0-16	0.2-0.6	0.10-0.20	7.9-8.4	Low	High	Low	0.32	2	8
	16-40	---	---	---	---	---	---	---		
Bunyan:										
14	0-8	2.0-6.0	0.11-0.15	6.1-7.3	Low	Low	Low	0.28	5	3
	8-58	0.6-2.0	0.15-0.19	5.6-8.4	Low	Moderate	Low	0.28		
	58-62	0.6-2.0	0.18-0.22	6.6-8.4	Low	Moderate	Low	0.28		
Chaney:										
15, 16	0-12	2.0-6.0	0.05-0.10	5.6-7.3	Very low	Low	Low	0.20	5	2
	12-44	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	High	Moderate	0.28		
	44-56	0.06-0.2	0.15-0.18	5.6-6.5	Moderate	High	Moderate	0.28		
	56-72	0.06-0.2	0.15-0.18	5.6-7.8	Moderate	High	Moderate	0.28		
Decordova:										
17	0-14	2.0-6.0	0.07-0.11	5.6-7.3	Very low	Low	Low	0.20	5	2
	14-80	2.0-6.0	0.10-0.16	5.6-8.4	Low	Low	Low	0.24		
Demona:										
18	0-34	2.0-6.0	0.05-0.10	5.6-7.8	Very low	Low	Moderate	0.17	5	2
	34-48	0.2-0.6	0.15-0.18	5.1-6.5	Moderate	High	Moderate	0.24		
	48-80	0.2-0.6	0.14-0.18	5.1-6.5	Moderate	High	Moderate	0.24		
Denton:										
19, 20	0-32	0.06-0.2	0.15-0.20	7.9-8.4	High	High	Low	0.32	2	4
	32-40	---	---	---	---	---	---	---		
Duffau:										
21	0-12	2.0-6.0	0.07-0.11	6.1-7.8	Very low	Low	Low	0.32	5	2
	12-80	0.6-2.0	0.12-0.19	6.1-7.8	Low	Moderate	Low	0.32		

See footnote at end of table.

TABLE 17.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion: Uncoated steel	Risk of corrosion: Concrete	Erosion factors: K	Erosion factors: T	Wind erodibility group
	In	In/hr	In/in	pH						
Duffau:										
22, 23, 24, 25	0-12	2.0-6.0	0.11-0.15	6.1-7.8	Low	Low	Low	0.43	5	3
	12-64	0.6-2.0	0.12-0.19	6.1-7.8	Low	Moderate	Low	0.32		
	64-80	0.6-2.0	0.10-0.15	6.1-7.8	Low	Moderate	Low	0.32		
Frio:										
26	0-38	0.2-0.6	0.15-0.22	7.9-8.4	Moderate	High	Low	0.32	5	4
	38-62	0.2-0.6	0.11-0.22	7.9-8.4	Moderate	High	Low	0.32		
Hassee:										
27, 28	0-14	0.6-2.0	0.11-0.20	6.1-7.3	Low	High	Low	0.43	5	3
	14-30	<0.06	0.12-0.18	6.1-8.4	High	High	Low	0.32		
	30-62	<0.06	0.12-0.20	6.6-8.4	High	High	Low	0.32		
Hensley:										
29	0-4	0.2-0.6	0.10-0.18	6.1-7.8	Low	High	Low	0.37	1	8
	4-18	0.06-0.2	0.10-0.20	6.6-8.4	Moderate	High	Low	0.32		
	18-20	—	—	—	—	—	—	—		
Krum:										
30, 31	0-7	0.2-0.6	0.15-0.20	7.4-8.4	High	High	Low	0.32	5	4
	7-48	0.2-0.6	0.14-0.20	7.9-8.4	High	High	Low	0.32		
	48-62	0.2-0.6	0.14-0.20	7.9-8.4	High	High	Low	0.32		
Maloterre:										
32	0-5	0.2-0.6	0.13-0.16	7.9-8.4	Low	High	Low	0.15	1	8
	5-8	—	—	—	—	—	—	—		
Nimrod:										
33	0-26	6.0-20	0.05-0.10	5.6-7.3	Very low	Low	Low	0.20	5	1
	26-72	0.2-0.6	0.12-0.17	5.1-6.0	Low	High	Moderate	0.32		
	72-80	0.2-0.6	0.06-0.17	5.1-6.5	Low	High	Moderate	0.32		
Paluxy:										
34, 35, 36	0-46	2.0-6.0	0.14-0.20	6.1-7.8	Very low	Low	Low	0.28	5	3
	46-62	2.0-6.0	0.14-0.20	7.9-8.4	Very low	Low	Low	0.28		
Patilo:										
37	0-48	6.0-20	0.05-0.08	5.6-7.3	Very low	Low	Low	0.17	5	1
	48-80	0.2-0.6	0.14-0.18	5.1-6.5	Low	High	Moderate	—		
Pedernales:										
38, 39, 40, 41	0-12	0.6-2.0	0.12-0.17	6.1-7.8	Low	Low	Low	0.37	5	3
	12-42	0.2-0.6	0.15-0.20	6.1-7.8	Moderate	High	Low	0.24		
	42-62	0.2-0.6	0.15-0.20	7.9-8.4	Moderate	Moderate	Low	0.15		
Purves:										
42, 43	0-12	0.2-0.6	0.12-0.18	7.9-8.4	High	High	Low	0.32	1	4
	12-17	0.2-0.6	0.08-0.18	7.9-8.4	High	High	Low	0.32		
	17-19	—	—	—	—	—	—	—		
Seawillow:										
44, 45	0-38	0.6-2.0	0.12-0.20	7.9-8.4	Moderate	Moderate	Low	0.32	5	4L
	38-62	0.6-2.0	0.12-0.18	7.9-8.4	Low	Moderate	Low	0.32		
Sunev:										
46, 47	0-12	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28	5	4L
	12-26	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28		
	26-62	0.6-2.0	0.11-0.16	7.9-8.4	Low	Moderate	Low	0.28		
Tarrant:										
[1]48:										
Tarrant part	0-14	0.2-0.6	0.10-0.17	7.9-8.4	Low	High	Low	0.32	1	8
	14-18	—	—	—	—	—	—	—		
Bolar part	0-13	0.6-2.0	0.10-0.18	7.9-8.4	Moderate	High	Low	0.32	2	8
	13-28	0.6-2.0	0.11-0.20	7.9-8.4	Moderate	High	Low	—		
	28-32	—	—	—	—	—	—	—		

See footnote at end of table..

TABLE 17.—PHYSICAL AND CHEMICAL PROPERTIES OF SOILS—Continued

Soil name and map symbol	Depth	Permea-bility	Available water capacity	Soil reaction	Shrink-swell potential	Risk of corrosion		Erosion factors		Wind erodi-bility group
						Uncoated steel	Concrete	K	T	
	In	In/hr	In/in	pH						
Tarrant:										
[1]49:										
Tarrant part	0-14	0.2-0.6	0.10-0.17	7.9-8.4	Low	High	Low	0.32	1	8
	14-18	---	---	---	---	---	---	---		
Purves part	0-12	0.2-0.6	0.08-0.15	7.9-8.4	High	High	Low	0.24	1	8
	12-17	0.2-0.6	0.08-0.15	7.9-8.4	High	High	Low	0.24		
	17-19	---	---	---	---	---	---	---		
Thurber:										
50	0-10	0.2-0.6	0.15-0.22	6.1-7.8	Moderate	High	Low	0.43	5	6
	10-35	<0.06	0.12-0.18	6.6-8.4	High	High	Low	0.32		
	35-62	<0.06	0.12-0.18	7.4-8.4	High	High	Low	0.32		
Truce:										
51	0-6	0.6-2.0	0.11-0.15	5.6-7.3	Low	Low	Low	0.32	3	3
	6-42	0.06-0.2	0.12-0.18	6.1-8.4	Moderate	High	Low	0.32		
	42-62	---	---	---	---	---	---	---		
[1]52	0-6	0.6-2.0	0.08-0.12	5.6-7.3	Low	Low	Low	0.24	3	8
	6-42	0.06-0.2	0.12-0.18	6.1-8.4	Moderate	High	Low	0.32		
	42-62	---	---	---	---	---	---	---		
Venus:										
53	0-13	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.28	5	4L
	13-42	0.6-2.0	0.15-0.20	7.9-8.4	Low	High	Low	0.28		
	42-60	0.6-2.0	0.13-0.18	7.9-8.4	Low	High	Low	0.28		
Windthorst:										
54	0-10	2.0-6.0	0.07-0.11	5.6-7.3	Very low	Low	Low	0.24	5	2
	10-34	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37		
	34-46	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37		
	46-62	---	---	---	---	---	---	---		
55, 56, 57, 58, [1]59	0-5	0.6-2.0	0.12-0.17	5.6-7.3	Low	Low	Low	0.49	5	3
	5-38	0.2-0.6	0.15-0.20	5.6-7.3	Moderate	High	Low	0.37		
	38-56	0.2-0.6	0.12-0.20	5.6-8.4	Moderate	Moderate	Low	0.37		
	56-62	---	---	---	---	---	---	---		
Yahola:										
[1]60:										
Yahola part	0-18	2.0-6.0	0.12-0.16	7.4-8.4	Low	Low	Low	0.24	5	3
	18-48	2.0-6.0	0.12-0.16	7.9-8.4	Low	Low	Low	0.24		
	48-62	2.0-6.0	0.07-0.16	7.9-8.4	Low	Low	Low	0.24		
Gaddy part	0-14	6.0-20	0.07-0.11	7.4-8.4	Low	Low	Low	0.17	5	2
	14-62	6.0-20	0.06-0.10	7.9-8.4	Low	Low	Low	0.17		

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 18.--SOIL AND WATER FEATURES

[Absence of an entry indicates the feature is not a concern. See text for descriptions of symbols and such terms as "rare," "brief," and "perched." The symbol < means less than; > means greater than]

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Bedrock	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness
					Ft			In	
Aledo:									
[1]1:									
Aledo part	C	None	---	---	>6.0	---	---	8-20	Hard
Bolar part	C	None	---	---	>6.0	---	---	20-40	Rippable
Bastrop:									
2, 3, 4, 5, 6, 7, 18	B	None	---	---	>6.0	---	---	>60	---
Blanket:									
9	C	None	---	---	>6.0	---	---	>60	---
Bolar:									
10, 11	C	None	---	---	>6.0	---	---	20-40	Rippable
Bosque:									
12	B	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Brackett:									
[1]13	C	None	---	---	>6.0	---	---	10-20	Rippable
Bunyan:									
14	B	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Chaney:									
15, 16	C	None	---	---	>6.0	---	---	>60	---
Decordova:									
17	B	None	---	---	>6.0	---	---	>60	---
Demona:									
18	C	None	---	---	1.5-3.5	Perched	May-Oct	>60	---
Denton:									
19, 20	D	None	---	---	>6.0	---	---	22-40	Rippable
Duffau:									
21, 22, 23, 24, 25	B	None	---	---	>6.0	---	---	>60	---
Frio:									
26	B	Rare to common.	Brief	May-Oct	>6.0	---	---	>60	---
Hassee:									
27,28	D	None	---	---	1.0-2.0	Perched	May-Oct	>60	---
Hensley:									
29	D	None	---	---	>6.0	---	---	10-20	Hard
Krum:									
30, 31	D	None	---	---	>6.0	---	---	>60	---
Maloterre:									
32	D	None	---	---	>6.0	---	---	3-10	Hard
Nimrod:									
33	C	None	---	---	1.5-3.5	Perched	May-Oct	>60	---
Paluxy:									
34, 35, 36	B	None	---	---	>6.0	---	---	>60	---

See footnote at end of table.

TABLE 18.—SOIL AND WATER FEATURES—Continued

Soil name and map symbol	Hydro-logic group	Flooding: Frequency	Flooding: Duration	Flooding: Months	High water table: Depth	High water table: Kind	High water table: Months	Bedrock: Depth	Bedrock: Hardness
					Ft			In	
Patilo:									
37	B	None	—	—	3.0-6.0	Perched	May-Oct	>60	—
Pedernales:									
38, 39, 40, 41	C	None	—	—	>6.0	—	—	>60	—
Purves:									
42, 43	D	None	—	—	>6.0	—	—	8-20	Hard
Seawillow:									
44, 45	B	None	—	—	>6.0	—	—	>60	—
Sunev:									
46, 47	B	None	—	—	>6.0	—	—	>60	—
Tarrant:									
[1]48:									
Tarrant part	D	None	—	—	>6.0	—	—	6-20	Hard
Bolar part	C	None	—	—	>6.0	—	—	20-40	Rippable
[1]49:									
Tarrant part	D	None	—	—	>6.0	—	—	6-20	Hard
Purves part	D	None	—	—	>6.0	—	—	8-20	Hard
Thurber:									
50	D	None	—	—	>6.0	—	—	>60	—
Truce:									
51, [1]52	C	None	—	—	>6.0	—	—	40-60	Rippable
Venus:									
53	B	None to common.	Very brief	May-Oct	>6.0	—	—	>60	—
Windthorst:									
54, 55, 56, 57, 58, [1]59	C	None	—	—	>6.0	—	—	>60	—
Yahola:									
[1]60:									
Yahola part	B	Common	Very brief	Mar-Aug	>6.0	—	—	>60	—
Gaddy part	A	Common	Very brief	Mar-Aug	>6.0	—	—	>60	—

[1]This mapping unit is made up of two or more dominant kinds of soil. See mapping unit description for the composition and behavior of the whole mapping unit.

TABLE 19.—ENGINEERING TEST DATA

[Tests were performed by the Texas Highway Department]

Soil name and sample number	Depth	Shrinkage			Classification[1]		Mechanical analysis[4]							Liquid limit	Plasticity index
							Percentage passing sieve				Percentage smaller than				
		Limit	Linear	Ratio	AASHTO[2]	Unified[3]	No. 4	No. 10	No. 40	No. 200	0.05 mm	0.005 mm	0.002 mm		
	In														
Aledo clay loam:															
73-197-R	0-4	18	9.6	1.73	A-6(7)	CL	84	79	66	53	47	20	14	38	17
Bosque loam:															
73-198-R	6-20	18	4.7	1.80	A-4(5)	CL	100	100	99	62	50	22	16	26	9
73-199-R	30-46	16	6.1	1.84	A-6(5)	CL	100	100	99	57	50	25	19	27	12
Chaney loamy fine sand:															
73-200-R	0-12	14	0.5	1.85	A-2-4(0)	SM	99	98	91	12	12	5	4	18	2
73-201-R	17-34	13	15.8	1.94	A-7-6(10)	SC	100	100	97	49	48	43	43	48	31
73-202-R	56-72	9	18.6	2.10	A-7-6(15)	CL	100	99	97	64	59	44	40	50	36
Decordova loamy fine sand:															
73-209-R	0-14	16	0.5	1.77	A-2-4(0)	SP-SM	100	100	90	11	7	3	3	19	3
73-210-R	14-58	16	1.6	1.83	A-2-4(0)	SM	100	100	94	21	16	7	7	18	2
Frio silty clay:															
73-204-R	8-26	13	14.1	1.97	A-7-6(15)	CL	100	100	99	87	82	46	37	42	27
Paluxy very fine sandy loam:															
73-203-R	10-34	19	1.4	1.76	A-4(2)	SM	100	100	100	44	30	10	8	21	2
Windthorst fine sandy loam:															
73-206-R	0-5	20	2.3	1.70	A-4(1)	SM-SC	100	100	100	38	26	12	11	23	4
73-207-R	5-18	14	14.0	1.89	A-7-6(15)	CL	100	100	100	71	62	44	43	44	27
73-208-R	38-56	19	4.4	1.71	A-4(6)	CL	100	100	100	67	45	16	15	27	8

[1]Unified and AASHTO classification made by Soil Conservation Service Personnel.

[2]Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 8)[1]. The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHTO Designation M 145-49.

[3]Based on the Unified Soil Classification System.

[4]Mechanical analyses according to the AASHTO Designation T88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analysed by the hydrometer method and the various grain-sized fractions are calculated on the bases of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analysed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-sized fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soil.

TABLE 20.—CLASSIFICATION OF THE SOILS

[An asterisk in the first column indicates a taxadjunct to the series. See text for a description of those characteristics of this taxadjunct that are outside the range of the series]

Soil name	Family or higher taxonomic class
Aledo	Loamy-skeletal, carbonatic, thermic Lithic Haplustolls
Bastrop	Fine-loamy, mixed, thermic Udic Paleustalfs
Blanket	Fine, mixed, thermic Pachic Argiustolls
Bolar	Fine-loamy, carbonatic, thermic Typic Calciustolls
Bosque	Fine-loamy, mixed, thermic Cumulic Haplustolls
Brackett	Loamy, carbonatic, thermic, shallow Typic Ustochrepts
Bunyan	Fine-loamy, mixed, nonacid, thermic Typic Ustifluvents
Chaney	Fine, mixed, thermic Aquic Paleustalfs
Decordova	Coarse-loamy, siliceous, thermic Udic Paleustalfs
*Demona	Clayey, mixed, thermic Aquic Arenic Paleustalfs
Denton	Fine, montmorillonitic, thermic Vertic Calciustolls
Duffau	Fine-loamy, siliceous, thermic Udic Paleustalfs
Frio	Fine, mixed, thermic Cumulic Haplustolls
Gaddy	Sandy, mixed, thermic Typic Ustifluvents
Hassee	Fine, montmorillonitic, thermic Mollic Albaqualfs
Hensley	Clayey, mixed, thermic Lithic Rhodustalfs
Krum	Fine, montmorillonitic, thermic Vertic Haplustolls
Maloterre	Loamy, carbonatic, thermic Lithic Ustorthents
Nimrod	Loamy, siliceous, thermic Aquic Arenic Paleustalfs
Paluxy	Coarse-loamy, mixed, thermic Udic Ustochrepts
Patilo	Loamy, siliceous, thermic Grossarenic Paleustalfs
Pedernales	Fine, mixed, thermic Udic Paleustalfs
Purves	Clayey, montmorillonitic, thermic Lithic Calciustolls
Seawillow	Fine-loamy, carbonatic, thermic Typic Ustochrepts
Sunev	Fine-loamy, carbonatic, thermic Typic Calciustolls
Tarrant	Clayey-skeletal, montmorillonitic, thermic Lithic Calciustolls
Thurber	Fine, montmorillonitic, thermic Typic Haplustalfs
Truce	Fine, mixed, thermic Udic Paleustalfs
Venus	Fine-loamy, mixed, thermic Typic Calciustolls
Windthorst	Fine, mixed, thermic Udic Paleustalfs
Yahola	Coarse-loamy, mixed (calcareous), thermic Typic Ustifluvents

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