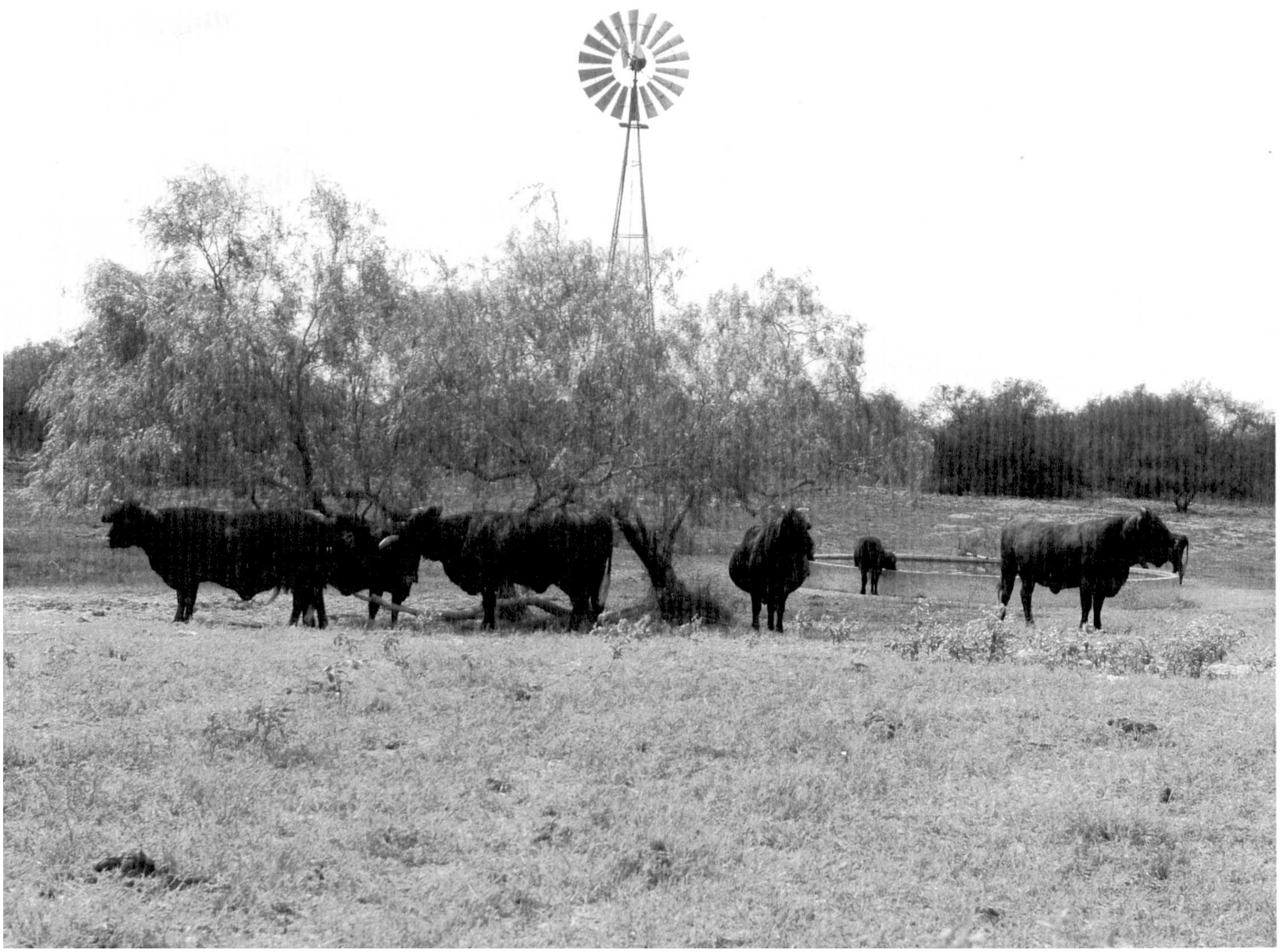
United States
Department of
Agriculture

Soil
Conservation
Service

In cooperation with
Texas Agricultural
Experiment Station

Soil Survey of Brooks County, Texas



How To Use This Soil Survey

General Soil Map

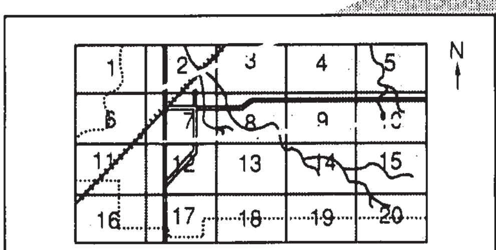
The general soil map, which is the color map preceding the detailed soil maps, shows the survey area divided into groups of associated soils called general soil map units. This map is useful in planning the use and management of large areas.

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

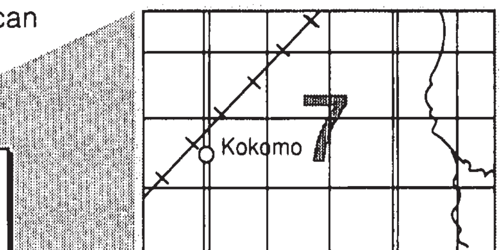
Detailed Soil Maps

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

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

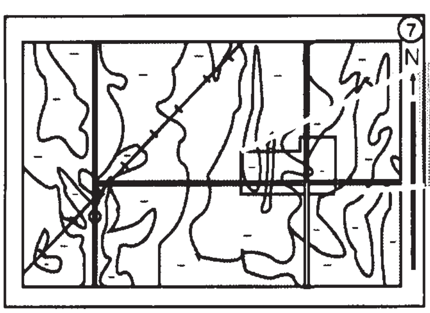


INDEX TO MAP SHEETS



MAP SHEET

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



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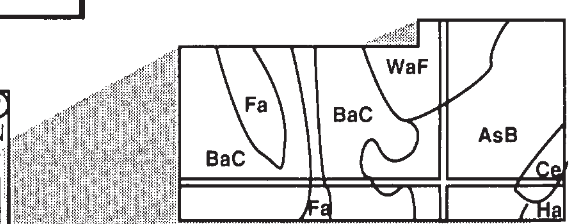

AREA OF INTEREST

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

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

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other federal agencies, state agencies including the Agricultural Experiment Stations, and local agencies. The Soil Conservation Service has leadership for the federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1986. Soil names and descriptions were approved in 1987. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1987. This soil 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 Loma Blanca Soil and Water Conservation District.

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

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

Cover: Santa Gertrudis cattle grazing in an area of Nueces fine sand, gently undulating. Windmills provide the major source of water for livestock.

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Issued October 1993

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Summary of Tables

Foreword

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

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

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

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

Harry W. Oneth
State Conservationist
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Soil Survey of
Brooks County, Texas

By Dennis L. Williamson, Soil Conservation Service

Fieldwork by Paul D. Holland, Fred Minzenmayer, Larry Ratliff, Russel Sanders, Dennis L. Williamson, Guido Franki, Sylvester Gonzales, and Charles Thompson, Soil Conservation Service

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

BROOKS COUNTY is centrally located in the South Texas Triangle, which is formed by the Rio Grande River, the Nueces River, and the Gulf of Mexico (fig. 1). It has a total area of 603,993 acres. Of this total, 1,405 acres is covered by water. Falfurrias, the Spanish name for the desert flower "heart's delight," is the county seat. In 1980, the population of the county was 8,424. Falfurrias had 6,103 inhabitants, or about 73 percent of the county's population.

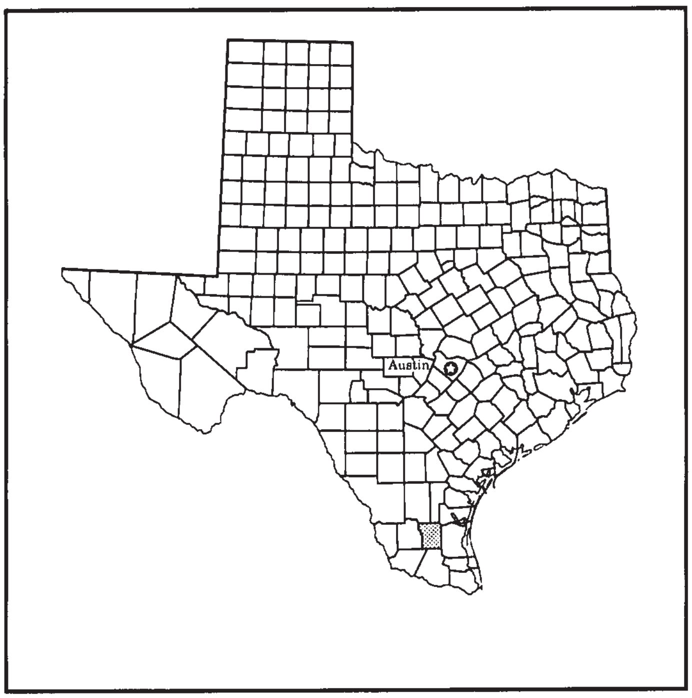

Figure 1.—Location of Brooks County in Texas.

General Nature of the County

Brooks County is in the Central Rio Grande Plain Region of Texas. It is unique because of its low rainfall, high rate of evaporation, and persistent southeasterly winds. The southeasterly winds have affected nearly all of the topographic features within the county. The area is predominantly a nearly level and gently undulating eolian sand plain. The surface consists of hummocky or elongated ridges and swales, which are aligned from southeast to northwest because of the prevailing southeasterly winds. Most of the ridges have been stabilized by native grasses and live oak trees. Those that have not been stabilized are active and are moved slowly by the winds in a northwesterly direction during the dry summer months.

The drainage systems in the county are small, localized, and not integrated. The amount of rainfall that accompanies hurricanes and major storms cannot be discharged by the small drainage systems; therefore, broad areas in the county may be flooded for weeks following a major storm. Los Olmos Creek, in the northeastern part of the county, is the only open drainage system that flows to the Gulf of Mexico.

Elevations range from about 40 feet above sea level in the eastern part of the county to about 400 feet in the western part.

The major use of agricultural land in Brooks County is cattle ranching. In 1986, about 90 percent of the county was rangeland, 3 percent was cropland, 5 percent was pasture or hayland, and 2 percent was urban or built-up areas or water areas.

There are 18 kinds of soil in the county. The soils formed under grass vegetation and are dominantly light colored, sandy, and dry. Erosion, salinity, wetness, and natural fertility are major factors that influence the agricultural uses of the soils.

History

Florence Schuetz, local historian, assisted with the preparation of this section.

Brooks County was established in March 1911 and organized in September of the same year. The county was formed from parts of Starr, Hidalgo, and Zapata Counties and originally was approximately twice its present size. It is now 944 square miles in size. The rest of the original county is now part of Jim Hogg County. Brooks County was named after Captain J.A. Brooks, the famous Texas Ranger who served as a member of the Texas House of Representatives.

For centuries bands of Coahuiltecan Indians roamed this area seeking food. By 1800, most of these Indians had died as a result of wars with other tribes or of disease. The survivors eventually moved across the Rio Grande River into Mexico.

After the decline in the Indian population, Mexican ranchers along the river began seeking grazing land to feed their cattle. From 1830 to 1836, the Mexican government issued a total of 27 land grants in an effort to get settlers to move into the area. At this time, the native rangeland was described as a vast sea of grass interspersed with scattered motts of trees, which sometimes served as landmarks. The rangeland was relatively free of brush, and the prairie offered good grazing land. Underground springs along creeks provided most of the water for livestock.

The next group of settlers arrived in the early 1850's, when families began receiving patents from the State of Texas. During this time, cattle ranching was virtually the only industry. A small percentage of ranchers raised sheep. Only enough farming was carried on to supply the needs of the ranchers. The cattle industry flourished until the Civil War began in 1861. At the beginning of the war, the cattle ranchers left and the cattle were driven into Mexico by bandits. After the war, the cattle ranchers returned. In 1870, the first cattle drive from southern Texas to Kansas was made. Trail driving continued throughout most of the 1880's, until the railroad allowed markets to be located close to ranches.

Great changes began to take place in the mid-1880's. Barbed wire enabled landowners to partition and fence their land. Droughty conditions, coupled with severe freezes, caused severe stress for livestock. By 1893, the drought was so severe that almost all of the livestock died. Many ranchers sold their land or traded it for necessities. Some borrowed money but were unable to repay the loans and lost the land, which had been put up as security. Others lost their land through tax sales.

Following this period, Ed C. Lasater came to the area and began buying land. He acquired approximately 380,000 acres and started a program of selective breeding, which eventually produced the Beefmaster breed of cattle. He also drilled wells to ensure an adequate water supply for his livestock.

Initially the nearest shipping point for livestock was Alice, which was 37 miles north of Falfurrias. Lasater and other ranchers finally persuaded the San Antonio and Aransas Pass Railroad to extend the railroad southward.

Following the coming of the railroad, the economic base turned toward farming and the dairy industry. The farmers experimented with many crops. Watermelons were a success from the start and are still a popular crop. Cotton was planted extensively for several years but is no longer grown. Citrus fruit was profitably grown for years but was virtually wiped out by a freeze in 1951. Dairy farming was extensive for many years. Lasater had 3,000 cows at one time. He built the Falfurrias Creamery in 1909 to provide an outlet for the dairy industry. Today, farmers and ranchers raise beef cattle. Brooks County is internationally recognized as a center for the production of Beefmaster, Santa Gertrudis, and Zebu cattle.

Natural Resources

Soil is the most important natural resource in Brooks County. Oil and natural gas were discovered in the county in 1936, and uranium was discovered more recently. In addition to these important natural resources, sand, clay, and caliche are available for use in the construction of roads and buildings.

Supplies of good-quality ground water in the county are limited *(3)*. The Goliad Formation is the main water-bearing formation in the county. It produces 90 to 95 percent of the water used. The quality of the water is generally suitable for public, livestock, and industrial uses and for supplemental irrigation. Water wells drilled in the Goliad Formation range from a depth of about 50 feet in the outcrop in the western part of the county to more than 800 feet in the eastern part. Water from other formations in the county is not of acceptable quality for public or industrial uses or for irrigation.

Wildlife is abundant in the county. The leasing of hunting rights is an important source of income for many landowners. White-tailed deer, javelina, bobwhite quail, mourning dove, and turkey are common throughout the county.

Climate

Prepared by the National Climatic Data Center, Asheville, North Carolina.

Brooks County has hot summers and fairly warm winters. Cold temperatures and snowfall are rare. Rainfall is usually heaviest in late spring and early fall. Rain in the fall is often associated with a dissipating tropical storm. The total annual precipitation is generally adequate for range vegetation. Because of a high rate of evapotranspiration, however, it commonly is not adequate for cotton, small grain, and sorghum. Irrigation is needed if these crops are grown.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Falfurrias in the period 1951 to 1984. 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 58 degrees F and the average daily minimum temperature is 45 degrees. The lowest temperature on record, which occurred at Falfurrias on January 12, 1962, is 9 degrees. In summer, the average temperature is 85 degrees and the average daily maximum temperature is 97 degrees. The highest recorded temperature, which occurred at Falfurrias on April 10, 1963, is 110 degrees.

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

The total annual precipitation is 25.74 inches. Of this, more than 17 inches, or about 65 percent, usually falls in April through September. The growing season for most crops falls within this period. In 2 years out of 10, the rainfall in April through September is less than 11 inches. The heaviest 1-day rainfall during the period of record was 10 inches at Falfurrias on September 20, 1967. Thunderstorms occur on about 29 days each year.

Snowfall is rare. In 99 percent of the winters, there is no measurable snowfall. In 1 percent, the snowfall, usually of short duration, is less than 1 inch.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 75 percent of the time possible in summer and 50 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 14 miles per hour, in spring.

How This Survey Was Made

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

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

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

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

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

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

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

Map Unit Composition

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

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

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

General Soil Map Units

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

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

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

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

Soil Descriptions

1. Nueces-Sarita

Very deep, gently undulating, well drained and moderately well drained, nonsaline, sandy soils

These soils are on broad plains that have many hummocks and small ridges. The Nueces soils are in the broad, smooth, convex areas, and the Sarita soils are on the hummocks and small ridges (fig. 2). The major soils in this map unit formed in sandy eolian and loamy alluvial sediments.

This map unit makes up about 47 percent of the county. It is about 46 percent Nueces soils, 34 percent Sarita soils, and 20 percent soils of minor extent.

The Nueces soils are moderately well drained and moderately slowly permeable. Typically, the surface layer is fine sand about 23 inches thick. It is pale brown in the upper 10 inches and brown in the lower 13 inches. The subsurface layer, from a depth of 23 to 30 inches, is light brown fine sand. The upper 18 inches of the subsoil, from a depth of 30 to 48 inches, is sandy clay loam that has reddish yellow mottles. It is light brownish gray in the upper 10 inches and light gray in the lower 8 inches. The lower part of the subsoil, from a depth of 48 to 80 inches, is yellow sandy clay loam.

The Sarita soils are well drained. They are rapidly permeable in the upper part and moderately rapidly permeable in the lower part. Typically, the surface layer is brown fine sand about 22 inches thick. The subsurface layer, from a depth of 22 to 48 inches, is very pale brown fine sand. The upper part of the subsoil, from a depth of 48 to 50 inches, is light brownish gray fine sandy loam. The lower part, from a depth of 50 to 80 inches, is light gray fine sandy loam that has common or many yellow mottles.

Of minor extent in this map unit are Comitas, Delfina, Delmita, Falfurrias, Padrones, Palobia, Papagua, Quiteria, Sauz, and Yturria soils and Dune land. Comitas and Padrones soils are in landscape positions similar to those of the Nueces soils. Falfurrias soils and the Dune land are slightly higher on the landscape than the Nueces and Sarita soils, and Delfina, Delmita, Palobia, and Quiteria soils are slightly lower on the landscape. Papagua and Sauz soils are in small, enclosed depressions and in drainageways. Yturria soils are on ridges along the margins of playas.

The major soils are used mainly as rangeland or wildlife habitat. The climax plant community consists of open grassland plants interspersed with a few mesquite trees and an occasional live oak tree. A few areas are used for improved pasture grasses, such as coastal bermudagrass. A few areas of the Nueces soils are used as cropland. The Sarita soils are not suited to cultivated crops because of the hazard of wind erosion and a low available water capacity.

Coastal bermudagrass, Wilman lovegrass, and alamo switchgrass are the main pasture grasses. Establishing these grasses is difficult because the soils dry out rapidly and are subject to wind erosion. Low fertility and a limited available water capacity reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

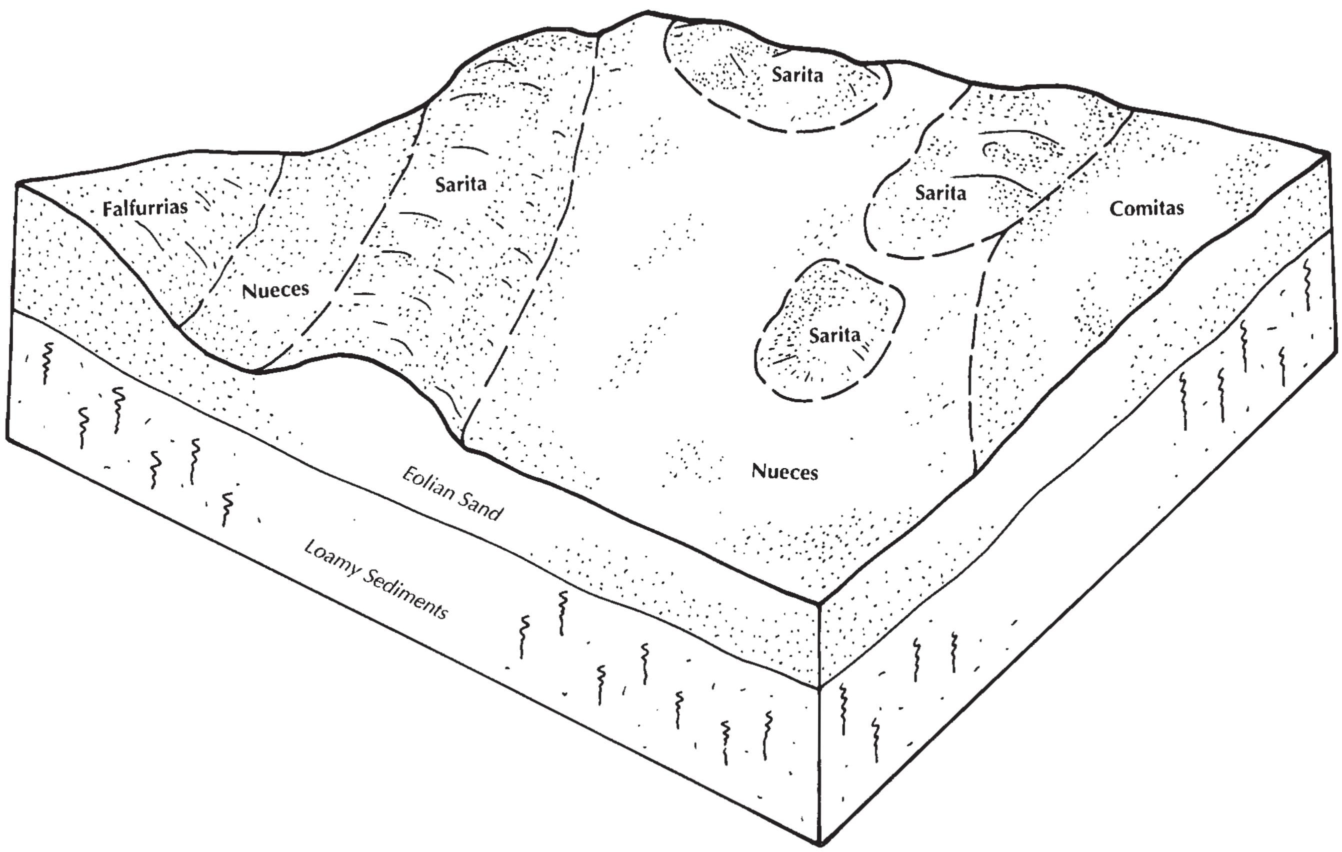

Figure 2.—Typical pattern of soils and parent material in the Nueces-Sarita general soil map unit.

The Nueces soils are marginally suited to cultivated crops. Watermelons, forage sorghum, and grain sorghum are grown in a few areas. Limitations include wind erosion, a moderate available water capacity, and low fertility. Applying fertilizer, leaving crop residue on the surface, or planting a cover crop can help to control wind erosion. Stripcropping or planting permanent wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface.

The major soils are severely limited as sites for some urban uses. The Nueces soils are limited as sites for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. The Sarita soils are severely limited as sites for septic tank absorption fields. They may not adequately filter the effluent, which may contaminate water supplies. The Nueces and Sarita soils are severely limited as sites for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or of the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Corrosion of uncoated steel is a hazard in the Nueces soils. It can be overcome by providing cathodic protection or by using galvanized steel. Caving or sloughing is a hazard in shallow excavations in areas of the Nueces and Sarita soils. It can be overcome by shoring the sidewalls.

In areas where the soils are dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. These soils do not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

The abundant perennial legumes and forbs attract dove, quail, turkey, and nongame birds. Because of the scarcity of woody cover, deer and javelinas use these areas primarily for food. Sufficient woody species are available for cover in areas that are overgrazed for extended periods.

2. Falfurrias

Very deep, undulating, somewhat excessively drained, nonsaline, sandy soils

These soils are on long, narrow, discontinuous ridges (fig. 3). These ridges are oriented in a southeast to northwest direction as a result of the prevailing southeast winds. The soils formed in sandy eolian sediments. They were once in areas of active sand dunes but have now been stabilized by vegetation.

This map unit makes up about 24 percent of the county. It is about 70 percent Falfurrias soils and 30 percent soils of minor extent.

The Falfurrias soils are rapidly permeable. Typically, the surface layer is fine sand about 38 inches thick. It is very pale brown in the upper part, brown in the next part, and light yellowish brown in the lower part. The underlying material, from a depth of 38 to 80 inches, is very pale brown fine sand.

Of minor extent in this map unit are Nueces, Sarita, and Sauz soils and Dune land. Nueces and Sarita soils are in small valleys between the sandy ridges. The Dune land is in landscape positions similar to or higher than those of the Falfurrias soils. Sauz soils are in shallow depressions and in poorly defined drainageways.

The Falfurrias soils are used as rangeland or wildlife habitat. A low available water capacity and the hazard of wind erosion are the main limitations. Proper management of rangeland can produce a variety of grasses, legumes, and forbs. About 50 percent of the map unit is covered by oak trees. Some areas have been invaded by a few mesquite trees.

These soils are not suited to cropland. The low available water capacity and the severe hazard of wind erosion are the main limitations.

Coastal bermudagrass, Wilman lovegrass, and alamo switchgrass are the main pasture grasses. Establishing grasses is difficult because the soils dry out rapidly and are subject to wind erosion. Low fertility and the limited available water capacity reduce yields. Applying fertilizer and controlling weeds and grazing can help to

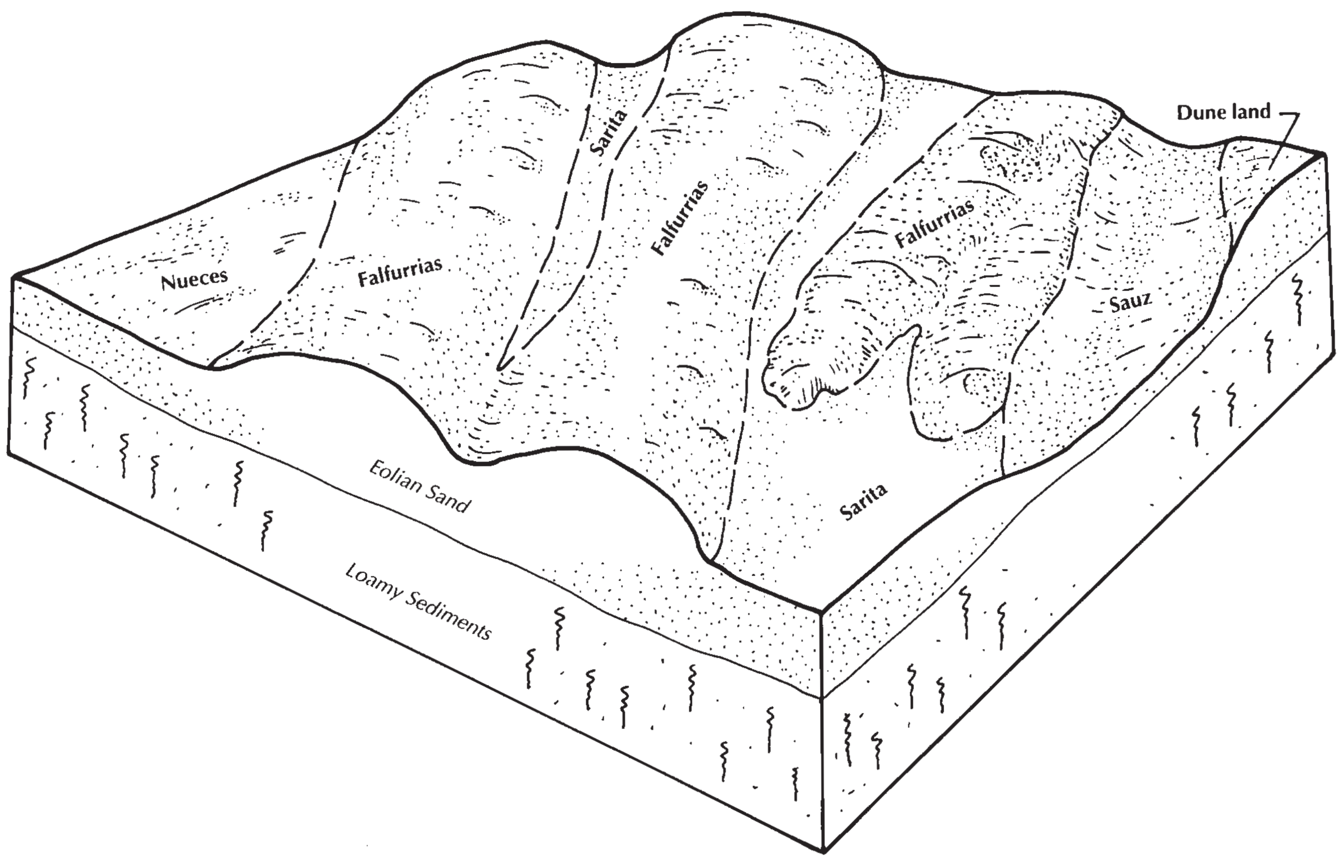

Figure 3.—Typical pattern of soils and parent material in the Falfurrias general soil map unit.

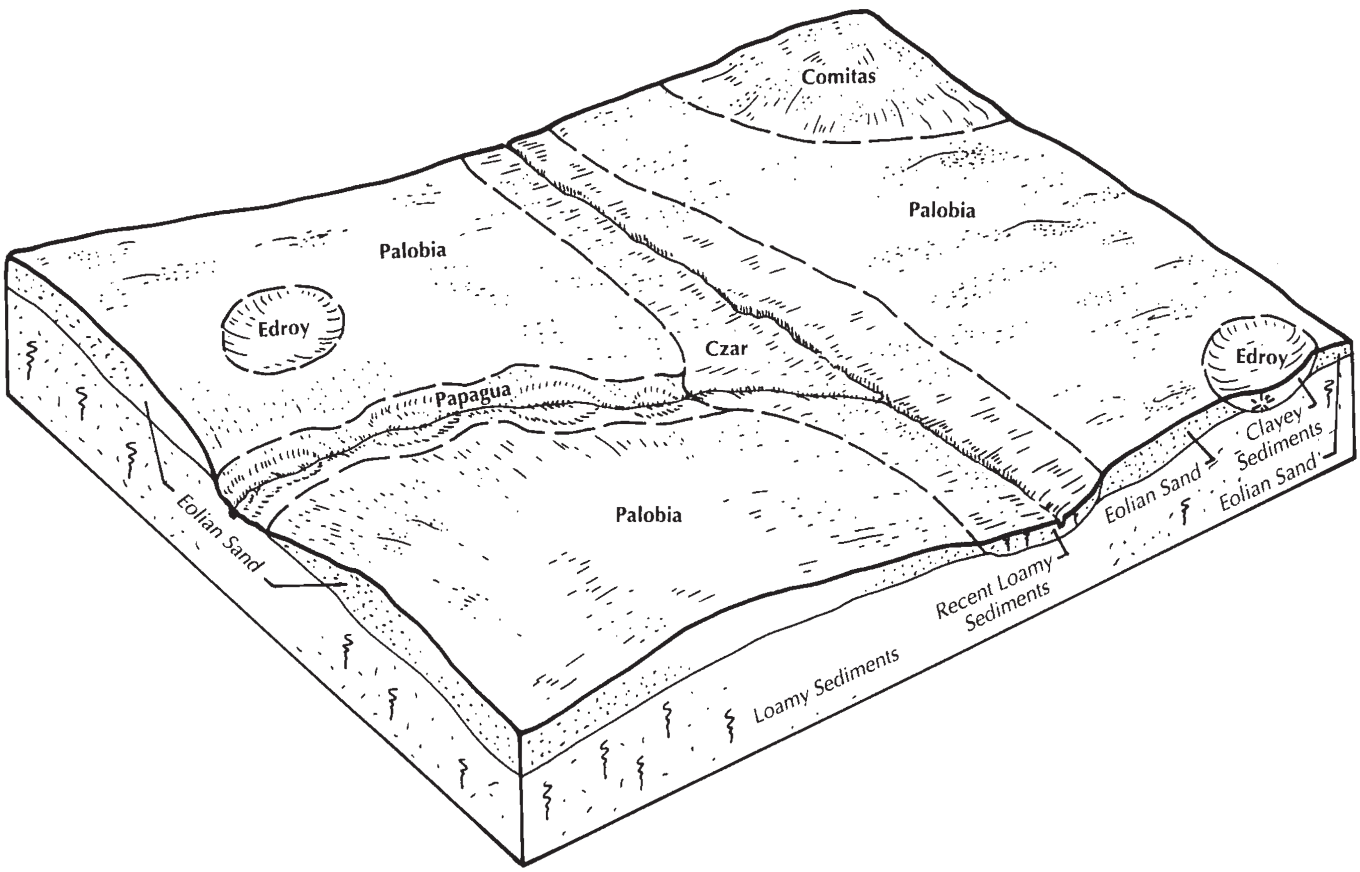

Figure 4.—Typical pattern of soils and parent material in the Palobia-Czar general soil map unit.

improve and maintain productivity.

These soils are severely limited as sites for some urban uses. In areas used as sites for septic tank absorption fields, the soils may not adequately filter the effluent, which may contaminate water supplies. The soils are severely limited as sites for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or of the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Caving or sloughing is a hazard. It can be overcome by shoring the sidewalls. The slope can increase the amount of excavation required to prepare sites for small commercial buildings.

In areas where the soils are dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. These soils do not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

The abundant live oak motts, perennial legumes, and forbs provide excellent cover, browse, mast, and seeds for dove, quail, turkey, deer, and javelinas.

3. Palobia-Czar

Very deep, nearly level, well drained and moderately well drained, saline and nonsaline, sandy and loamy soils

These soils are on broad, smooth plains dissected by weakly to strongly defined drainageways and depressions. The Palobia soils are on the broad, smooth, slightly convex plains. The Czar soils are on stream terraces along the drainageways (fig. 4). The major soils in this map unit formed in loamy alluvial and sandy eolian sediments.

This map unit makes up about 8 percent of the county. It is about 50 percent Palobia soils, 16 percent Czar soils, and 34 percent soils of minor extent.

The Palobia soils are moderately well drained and slowly permeable. Typically, the surface layer is brown loamy fine sand about 9 inches thick. The subsoil extends from a depth of 9 to 80 inches. In sequence downward it is brown sandy clay loam that has grayish brown, strong brown, and yellowish red mottles; light brown sandy clay loam that has strong brown mottles; very pale brown sandy clay loam; and pale yellow sandy clay loam.

The Czar soils are well drained and moderately permeable. Typically, the surface layer is dark brown fine sandy loam about 6 inches thick. The subsoil extends from a depth of 6 to 80 inches. In sequence downward it is dark brown sandy clay loam, dark grayish brown sandy clay loam, grayish brown sandy clay loam, brown fine sandy loam, and pale brown sandy loam.

Of minor extent in this map unit are Comitas, Delfina, Edroy, Padrones, Papagua, Quiteria, Sauz, Turcotte, and Yturria soils and a large area of water. Comitas and Padrones soils are slightly higher on the landscape than the Palobia soils. Delfina and Quiteria soils are in landscape positions similar to those of the Palobia soils. Edroy, Papagua, and Sauz soils are in depressions and drainageways. They are in landscape positions similar to or lower than those of the Czar soils. Turcotte and Yturria soils are on ridges along the margin of playas.

The major soils are used as cropland, pasture, or rangeland. Grain sorghum, forage sorghum, and watermelons are the main crops. Cotton, corn, small grain, and warm-season vegetables also are suitable crops. Excess sodium, wind erosion, and low fertility are the main limitations in areas of the Palobia soils. Wind erosion is the main hazard in areas of the Czar soils. Leaving crop residue on the surface or planting a cover crop can help to control wind erosion. Stripcropping or planting permanent wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface.

Coastal bermudagrass, kleingrass, buffelgrass, alamo switchgrass, and Wilman lovegrass are the main pasture grasses. The excess sodium and low fertility are limitations in areas of the Palobia soils. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

The major soils are well suited to rangeland. The native plants consist of mid and tall grasses.

The Palobia soils are severely limited as sites for some urban uses. They are limited as sites for septic tank absorption fields because of seasonal wetness and the slow movement of water through the profile. These limitations can be overcome by properly designing the absorption field and by increasing the size of the absorption area. The soils are limited as sites for sewage lagoons because of the hazard of seepage, which can pollute aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon with relatively impervious material can control seepage and minimize the potential for contamination. Excess sodium is the main limitation affecting trench sanitary landfills. A perched water table, which can pollute water supplies, is the main limitation affecting area sanitary landfills. The shrink-swell potential is a limitation affecting the construction of buildings. It can be overcome by strengthening the foundation of buildings or by stabilizing the moisture content of the adjacent soils. The perched water table can limit the period of time when excavations can be made. The moderate shrink-swell potential and the perched water table are limitations affecting the use of these soils as sites for dwellings with basements. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. Cements that have pozzolanic admixtures can be used to reduce the rate of concrete deterioration.

The Czar soils are severely limited as sites for most urban uses. Flooding occurs during cyclonic storms. Overcoming this hazard is difficult and costly. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

The excess sodium in the subsoil is a limitation affecting recreational development in areas of the Palobia soils. It can interfere with the growth of plants. Backfilling with loamy material that promotes plant growth can help to overcome this limitation.

The flooding of campsites is the main limitation affecting recreational development in areas of the Czar soils.

Quail, dove, turkey, and nongame birds use areas of this map unit for food and cover. As the density of brush and trees increases, the areas become better suited to deer and javelinas.

4. Quiteria-Padrones-Sauz

Very deep, nearly level, moderately well drained and somewhat poorly drained, saline, sandy soils

These soils are on broad, smooth plains dissected by weakly defined watercourses and depressions. The Quiteria and Padrones soils are on the broad, smooth, slightly convex plains. The Sauz soils are in the watercourses and depressions. The major soils in this map unit formed in loamy alluvial and sandy eolian sediments.

This map unit makes up about 8 percent of the county. It is about 35 percent Quiteria soils, 31 percent Padrones soils, 20 percent Sauz soils, and 14 percent soils of minor extent.

The Quiteria soils are moderately well drained and moderately slowly permeable. Typically, the surface layer is pale brown fine sand about 15 inches thick. The subsoil extends from a depth of 15 to 80 inches. In sequence downward it is brown fine sandy loam that has yellowish brown and light gray mottles, light brownish gray fine sandy loam that has yellow and brownish yellow mottles, yellow sandy clay loam, very pale brown sandy clay loam that has brownish yellow and reddish yellow mottles, white sandy clay loam that has reddish yellow mottles, and white fine sandy loam.

The Padrones soils are moderately well drained and moderately slowly permeable. Typically, the surface layer is pale brown fine sand about 17 inches thick. The subsurface layer, from a depth of 17 to 28 inches, is very pale brown fine sand. The subsoil extends from a depth of 28 to 80 inches. In sequence downward it is light brownish gray loamy fine sand, light brownish gray fine sandy loam, light gray fine sandy loam, and white fine sandy loam. It is mottled in shades of yellow, brown, or red.

The Sauz soils are somewhat poorly drained and moderately slowly permeable. Typically, the surface layer is fine sand about 9 inches thick. It is grayish brown in the upper part and light gray in the lower part. The subsoil, from a depth of 9 to 45 inches, is fine sandy loam. It is grayish brown in the upper part, light brownish gray in the next part, and light gray in the lower part. The underlying material, from a depth of 45 to 70 inches, is light gray sandy clay loam.

Of minor extent in this map unit are Falfurrias, Sarita, Turcotte, and Yturria soils and areas of water. Falfurrias and Sarita soils are slightly higher on the landscape than the Quiteria and Padrones soils. Turcotte and Yturria soils are along the windward and leeward margin of the saline playas, in the slightly higher positions.

The major soils are used mainly as rangeland, and they are best suited to this use. The limitations include excess sodium, a low available water capacity, and the hazard of wind erosion. The vegetation in areas of the Quiteria and Padrones soils consists of mid and tall grasses. Gulf cordgrass is the dominant plant in areas of the Sauz soils.

A few areas of the Quiteria and Padrones soils are used for improved pasture grasses, such as coastal bermudagrass, Wilman lovegrass, and alamo switchgrass. The excess sodium and the low available water capacity are the main limitations. The Sauz soils are not suited to improved pasture. Applying fertilizer and controlling weeds and grazing are the main management needs.

The Quiteria and Padrones soils are marginally suited to cropland. The hazard of wind erosion, salinity, and the low available water capacity are the main limitations. Suitable crops are grain sorghum, cotton, small grain, and watermelons. Leaving crop residue on the surface or planting a cover crop can help to control wind erosion. Stripcropping or planting permanent wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface. The Sauz soils are not suited to cropland.

The Quiteria and Padrones soils are severely limited as sites for some urban uses. They are limited as sites for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the absorption area. These soils are limited as sites for sewage lagoons because of the hazard of seepage, which can pollute aquifers, wells, and streams. Lining the floor and sides of the sewage lagoon with relatively impervious material can control seepage and minimize the potential for contamination. Excess sodium is the main limitation affecting trench sanitary landfills. The sides of shallow excavations in areas of the Quiteria soils are susceptible to caving or sloughing. This limitation can be overcome by shoring the sidewalls.

The Sauz soils are severely limited as sites for all urban uses. Wetness is the main limitation. Overcoming this limitation is difficult and costly.

Corrosivity is a limitation affecting uncoated steel and concrete in all of the major soils. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. Cements that have pozzolanic admixtures can be used to reduce the rate of concrete deterioration.

Excess sodium, excess salt, and the sandy surface layer are limitations affecting recreational development. The excess sodium and salt in the subsoil interfere with plant growth. The sandy surface layer is subject to soil blowing in areas where the soils are bare of vegetation. It does not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome these limitations.

The abundant perennial legumes and forbs attract dove, quail, turkey, and nongame birds. Because of the scarcity of woody cover, deer and javelinas use these areas primarily for food. Sufficient woody species are available for cover in areas that are overgrazed for extended periods.

5. Sarita-Sauz

Very deep, nearly level and gently undulating, well drained and somewhat poorly drained, nonsaline and saline, sandy soils

These soils are on undulating plains dissected by weakly defined drainageways and depressions (fig. 5).

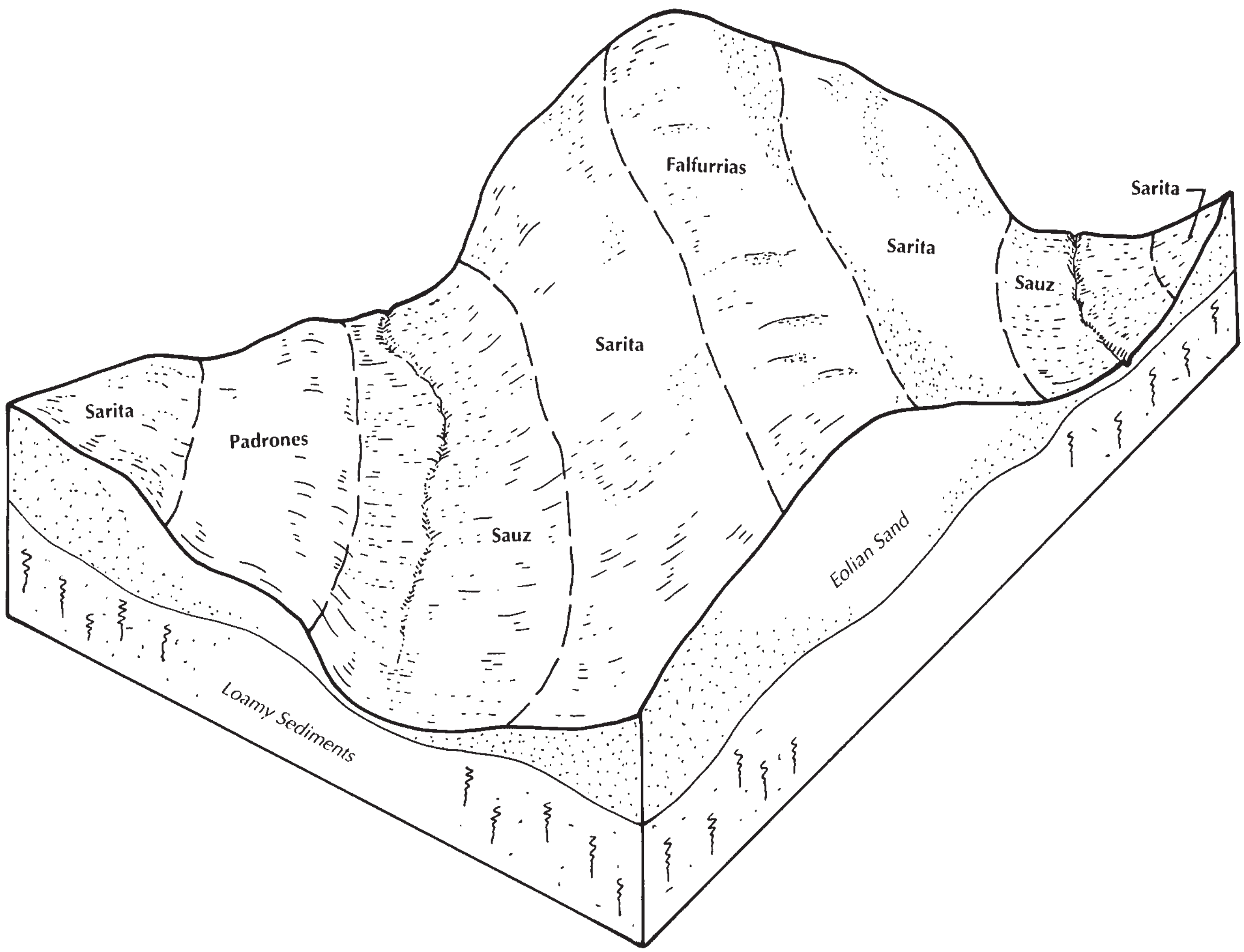

Figure 5.—Typical pattern of soils and parent material in the Sarita-Sauz general soil map unit.

The Sarita soils are on convex uplands. The Sauz soils are in the drainageways and depressions.

This map unit makes up about 8 percent of the county. It is about 42 percent Sarita soils, 35 percent Sauz soils, and 23 percent soils of minor extent.

The Sarita soils are well drained. They are rapidly permeable in the upper part and moderately rapidly permeable in the lower part. Typically, the surface layer is pale brown fine sand about 27 inches thick. The subsurface layer, from a depth of 27 to 43 inches, is very pale brown fine sand. The upper part of the subsoil, from a depth of 43 to 47 inches, is light brownish gray fine sandy loam. The lower part, from a depth of 47 to 72 inches, is very pale brown sandy clay loam that has yellow mottles.

The Sauz soils are somewhat poorly drained and moderately slowly permeable. Typically, the surface layer is fine sand about 9 inches thick. It is grayish brown in the upper part and light gray in the lower part. The subsoil, from a depth of 9 to 45 inches, is fine sandy loam. It is grayish brown in the upper part, light brownish gray in the next part, and light gray in the lower part. The subsoil has mottles in shades of yellow and brown. The underlying material, from a depth of 45 to 70 inches, is light gray sandy clay loam that has yellowish mottles.

Of minor extent in this map unit are Falfurrias, Nueces, Padrones, Quiteria, and Yturria soils and Dune land. Nueces, Padrones, and Quiteria soils are slightly lower on the landscape than the Sarita soils but are higher on the landscape than the Sauz soils. Falfurrias soils and the Dune land are higher on the landscape than the Sarita soils. Yturria soils are on ridges along the margin of saline playas. They are slightly higher on the landscape than the Sarita soils.

The major soils are used mainly as rangeland or wildlife habitat. The vegetation on the Sarita soils consists of open grassland plants interspersed with scattered areas of mesquite trees and an occasional live oak tree. Gulf cordgrass is the dominant plant in areas of the Sauz soils. A few areas of the Sarita soils are used for improved pasture grasses, such as coastal bermudagrass. The major soils are not suited to cultivated crops because of the hazard of wind erosion and a low available water capacity. In addition, because the Sauz soils are wet for long periods following heavy rains, soluble salts can limit the growth of vegetation.

Wilman lovegrass and alamo switchgrass are suited to the Sarita soils. Establishing grasses on these soils is difficult because the soils dry out rapidly and are subject to wind erosion. The low available water capacity and low fertility can reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

The Sarita soils are severely limited as sites for some urban uses. They are limited as sites for septic tank absorption fields because they may not adequately filter the effluent, which can contaminate water supplies. They are severely limited as sites for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or of the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Caving or sloughing is a hazard in shallow excavations. It can be overcome by shoring the sidewalls.

The Sauz soils are severely limited as sites for all urban uses. Wetness is the main limitation. Overcoming this limitation is difficult and costly. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. Cements that have pozzolanic admixtures can be used to reduce the rate of concrete deterioration.

In areas where the major soils are dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. These soils do not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation. The excess sodium and salt in the subsoil of the Sauz soils can interfere with the growth of plants.

The abundant perennial legumes and forbs attract dove, quail, and nongame birds. Deer and javelinas inhabit these areas in places where brush and trees provide sufficient cover.

6. Delmita-Yturria

Moderately deep and very deep, nearly level and gently undulating, well drained, loamy soils

These soils are on broad plains and low ridges dissected by narrow drainageways. The Delmita soils are in the broad, smooth, convex areas. The Yturria soils are on the low ridges and in slightly depressional areas. The Delmita soils formed in loamy eolian sediments over cemented caliche. The Yturria soils formed in the deeper, loamy eolian sediments.

This map unit makes up about 5 percent of the county. It is about 48 percent Delmita soils, 30 percent Yturria soils, and 22 percent soils of minor extent.

The Delmita soils are well drained and moderately permeable. Typically, the surface layer is reddish brown fine sandy loam about 14 inches thick. The subsoil, from a depth of 14 to 38 inches, is red sandy clay loam. The underlying material is white caliche that is indurated in the upper part. It becomes less cemented and massive with increasing depth.

The Yturria soils are well drained and moderately rapidly permeable. Typically, the surface layer is dark brown fine sandy loam about 22 inches thick. The upper part of the subsoil, from a depth of 22 to 33 inches, is pale brown fine sandy loam. The lower part, from a depth of 33 to 80 inches, is very pale brown fine sandy loam.

Of minor extent in this map unit are Delfina, Jardin, Nueces, Tasajal, and Vargas soils. Nueces and Delfina soils are slightly higher on the landscape than the Delmita and Yturria soils. Jardin, Vargas, and Tasajal soils are in landscape positions similar to those of the Delmita soils.

The major soils are used mainly as rangeland or wildlife habitat. Proper management can produce a variety of grasses, forbs, and shrubs. A low available water capacity, the depth to bedrock, and low fertility are the main limitations.

Buffelgrass, kleingrass, Wilman lovegrass, alamo switchgrass, and coastal bermudagrass are the main pasture grasses. The low fertility, the limited available water capacity, and the depth to bedrock reduce yields in areas of improved pasture.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. The hazards of water erosion and wind erosion, the moderate rooting depth, the low available water capacity, and erratic rainfall distribution are the main limitations.

The Delmita soils are severely limited as sites for some urban uses. They are limited as sites for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, and dwellings with basements because of depth to the cemented pan. In most areas the cemented pan can be excavated with a backhoe. In areas used as sites for septic tank absorption fields, properly designing the absorption field and increasing the size of the absorption area can help to overcome this limitation. Overcoming this limitation can be difficult and costly on sites for sewage lagoons and sanitary landfills. Seepage is a limitation affecting sites for sewage lagoons. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

The Yturria soils have few limitations affecting most urban uses. They are severely limited as sites for sewage lagoons and sanitary landfills, however, because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or of the trench sanitary landfill with relatively impervious material can minimize the potential for contamination.

The Delmita and Yturria soils are only slightly limited for most recreational uses.

Deer, javelinas, quail, turkey, and doves are common in areas of these soils. The native vegetation provides adequate cover and a good variety of food.

Detailed Soil Map Units

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

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

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

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

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

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

A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Vargas-Jardin complex, nearly level, is an example.

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. Sarita-Sauz association, gently undulating, is an example.

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

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

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

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

Soil Descriptions

COB—Comitas loamy fine sand, gently undulating. This very deep soil is on upland ridges and stream terraces. The surface is plane or slightly convex. Individual areas are oval, long and narrow, or irregular in shape and range from 20 to 1,200 acres in size. Slopes range from 0 to 3 percent.

Typically, the surface layer is very friable, slightly acid, loamy fine sand about 25 inches thick. It is pale brown in the upper 9 inches and brown in the lower 16 inches. The upper part of the subsoil, from a depth of 25 to 40 inches, is firm, slightly acid, brown sandy clay loam. The next part, from a depth of 40 to 60 inches, is neutral, strong brown sandy clay loam. It is firm in the upper 11 inches and friable in the lower 9 inches. The lower part, from a depth of 60 to 80 inches, is friable, neutral, light brown sandy clay loam.

This soil is well drained. Runoff is very slow. Permeability is moderately rapid, and the available water capacity is moderate. The root zone is deep and can be easily penetrated by plant roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Comitas soil and a similar soil make up 70 to 85 percent of the unit, and included soils make up 15 to 30 percent. The similar soil has a sandy surface layer that is less than 20 inches thick. The included soils are the Czar, Delmita, Nueces, and Yturria soils.

The Comitas soil is used mainly as rangeland, wildlife habitat, or improved pasture. A few areas are used as cropland.

The climax plant community consists of open grassland plants interspersed with a few woody species and an abundance of forbs. Where the range is in excellent condition, forage production is only medium because of the moderate available water capacity and a low fertility level. Overgrazing reduces the amount of quality forage by replacing desirable grasses and forbs with those of lower forage value and by increasing the amount of brush and trees. A planned grazing system and brush management can improve and maintain forage production.

Coastal bermudagrass, Wilman lovegrass, and alamo switchgrass are the main pasture grasses. Establishing these grasses is difficult because the soil dries out rapidly and is subject to wind erosion. The moderate available water capacity and the low fertility level reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. Limitations include wind erosion and the low fertility level. Cropping systems that include high-residue crops can help to maintain tilth, reduce evaporation, provide organic matter, and control wind erosion. Planting wind stripcrops or stripcropping can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is limited as a site for some urban uses. It is severely limited as a site for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Shallow excavations are susceptible to caving or sloughing, but this limitation can be overcome by shoring the sidewalls.

In areas where the soil is dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. This soil does not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

Quail, dove, and nongame birds use areas of this soil for food and cover. As the density of brush and trees increases, areas become better suited to deer and javelinas.

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

CzA—Czar fine sandy loam, rarely flooded. This very deep, nearly level soil is on stream terraces. Areas are long and narrow or irregular in shape and range from 20 to 400 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is very friable, mildly alkaline, dark brown fine sandy loam about 6 inches thick. The upper part of the subsoil, from a depth of 6 to 22 inches, is firm, mildly alkaline, dark brown sandy clay loam. The next part, from a depth of 22 to 46 inches, is firm, moderately alkaline sandy clay loam that is dark grayish brown in the upper part and grayish brown in the lower part. The lower part, from a depth of 46 to 80 inches, is very friable, moderately alkaline fine sandy loam that is brown in the upper part and pale brown in the lower part.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is moderate. The root zone is deep and can be easily penetrated by roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is moderate. Most areas are subject to flooding during cyclonic storms.

The Czar soil makes up 80 to 95 percent of the unit, and included soils make up 5 to 20 percent. The included soils are the Comitas, Delfina, Palobia, and Papagua soils.

The Czar soil is used mainly as cropland, pasture, or rangeland.

The climax plant community consists of open grassland plants interspersed with some woody species and forbs. Where the range is in excellent condition, forage production is high. Continuous heavy overgrazing by livestock reduces the amount of quality forage by replacing desirable grasses and forbs with those of lower forage value and by increasing the amount of brush and trees. Controlled grazing and brush management can improve and maintain forage production.

Buffelgrass, kleingrass, and coastal bermudagrass are adapted pasture grasses. Applying fertilizer, controlling weeds and grazing, and managing brush are management needs.

This soil is well suited to cropland. Wind erosion is the main hazard. Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Leaving crop residue on the surface can help to improve tilth, control wind erosion, and conserve soil moisture. Stripcropping can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is severely limited as a site for most urban uses. The flooding that occurs during cyclonic storms is difficult and costly to overcome. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

This soil is only slightly limited for recreational development; however, flooding is a severe hazard on sites for camp areas.

Quail, dove, and nongame birds use areas of this soil for food and cover. As the density of brush and trees increases, areas become better suited to deer and javelinas.

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

DeB—Delfina loamy fine sand, 0 to 2 percent slopes. This very deep, nearly level to gently sloping soil is on upland plains. The surface is plane or convex. Individual areas are irregular in shape and range from 20 to 1,300 acres in size.

Typically, the surface layer is very friable, slightly acid loamy fine sand about 16 inches thick. It is yellowish brown in the upper 7 inches and brown in the lower 9 inches. The upper part of the subsoil, from a depth of 16 to 23 inches, is firm, mildly alkaline, dark grayish brown sandy clay loam that has brownish mottles. The next part, from a depth of 23 to 31 inches, is firm, moderately alkaline, brownish yellow sandy clay loam that has reddish mottles. The lower part, from a depth of 31 to 80 inches, is friable, moderately alkaline, reddish yellow sandy clay loam that has reddish and yellowish mottles.

This soil is moderately well drained. Runoff is slow. Permeability is moderately slow, and the available water capacity is moderate. A perched water table is above the subsoil for short periods after heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Delfina soil and a similar soil make up 80 to 95 percent of the unit, and included soils make up 5 to 20 percent. The similar soil has a surface layer that is 20 to 26 inches thick. The included soils are the Edroy, Nueces, Papagua, and Sarita soils.

The Delfina soil is used as rangeland, pasture, cropland, or wildlife habitat.

The climax plant community consists of open grassland plants interspersed with a few mesquite trees and an abundance of forbs. Where the range is in excellent condition, forage production is only medium because of the moderate available water capacity and a low fertility level. Continuous overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with lower quality grasses, brush, and trees. A planned grazing system and brush management can improve and maintain forage production.

Coastal bermudagrass and buffelgrass are the main pasture grasses. Establishing these grasses is difficult because the soil dries out rapidly and is subject to wind erosion. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. Limitations include wind erosion, the moderate available water capacity, and the low fertility level. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Stripcropping or planting permanent wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is limited as a site for some urban uses. It is limited as a site for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is limited as a site for sewage lagoons because of the hazard of seepage, which can pollute aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon with relatively impervious material can reduce seepage and minimize the potential for contamination. The shrink-swell potential is a limitation affecting the construction of buildings. It can be overcome by strengthening the foundation of buildings or by stabilizing the moisture content of the adjacent soil. The moderate shrink-swell potential and the low soil strength are limitations affecting the construction of roads and streets. These limitations can be overcome by stabilizing, strengthening, or replacing the base material. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

This soil is only slightly limited as a site for most recreational uses.

Quail, dove, and nongame birds use areas of this soil for food and cover. As the density of brush and trees increases, areas become better suited to deer and javelinas.

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

DfB—Delfina fine sandy loam, 0 to 2 percent slopes. This very deep, nearly level to gently sloping soil is on convex plains and in concave areas on terraces. The areas are elongated or irregular in shape and range from 20 to 300 acres in size.

Typically, the surface layer is friable, neutral, grayish brown fine sandy loam about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 23 inches, is firm, neutral, dark grayish brown sandy clay loam that has brownish and yellowish mottles. The next part, from a depth of 23 to 34 inches, is firm, mildly alkaline, brown sandy clay loam that has brownish mottles. The lower part, from a depth of 34 to 80 inches, is friable, moderately alkaline, light yellowish brown sandy clay loam.

This soil is moderately well drained. Runoff is slow. Permeability is moderately slow, and the available water capacity is moderate. A perched water table is above the subsoil for short periods after heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. The hazards of water erosion and wind erosion are moderate.

The Delfina soil and a similar soil make up 80 to 90 percent of the unit, and included soils make up 10 to 20 percent. The similar soil has a surface layer that is 20 to 24 inches thick. The included soils are the Delmita, Edroy, Nueces, and Sarita soils.

The Delfina soil is used as rangeland, pasture, cropland, or wildlife habitat.

The climax plant community consists of open grassland plants interspersed with scattered mesquite trees and woody brush. Forage production is medium. It is limited by the moderate available water capacity and a low fertility level. A planned grazing system and brush management can help to improve and maintain productivity.

Coastal bermudagrass, kleingrass, and buffelgrass are the main pasture grasses. The low fertility level and the moderate available water capacity can reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. Limitations include the moderate available water capacity and the low fertility level. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Leaving crop residue on the surface can help to improve tilth, conserve moisture, and control wind erosion. Planting wind stripcrops or stripcropping can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is limited as a site for some urban uses. It is limited as a site for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is limited as a site for sewage lagoons because of the hazard of seepage, which can pollute aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon with relatively impervious material can reduce seepage and minimize the potential for contamination. The shrink-swell potential is a limitation affecting the construction of buildings. It can be overcome by strengthening the foundation of buildings or by stabilizing the moisture content of the adjacent soil. The moderate shrink-swell potential and the low soil strength are limitations affecting the construction of roads and streets. These limitations can be overcome by stabilizing, strengthening, or replacing the base material. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

This soil is only slightly limited as a site for most recreational uses.

Deer, javelinas, small furbearing animals, and coyote use areas of this soil for food and cover. The abundant perennial legumes and forbs attract dove, quail, and nongame birds.

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

DMB—Delmita loamy fine sand, gently undulating. This soil is moderately deep to a cemented pan. It is on broad, convex upland plains. Individual areas are irregular in shape and range from 20 to 500 acres in size. Slopes range from 0 to 3 percent.

Typically, the surface layer is very friable, slightly acid, brown loamy fine sand about 15 inches thick. The subsoil, from a depth of 15 to 34 inches, is firm, neutral, reddish brown sandy clay loam. The underlying material is white caliche that is indurated in the upper part. It becomes less cemented with increasing depth.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is low. The root zone is moderately deep, but the cemented pan restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Delmita soil and similar soils make up 80 to 95 percent of the map unit, and included soils make up 5 to 20 percent. One of the similar soils has hard caliche at a depth of 40 to 50 inches, and another has hard caliche at a depth of 16 to 20 inches. The included soils are the Delfina, Nueces, and Yturria soils.

The Delmita soil is used as rangeland, wildlife habitat, pasture, or cropland. It is an important source of caliche for road construction.

The climax plant community consists of open grassland plants interspersed with a few woody species and an abundance of forbs. Where the range is in excellent condition, forage production is only medium because of the low available water capacity and a low fertility level. Overgrazing reduces the amount of quality forage by replacing desirable grasses and forbs with those of lower forage value. A planned grazing system and brush management can improve and maintain forage production.

Buffelgrass, kleingrass, and coastal bermudagrass are the main pasture grasses. Establishing these grasses is difficult because the soil dries out rapidly and is subject to wind erosion. The low available water capacity and the low fertility level can reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. The main limitations are the severe hazard of wind erosion, the moderate rooting depth, the low available water capacity, and an erratic rainfall distribution. Leaving crop residue on the surface can help to maintain tilth, reduce evaporation, provide organic matter, and control wind erosion. Planting wind stripcrops or stripcropping can help to control wind erosion by decreasing wind velocity near the soil surface.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, and dwellings with basements because of depth to the cemented pan. In most areas the cemented pan can be excavated with a backhoe. Overcoming this limitation can be difficult and costly on sites for sewage lagoons and sanitary landfills. In areas used as sites for septic tank absorption fields, properly designing the absorption field or increasing the size of the field can help to overcome this limitation. Seepage is a limitation on sites for sewage lagoons. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

This soil is only slightly limited as a site for most recreational uses.

Quail, dove, and nongame birds use areas of this soil for food and cover. As the density of brush and trees increases, areas become better suited to deer and javelinas.

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

DtB—Delmita fine sandy loam, 0 to 2 percent slopes. This soil is moderately deep to a cemented pan. It is on nearly level to gently sloping upland plains. The surface is slightly convex. Individual areas are irregular in shape and range from 20 to 500 acres in size.

Typically, the surface layer is friable, neutral, reddish brown fine sandy loam about 14 inches thick. The subsoil is neutral, red sandy clay loam. The upper part, from a depth of 14 to 25 inches, is friable. The lower part, from a depth of 25 to 38 inches, is firm. The underlying material is white caliche that is indurated in the upper part. It becomes less cemented with increasing depth.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is low. The root zone is moderately deep, but the cemented pan restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazards of water erosion and wind erosion are moderate.

The Delmita soil and similar soils make up 85 to 95 percent of the map unit, and included soils make up 5 to 15 percent. One of the similar soils has hard caliche at a depth of 40 to 50 inches, and another has hard caliche at a depth of 16 to 20 inches. The included soils are the Comitas, Delfina, Edroy, Nueces, and Yturria soils.

The Delmita soil is used as rangeland, wildlife habitat, pasture, or cropland. It is an important source of caliche for road construction.

The climax plant community consists of open grassland plants interspersed with shrubs and forbs. Where the range is in excellent condition, forage production is only medium because of the low available water capacity and a low fertility level. Overgrazing reduces the amount of quality forage by replacing desirable grasses and forbs with those of lower forage value and by increasing the amount of brush and trees. A planned grazing system and brush management can improve and maintain forage production.

Buffelgrass, kleingrass, and coastal bermudagrass are the main pasture grasses. The low available water capacity and the low fertility level reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. The main limitations are water erosion, wind erosion, the moderate rooting depth, the low available water capacity, and an erratic rainfall distribution. Cropping systems that include high-residue crops can help to maintain tilth, reduce evaporation, provide organic matter, and control erosion. Stripcropping or planting permanent wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, and dwellings with basements because of the depth to the cemented pan. In most areas the cemented pan can be excavated with a backhoe. Overcoming this limitation can be difficult and costly on sites for sewage lagoons and sanitary landfills. In areas used as sites for septic tank absorption fields, properly designing the absorption fields or increasing the size of the field can help to overcome this limitation. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

This soil is only slightly limited as a site for most recreational uses.

Deer, javelinas, quail, and doves are common in areas of this soil. Under normal conditions, the native vegetation provides adequate cover and a good variety of food.

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

DU—Dune land. This unit consists of gently sloping to strongly sloping, active sand dunes. Because of the prevailing southeast winds, the dunes occur as ridges that are oriented in a southeast to northwest direction. They are 5 to more than 30 feet high. Areas are oblong or irregular in shape and range from 40 to about 800 acres in size. Slopes range from 1 to 8 percent.

Typically, the dunes are neutral, very pale brown fine sand to a depth of more than 80 inches.

This unit is somewhat excessively drained. Runoff does not occur or is very slow. Permeability is rapid, and the available water capacity is very low. The hazard of water erosion is slight, and the hazard of wind erosion is severe (fig. 6).

The Dune land makes up 73 to 86 percent of the unit, and included soils make up 14 to 27 percent. The included soils are the Nueces, Sarita, and Falfurrias soils. They are in valleys between the sand ridges.

This unit supports almost no vegetation. Cattle use the dunes as bedding grounds and as an escape from insects. Blowouts between the dunes can provide water for livestock and wildlife during wet seasons.

This unit is not suited to most land uses. It has the greatest potential as rangeland or wildlife habitat. Wind erosion, loose sand, the rapid permeability, and the very low available water capacity are the main limitations. The unit can be stabilized by special management. If moisture is available, vegetation can be established by hand planting native or adapted species. After planting, vegetation should be covered with hay or paper mulch in order to conserve moisture and deter grazing. After vegetation is established, areas can be used as wildlife habitat or rangeland. If areas are used as rangeland, a well planned rotation system that includes adjoining rangeland is needed.

Dune land is in capability subclass VIIIe. A range site is not assigned.

EdA—Edroy clay, depressional. This very deep, nearly level soil is in depressions and in weakly defined, discontinuous drainageways. The depressions are oval or oblong. Individual areas are about 2 to 6 feet lower than the surrounding soils. They range from 10 to 180 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is firm, dark gray clay about 10 inches thick. It is slightly acid in the upper 4 inches and neutral in the lower 6 inches. The upper part of the subsoil, from a depth of 10 to 16 inches, is firm, mildly alkaline, gray clay. The next part, from a depth of 16 to 26 inches, is very firm, moderately alkaline, light gray clay that has common fine concretions of calcium carbonate. The lower part, from a depth of 26 to 56 inches, is firm, moderately alkaline, light gray clay loam that has concretions of calcium carbonate. The underlying material, from a depth of 56 to 75 inches, is firm, moderately alkaline, light gray sandy clay loam.

This soil is poorly drained. Runoff is ponded. The soil is saturated or covered with water for about 9 months in years of normal rainfall. Permeability is very slow, and the available water capacity is moderate. The root zone is deep, but the content of clay restricts movement of air and water and the penetration of roots. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

The Edroy soil makes up 80 to 95 percent of the unit, and included soils make up 5 to 20 percent. The included soils are the Palobia and Papagua soils.

The Edroy soil is used mainly as rangeland or wildlife habitat. It is not suited to cultivated crops or improved pasture because of wetness. Areas are generally small

Figure 6.—Severe wind erosion in an area of Dune land.

and are impractical or uneconomical to drain.

The climax plant community consists of open grassland plants of dominantly mid grasses interspersed with an occasional shrub. The quantity and species of plants produced on this soil vary widely because of the wetness and past grazing use. Management needs include a planned grazing system and brush management.

This soil is severely limited as a site for most urban and recreational uses. A high shrink-swell potential, the corrosivity to steel, the very slow permeability, and the ponding are the main limitations. The ponding is very difficult and costly to overcome.

Areas of this soil are used by deer, dove, turkey, quail, and javelinas. Several species of forbs and grasses provide good cover, mast, and seeds for game birds and animals. During wet winters these areas provide an excellent habitat for migratory waterfowl.

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

FAB—Falfurrias fine sand, undulating. This very deep soil is on uplands, mainly in a series of long, discontinuous ridges. Because of the prevailing southeast winds, the ridges are oriented in a southeast to northwest direction. Individual areas are long and narrow or irregular in shape and range from 40 to several thousand acres in size. Slopes range from 0 to 8 percent.

Typically, the surface layer is loose fine sand about 38 inches thick. It is slightly acid and very pale brown from a depth of 0 to 3 inches, medium acid and brown from a depth of 3 to 16 inches, and strongly acid and light yellowish brown from a depth of 16 to 38 inches. The underlying material to a depth of 80 inches is loose, strongly acid, very pale brown fine sand.

This soil is somewhat excessively drained. Runoff is very slow. Permeability is rapid, and the available water capacity is low. The root zone is deep and can be easily penetrated by plant roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Falfurrias soil makes up 80 to 98 percent of the unit, and included soils make up 2 to 20 percent. The included soils are the Nueces, Sarita, and Sauz soils in the valleys between ridges of the Falfurrias soil. Dune land also is an inclusion.

The Falfurrias soil is used mainly as rangeland or wildlife habitat. A few acres are used as an improved pasture of coastal bermudagrass. The soil is not suited to cultivated crops because of the hazard of wind erosion and the low available water capacity.

The climax plant community consists of open grassland plants interspersed with motts of live oak or mesquite trees. Tall and mid grasses are dominant, although perennial legumes and forbs are relatively abundant. Forage production is medium. It is limited by the low available water capacity and the fertility level. Establishing grasses is difficult because the soil dries out rapidly and is subject to wind erosion. Controlled grazing and brush management can improve and maintain forage production.

Coastal bermudagrass, Wilman lovegrass, and alamo switchgrass are the main pasture grasses. Establishing these grasses is difficult because the soil dries out rapidly and is subject to wind erosion. The low available water capacity and the fertility level reduce yields. Applying fertilizer and controlling weeds and grazing can help to improve and maintain productivity.

This soil is severely limited as a site for some urban uses. The effluent in septic tank absorption fields can contaminate water supplies in the area. The soil may not adequately filter the effluent from waste disposal systems because of the rapid permeability. It is severely limited as a site for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Shallow excavations are susceptible to caving or sloughing, but this limitation can be overcome by shoring the sidewalls. Slope increases the amount of excavation required in preparing sites for small commercial buildings.

In areas where the soil is dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. This soil does not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

The abundant live oak motts, perennial legumes, and forbs provide excellent cover, browse, mast, and seeds for dove, quail, turkey, deer, and javelinas.

This soil is in capability subclass VIIe and in the Sand Hill range site.

JDB—Jardin fine sandy loam, gently undulating. This soil is shallow to a cemented pan. It is on uplands. The surface is plane or convex. Individual areas are irregular in shape and range from 10 to 100 acres in size. Slopes range from 0 to 3 percent.

Typically, the surface layer is friable, mildly alkaline, brown fine sandy loam about 17 inches thick. The underlying material is white caliche that is indurated in the upper part. It becomes less cemented and massive with increasing depth.

This soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is very low. The root zone is shallow because the cemented pan restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazards of water erosion and wind erosion are moderate.

The Jardin soil and similar soils make up 80 to 95 percent of the unit, and included soils make up 5 to 20 percent. One of the similar soils has hard caliche at a depth of 20 to 28 inches, and another has a surface layer that is lighter in color than that of the Jardin soil. Also included are small areas of soils that have caliche at or near the surface. The included soils are the Comitas, Delfina, Delmita, Nueces, Sarita, Vargas, and Yturria soils.

The Jardin soil is used mainly as rangeland or wildlife habitat. A few areas are used as an improved pasture of buffelgrass. This soil is not suited to cultivated crops because of the very low available water capacity and the shallowness to a cemented pan. It is an important source of caliche for road construction.

The climax plant community consists of open grassland plants interspersed with scattered brush and forbs. Forage production is low. It is limited by the low fertility level and the very low available water capacity, both of which result from the shallowness to a cemented pan. Controlled grazing and brush management can improve and maintain forage production.

Pasture yields are reduced by the low fertility level and the very low available water capacity. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

This soil is severely limited as a site for most urban uses because of the shallowness to a cemented pan. In most areas the cemented pan can be excavated with a backhoe. When a septic tank absorption system is installed, excavating the cemented pan and the underlying material and backfilling with loamy material can help to overcome this limitation. Overcoming the shallowness to a cemented pan is difficult and costly on sites for sewage lagoons and sanitary landfills. Foundations for small buildings, roads, and other structures can be built on the cemented pan. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

The shallowness to a cemented pan is a limitation affecting most recreational uses. Backfilling with loamy material can help to overcome this limitation.

Brush growth on this soil is normally heavy. The brush provides cover for a variety of wildlife, but the soil is too shallow to produce an abundance of food, other than browse, for wildlife. The carrying capacity for deer, javelinas, turkey, and quail is generally lower than that of the more productive adjacent soils.

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

NFB—Nueces fine sand, gently undulating. This very deep soil is on broad upland plains. The surface is plane or hummocky. Individual areas are irregular in shape and range from 20 to several thousand acres in size. Slopes range from 0 to 3 percent.

Typically, the surface layer is very friable, neutral fine sand about 23 inches thick. It is pale brown in the upper 10 inches and brown in the lower 13 inches. The subsurface layer, from a depth of 23 to 30 inches, is very friable, neutral, light brown fine sand. The upper part of the subsoil, from a depth of 30 to 48 inches, is firm, neutral, sandy clay loam that has common or many reddish yellow mottles. It is light brownish gray in the upper 10 inches and light gray in the lower 8 inches. The lower part of the subsoil, from a depth of 48 to 80 inches, is firm, moderately alkaline, yellow sandy clay loam.

This soil is moderately well drained. Runoff is very slow. Permeability is moderately slow, and the available water capacity is moderate. A perched water table is above the subsoil for short periods after heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Nueces soil and similar soils make up 80 to 95 percent of the unit, and included soils make up 5 to 20 percent. One of the similar soils has a sandy surface layer that is 40 to 47 inches thick, and another has a sandy surface layer that is less than 20 inches thick. The included soils are the Comitas, Delfina, Falfurrias, and Sarita soils. Also included are small depressions less than 12 acres in size. These depressions are intermittently filled with water.

The Nueces soil is used mainly as rangeland or wildlife habitat. A few areas are used as an improved pasture of Wilman lovegrass, alamo switchgrass, and coastal bermudagrass. A few areas are used as cropland.

The climax plant community consists of open grassland plants interspersed with a few mesquite trees and an occasional live oak tree. Where the range is in excellent condition, forage production is high. Continuous overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with brush, trees, and poorer quality grasses. A planned grazing system and brush management can improve and maintain forage production.

Establishing pasture grasses is difficult because the soil dries out rapidly and is subject to wind erosion. The low fertility level and the moderate available water capacity can reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

This soil is marginally suited to cultivated crops. Watermelons, forage sorghum, and grain sorghum are grown in some areas. Limitations include wind erosion, the moderate available water capacity, and the low fertility level. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Stripcropping or planting permanent wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface. Leaving crop residue on the surface can help to improve tilth, conserve soil moisture, and control wind erosion.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is severely limited as a site for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Shallow excavations are susceptible to caving or sloughing, but this limitation can be overcome by shoring the sidewalls. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

In areas where the soil is dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. This soil does not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

The abundant perennial legumes and forbs attract dove, quail, turkey, and nongame birds. Because of the scarcity of woody cover, deer and javelinas use these areas primarily for food. Sufficient woody species are available for cover in areas that have been overgrazed for extended periods.

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

NSB—Nueces-Sarita association, gently undulating. These very deep, sandy soils are on broad upland plains. Hummocks and small ridges are common. The surface is plane or convex. Areas are irregular in shape and range from 50 to 600 acres in size. Slopes range from 0 to 5 percent.

The Nueces soil makes up 50 to 70 percent of the unit, the Sarita soil makes up 25 to 45 percent, and included soils and areas that are intermittently filled with water make up 5 to 20 percent. The Nueces soil is in broad, slightly convex areas. The Sarita soil is on the hummocks and small ridges. These soils were not mapped separately because both are used as rangeland and require similar management.

Typically, the surface layer of the Nueces soil is very friable, neutral, pale brown fine sand about 24 inches thick. The subsurface layer, from a depth of 24 to 33 inches, is very friable, neutral, very pale brown fine sand. The upper part of the subsoil, from a depth of 33 to 46 inches, is firm, neutral, light brownish gray sandy clay loam that has common yellow mottles. The next part, from a depth of 46 to 62 inches, is firm, mildly alkaline, light gray sandy clay loam that has few yellow mottles. The lower part, from a depth of 62 to 80 inches, is firm, moderately alkaline, very pale brown sandy clay loam that has common reddish yellow mottles.

The Nueces soil is moderately well drained. Runoff is very slow. Permeability is moderately slow, and the available water capacity is moderate. A perched water table is above the subsoil for short periods after heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

Typically, the surface layer of the Sarita soil is very friable, neutral, pale brown fine sand about 24 inches thick. The subsurface layer, from a depth of 24 to 42 inches, is very friable, neutral, very pale brown fine sand. The upper part of the subsoil, from a depth of 42 to 60 inches, is friable, neutral sandy clay loam. It is light brownish gray in the upper 10 inches and very pale brown in the lower 8 inches. The lower part, from a depth of 60 to 80 inches, is friable, mildly alkaline, very pale brown sandy clay loam. The underlying material, from a depth of 42 to 80 inches, has few or common, yellow or red mottles.

The Sarita soil is well drained. Runoff is very slow. Permeability is rapid in the upper part of the profile and moderately rapid in the lower part. The available water capacity is low. The root zone is deep and can be easily penetrated by plant roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

Included in mapping are small areas of Comitas, Delfina, Delmita, and Falfurrias soils. Also included are small depressions that are less than 10 acres in size. These depressions are intermittently filled with water.

The Nueces and Sarita soils are used mainly as rangeland or wildlife habitat. A few areas are used as an improved pasture of coastal bermudagrass. The Nueces soil may be used as cropland. The Sarita soil is not suited to cultivated crops because of the hazard of wind erosion and the low available water capacity.

The climax plant community consists of open grassland plants interspersed with a few mesquite trees and an occasional live oak tree. Where the range is in excellent condition, forage production is high. Continuous overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with lower quality grasses, brush, and trees. A planned grazing system and brush management can improve and maintain forage production.

Establishing pasture grasses is difficult because the soils dry out rapidly and are subject to wind erosion. The low fertility level and the moderate or low available water capacity reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity. Wilman lovegrass, alamo switchgrass, and similar grasses are suited to these soils.

The Nueces soil is marginally suited to cultivated crops. Watermelons, forage sorghum, and grain sorghum can be grown. Limitations include wind erosion, the moderate available water capacity, and the low fertility level. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Planting wind stripcrops or stripcropping can help to control wind erosion by reducing wind velocity near the soil surface.

The Nueces and Sarita soils are severely limited as sites for some urban uses. The Nueces soil is limited as a site for septic tank absorption fields by the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the field. The Sarita soil is severely limited as a site for septic tank absorption fields because it may not adequately filter the effluent from waste disposal systems, which can contaminate water supplies. The Nueces and Sarita soils are severely limited as sites for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel. Shallow excavations are susceptible to caving or sloughing. This limitation can be overcome by shoring the sidewalls.

In areas where the soils are dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. These soils do not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

The abundant perennial legumes and forbs attract dove, quail, and nongame birds. Because of the scarcity of woody cover, deer and javelinas use these areas primarily for food. Sufficient woody species are available for cover in areas that have been overgrazed for extended periods.

The Nueces soil is in capability subclass IVe. The Sarita soil is in capability subclass VIe. Both soils are in the Sandy range site.

PAA—Padrones fine sand, nearly level. This very deep soil is on broad, smooth upland plains. Individual areas are irregular in shape and range from 20 to 400 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is very friable, neutral, pale brown fine sand about 17 inches thick. The subsurface layer, from a depth of 17 to 28 inches, is very friable, neutral, very pale brown fine sand. The subsoil extends from a depth of 28 to 80 inches. In sequence downward it is firm, neutral, light brownish gray loamy fine sand that has common brownish yellow and few strong brown mottles; very firm, mildly alkaline, light brownish gray fine sandy loam that has few brownish yellow mottles; firm, mildly alkaline, light gray fine sandy loam that has many yellow and few red mottles; firm, moderately alkaline, white fine sandy loam that has common yellow and few red mottles; and firm, strongly alkaline, white fine sandy loam that has few yellow mottles.

This soil is moderately well drained. Runoff is very slow. Permeability is moderately slow, and the available water capacity is low. A perched water table is above the subsoil for short periods after heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. Sodium affects plant growth in some areas. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Padrones soil makes up 78 to 95 percent of the unit, and included soils make up 5 to 22 percent. The included soils are the Quiteria, Sarita, Sauz, and Yturria soils. Also included are small depressions that are less than 10 acres in size. These depressions are intermittently filled with water.

The Padrones soil is used almost exclusively as rangeland or wildlife habitat. A few areas are used as an improved pasture of coastal bermudagrass.

The climax plant community consists of open grassland plants interspersed with a few mesquite and live oak trees. Where the range is in excellent condition, forage production is high. Continuous overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with brush, trees, and poorer quality grasses. A planned grazing system and brush management can improve and maintain forage production.

Establishing pasture grasses is difficult because the soil dries out rapidly and is subject to wind erosion. Excess sodium, the low fertility level, and the low available water capacity reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity. Wilman lovegrass, alamo switchgrass, and similar grasses are suited to this soil.

This soil is marginally suited to cultivated crops. Limitations include excess sodium, the low fertility level, and the low available water capacity. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Stripcropping or planting wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is severely limited as a site for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Excess sodium is the main limitation on sites for trench sanitary landfills. Shallow excavations are susceptible to caving or sloughing, but this limitation can be overcome by shoring the sidewalls. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. The corrosion of concrete can be reduced by using cement with special pozzolanic admixtures.

In areas where the soil is dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. This soil does not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

The abundant perennial legumes and forbs attract dove, quail, turkey, and nongame birds. Because of the scarcity of woody cover, deer and javelinas use these areas primarily for food. Sufficient woody species are available for cover in areas that are overgrazed for extended periods.

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

PbA—Palobia loamy fine sand, 0 to 1 percent slopes. This very deep, nearly level soil is on broad, smooth upland plains. The surface is plane or slightly convex. Individual areas are irregular in shape and range from 10 to 1,800 acres in size.

Typically, the surface layer is very friable, brown loamy fine sand about 9 inches thick. It is slightly acid in the upper 5 inches and neutral in the lower 4 inches. The subsoil extends from a depth of 9 to 80 inches. In sequence downward it is firm, mildly alkaline, brown sandy clay loam that has common grayish brown and few strong brown and yellowish red mottles; firm, mildly alkaline, light brown sandy clay loam that has few strong brown mottles; firm, moderately alkaline, very pale brown sandy clay loam; and firm, strongly alkaline, pale yellow sandy clay loam.

This soil is moderately well drained. Runoff is slow. Permeability is slow, and the available water capacity is low. From September through May in most years, a perched water table is above the subsoil for several weeks after periods of heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. Sodium and the more soluble salts affect plant growth in some areas. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Palobia soil makes up 80 to 93 percent of the unit, and included soils make up 7 to 20 percent. The included soils are the Czar, Edroy, Padrones, Papagua, and Quiteria soils.

The Palobia soil is used as rangeland, pasture, cropland, or wildlife habitat.

The climax plant community consists of open grassland plants interspersed with scattered mesquite and other woody brush species. Also, forbs and legumes grow well on this soil. Where the range is in excellent condition, forage production is only medium because of the low available water capacity and a low fertility level. Continuous overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with brush, trees, and lower quality grasses. A planned grazing system and brush management can improve and maintain forage production.

Coastal bermudagrass, kleingrass, Wilman lovegrass, alamo switchgrass, and buffelgrass are the main pasture grasses. Establishing these grasses is difficult because the soil dries out rapidly and is subject to wind erosion. Salinity, the low fertility level, and the low available water capacity reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops (fig. 7). Limitations include salinity, the low fertility level, and the low available water capacity. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Leaving crop residue on the surface can help to improve tilth, control wind erosion, and conserve soil moisture. Stripcropping or planting wind stripcrops can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields because of the seasonal wetness and the slow

Figure 7.—Grain sorghum in an area of Palobia loamy fine sand, 0 to 1 percent slopes.

movement of water through the profile. These limitations can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is limited as a site for sewage lagoons because of the hazard of seepage, which can pollute aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon with relatively impervious material can reduce seepage and minimize the potential for contamination. Excess sodium is the main limitation on sites for trench sanitary landfills. The soil is limited as a site for area sanitary landfills because of the perched water table, which can transmit pollutants to the water supply. The shrink-swell potential is a limitation affecting the construction of buildings. It can be overcome by strengthening the foundation of buildings or by stabilizing the moisture content of the adjacent soil. The perched water table can limit the period when excavations can be made. The moderate shrink-swell potential and the perched water table are limitations on sites for dwellings with basements. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. Cements that have pozzolanic admixtures can be used to reduce the rate of concrete deterioration.

Excess sodium in the subsoil is a limitation affecting recreational development because it can interfere with plant growth. Backfilling with loamy material can help to overcome this limitation.

Quail, dove, and nongame birds use these areas for food and cover. As the density of brush and trees increases, areas become better suited to deer and javelinas.

This soil is in capability subclass IVs and in the Loamy Sand range site.

PfA—Palobia fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil is on broad, smooth upland plains. The surface is plane or slightly convex. Individual areas are irregular in shape and range from 10 to 600 acres in size.

Typically, the surface layer is friable, slightly acid, dark grayish brown fine sandy loam about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 20 inches, is very firm, neutral, brown sandy clay loam that has common dark grayish brown and few reddish yellow mottles. The next part, from a depth of 20 to 38 inches, is firm, light brown sandy clay loam that has few reddish yellow mottles. The lower part, from a depth of 38 to 80 inches, is friable, moderately alkaline, very pale brown sandy clay loam.

This soil is moderately well drained. Runoff is slow. Permeability is slow, and the available water capacity is low. From September through May in most years, a perched water table is above the subsoil for several weeks after periods of heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. Sodium and other salts affect plant growth. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is moderate.

The Palobia soil makes up 80 to 90 percent of the unit, and included soils make up 10 to 20 percent. The included soils are the Czar, Edroy, Padrones, Papagua, and Quiteria soils.

The Palobia soil is used as rangeland, pasture, cropland, or wildlife habitat.

The climax plant community consists of open grassland plants interspersed with scattered mesquite and other woody brush species. Where the range is in excellent condition, forage production is only medium because of the low available water capacity and a low fertility level. Continuous overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with brush, trees, and lower quality grasses. A planned grazing system and brush management can improve and maintain forage production.

Coastal bermudagrass and buffelgrass are the main pasture grasses. Establishing these grasses is difficult because the soil dries out rapidly and is subject to wind erosion. Salinity, the low fertility level, and the low available water capacity reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. Limitations include salinity, the low fertility level, and the low available water capacity. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Leaving crop residue on the surface can help to improve tilth, control wind erosion, and conserve soil moisture. Stripcropping or planting wind stripcrops helps to control wind erosion by reducing wind velocity near the soil surface.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields because of the seasonal wetness and the slow movement of water through the profile. These limitations can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is limited as a site for sewage lagoons because of the hazard of seepage, which can pollute aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon with relatively impervious material can reduce seepage and minimize the potential for contamination. Excess sodium is the main limitation on sites for trench sanitary landfills. The soil is limited as a site for area sanitary landfills because of the perched water table, which can transmit pollutants to the water supply. The shrink-swell potential is a limitation affecting the construction of buildings. It can be overcome by strengthening the foundation of buildings or by stabilizing the moisture content of the adjacent soil. The perched water table can limit the period when excavations can be made. The moderate shrink-swell potential and the perched water table are limitations on sites for dwellings with basements. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. Cements that have pozzolanic admixtures can be used to reduce the rate of concrete deterioration.

Excess sodium in the subsoil is a limitation affecting recreational development because it can interfere with plant growth. Backfilling with loamy material can help to overcome this limitation.

Quail, turkey, dove, and nongame birds use areas of this soil for food and cover. As the density of brush and trees increases, areas become better suited to deer and javelinas.

This soil is in capability subclass IVs and in the Loamy Sand range site.

PpA—Papagua fine sandy loam, 0 to 1 percent slopes. This very deep, nearly level soil is along upland drainageways and in shallow depressions. The surface is plane or slightly concave. The drainageways are elongated, and the depressions are oval. Individual areas range from 20 to 200 acres in size.

Typically, the surface layer is friable, neutral, light brownish gray fine sandy loam about 12 inches thick. The subsoil extends from a depth of 12 to 80 inches. In sequence downward it is firm, neutral, grayish brown sandy clay that has common brownish yellow mottles; firm, neutral, light brownish gray sandy clay that has few yellowish brown mottles; firm, mildly alkaline, light gray sandy clay loam that has few brownish yellow and yellow mottles; and firm, moderately alkaline, very pale brown sandy clay loam that has few brownish yellow mottles. The underlying material, from a depth of 80 to 90 inches, is firm, moderately alkaline, white sandy clay loam.

This soil is moderately well drained. Runoff is slow in some areas along the drainageways. Heavy rainfall can cause additional runoff from adjacent soils. Depressions are ponded, mainly from September through May. Permeability is slow, and the available water capacity is moderate. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is moderate.

The Papagua soil makes up 84 to 96 percent of the unit, and included soils make up 4 to 16 percent. The included soils are the Czar, Delfina, Edroy, Palobia, and Quiteria soils.

The Papagua soil is used mainly as rangeland or pasture. A few areas are used as cropland.

The climax plant community consists of open grassland plants interspersed with some woody species and an abundance of forbs. Where the range is in excellent condition, forage production is high. Overgrazing reduces the amount of quality forage by replacing desirable grasses and forbs with those of lower forage value and by increasing the amount of brush and trees. A planned grazing system and brush management can improve and maintain forage production.

Adapted pasture grasses include buffelgrass and coastal bermudagrass. Applying fertilizer, controlling weeds and grazing, and managing brush are management needs.

Grain sorghum and forage sorghum are the main cultivated crops. Management objectives include controlling erosion and maintaining tilth. Applications of fertilizer, conservation tillage, crop residue management, and cover crops can help to control erosion and maintain tilth. Grassed waterways, diversion terraces, and field drainage ditches can help to control runoff during heavy rainfall.

This soil is severely limited as a site for most urban and recreational uses. The main limitations are a high shrink-swell potential, corrosion of uncoated steel, the slow permeability, and the ponding. The ponding can be very difficult and costly to overcome.

The abundant legumes and forbs attract quail, dove, numerous songbirds, and turkey. Deer and javelinas use areas of this soil primarily for food.

The soil is in capability subclass IIIw and in the Ramadero range site.

QTA—Quiteria fine sand, nearly level. This very deep soil is on broad, smooth upland plains. Individual areas are irregular in shape and range from 10 to 300 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is friable and very friable, medium acid, pale brown fine sand about 15 inches thick. The subsoil extends from a depth of 15 to 80 inches. In sequence downward it is firm, neutral, brown fine sandy loam that has few yellowish brown and light gray mottles; very firm, mildly alkaline, light brownish gray fine sandy loam that has many yellow and few brownish yellow mottles; firm, moderately alkaline, yellow sandy clay loam; firm, strongly alkaline, very pale brown sandy clay loam that has few brownish yellow and reddish yellow mottles; firm, strongly alkaline, white sandy clay loam that has few reddish yellow mottles; and firm, strongly alkaline, white fine sandy loam.

This soil is moderately well drained. Runoff is very slow. Permeability is moderately slow, and the available water capacity is low. A perched water table is above the subsoil for short periods after heavy rainfall. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. Sodium and other soluble salts affect plant growth in some areas. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Quiteria soil and a similar soil make up 85 to 96 percent of the unit, and included soils make up 4 to 15 percent. The similar soil has a sandy surface layer that is 20 to 24 inches thick. The included soils are the Padrones, Sauz, and Yturria soils. Also included are small depressions that are less than 10 acres in size. These depressions are intermittently filled with water.

The Quiteria soil is used almost exclusively as rangeland or wildlife habitat. A few areas are used as an improved pasture of coastal bermudagrass.

The climax plant community consists of open grassland plants of dominantly mid grasses interspersed with some woody species and an abundance of forbs. Where the range is in excellent condition, forage production is only low because of the low available water capacity and a low fertility level. A planned grazing system and brush management can improve and maintain forage production.

Establishing pasture grasses is difficult because the soil dries out rapidly and is subject to wind erosion. Wetness following extended rainy periods, salinity, the low fertility level, and the low available water capacity reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity. Wilman lovegrass, alamo switchgrass, buffelgrass, and kleingrass are suitable pasture grasses.

This soil is marginally suited to cultivated crops. Limitations include wetness following extended rainy periods, salinity, the low fertility level, and the low available water capacity. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Leaving crop residue on the surface can help to improve tilth, control wind erosion, and conserve soil moisture. Planting wind stripcrops or stripcropping can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is limited as a site for sewage lagoons because of the hazard of seepage, which can pollute aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon with relatively impervious material can reduce seepage and minimize the potential for contamination. Excess sodium is the main limitation on sites for trench sanitary landfills. In areas where the subsoil is loamy fine sand, shallow excavations are susceptible to caving or sloughing. This limitation can be overcome by shoring the sidewalls. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. Cements that have pozzolanic admixtures can be used to reduce the rate of concrete deterioration.

The excess sodium in the subsoil and the sandy surface layer are limitations affecting recreational development. The excess sodium in the subsoil interferes with plant growth. In areas where the soil is dry and bare of vegetation, this soil does not provide a good base for roads and streets or for paths and trails because of the sandy surface layer. Backfilling with loamy material can help to overcome these limitations.

The abundant legumes and forbs attract dove, quail, turkey, and nongame birds. Because of the scarcity of woody cover, deer and javelinas use areas of this soil primarily for food. Sufficient woody species are available for cover in areas that are overgrazed for extended periods.

This soil is in capability subclass IVs and in the Loamy Sand range site.

SAB—Sarita fine sand, gently undulating. This very deep soil is on broad upland plains. The surface is plane or hummocky. Individual areas are irregular in shape and range from 20 to several thousand acres in size. Slopes range from 0 to 5 percent.

Typically, the surface layer is very friable, neutral, brown fine sand about 22 inches thick. The subsurface layer, from a depth of 22 to 48 inches, is very friable, neutral, very pale brown fine sand. The upper part of the subsoil, from a depth of 48 to 50 inches, is friable, neutral, light brownish gray fine sandy loam that has few yellow mottles. The lower part, from a depth of 50 to 80 inches, is neutral, light gray fine sandy loam that has common or many yellow mottles.

This soil is well drained. Runoff is very slow. Permeability is rapid in the upper part of the profile and moderately rapid in the lower part. The available water capacity is low. The root zone is deep and can be easily penetrated by plant roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Sarita soil and similar soils make up 83 to 95 percent of the unit, and included soils make up 5 to 17 percent. One of the similar soils has a sandy surface layer that is 81 to 90 inches thick, and another has a sandy surface layer that is less than 40 inches thick. The included soils are the Comitas, Turcotte, Falfurrias, and Nueces soils. Also included are small depressions that are less than 10 acres in size. These depressions are intermittently filled with water.

The Sarita soil is used mainly as rangeland or wildlife habitat. A few areas are used as an improved pasture of coastal bermudagrass. This soil is not suited to cultivated crops because of the hazard of wind erosion and the low available water capacity.

The climax plant community consists of open grassland plants interspersed with a few mesquite trees and an occasional live oak tree. Where the range is in excellent condition, forage production is high.

Overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with brush, trees, and poorer quality grasses. A planned grazing system and brush management can improve and maintain forage production.

Establishing pasture grasses is difficult because the soil dries out rapidly and is subject to wind erosion. The low available water capacity and the low fertility level reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity. Adapted pasture grasses include Wilman lovegrass and alamo switchgrass.

This soil is severely limited as a site for some urban uses. The effluent in septic tank absorption fields can contaminate water supplies in the area. The soil may not adequately filter the effluent from waste disposal systems because of the rapid permeability. It is severely limited as a site for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Shallow excavations are susceptible to caving or sloughing, but this limitation can be overcome by shoring the sidewalls.

In areas where the soil is dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. This soil does not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

The abundant perennial legumes and forbs attract dove, quail, turkey, and nongame birds. Because of the scarcity of woody cover, deer and javelinas use areas of this soil primarily for food. Sufficient woody species are available for cover in areas that are overgrazed for extended periods.

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

SSB—Sarita-Sauz association, gently undulating. These very deep, sandy soils are on broad upland plains. These plains are dissected by small, discontinuous ridges, depressions, and poorly defined drainageways (fig. 8). Areas are irregular in shape and range from 50 to several thousand acres in size. Slopes range from 0 to 5 percent.

The Sarita soil makes up 40 to 50 percent of the unit, the Sauz soil makes up 30 to 40 percent, and included soils and areas that are intermittently filled with water make up 15 to 25 percent. The Sarita soil is on the side slopes and summit of the ridges. The Sauz soil is in shallow depressions and poorly defined drainageways. These soils were not mapped separately because both are used as rangeland and require similar management.

Typically, the surface layer of the Sarita soil is very friable, neutral, pale brown fine sand about 27 inches thick. The subsurface layer, from a depth of 27 to 43 inches, is very friable, neutral, very pale brown fine sand. The upper part of the subsoil, from a depth of 43 to 47 inches, is friable, neutral, light brownish gray fine sandy loam. The lower part, from a depth of 47 to 72 inches, is firm, neutral, very pale brown sandy clay loam that has common yellow mottles.

The Sarita soil is well drained. Runoff is very slow. Permeability is rapid in the upper part of the profile and moderately rapid in the lower part. The available water capacity is low. The root zone is deep and can be easily penetrated by plant roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

Typically, the surface layer of the Sauz soil is very friable, neutral, light brownish gray fine sand about 7 inches thick. The upper part of the subsoil, from a depth of 7 to 14 inches, is firm, moderately alkaline, grayish brown fine sandy loam that has few brownish yellow mottles. The lower part, from a depth of 14 to 44 inches, is firm, strongly alkaline, light brownish gray fine sandy loam that has common brownish yellow mottles. The underlying material, from a depth of 44 to 70 inches, is friable, strongly alkaline, light gray sandy clay loam that has few brownish yellow mottles.

The Sauz soil is somewhat poorly drained. Runoff is slow. Permeability is moderately slow, and the available water capacity is low. From September through May in most years, the water table is within a depth of 3 feet. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. Because of sodium and the more soluble salts, vegetation is limited to salt-tolerant species. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

Included in mapping are small areas of Falfurrias, Padrones, Quiteria, and Yturria soils. Also included are small depressions that are less than 10 acres in size. These depressions are intermittently filled with water.

The Sarita and Sauz soils are used mainly as rangeland or wildlife habitat. A few areas of the Sarita soil are used as an improved pasture of coastal bermudagrass. The Sarita and Sauz soils are not suited to cultivated crops because of the hazard of wind erosion and the low available water capacity. In areas of the Sauz soil, long periods of wetness following heavy rainfall and the soluble salts in the soil are additional limitations.

The climax plant community consists of open

Figure 8.—An area of the Sarita-Sauz association, gently undulating, is in the foreground. An area of Dune land is in the background. Mesquite and native grasses are being used to stabilize the Dune land.

grassland plants interspersed with scattered mesquite and an occasional live oak tree. Where the range is in excellent condition, forage production is high. Gulf cordgrass is the dominant species in areas of the Sauz soil. The palatability of this grass is low during most of the year. A planned grazing system and brush management can improve and maintain forage production.

Establishing grasses on the Sarita soil is difficult because the soil dries out rapidly and is subject to wind erosion. The low available water capacity and a low fertility level can reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity on the Sarita and Sauz soils. Suitable pasture species are coastal bermudagrass, Wilman lovegrass, and alamo switchgrass.

The Sarita soil is severely limited as a site for some urban uses. The effluent in septic tank absorption fields can contaminate water supplies. The soil may not adequately filter the effluent from waste disposal systems because of the rapid permeability. It is severely limited as a site for sewage lagoons and sanitary landfills because of the hazard of seepage, which can contaminate aquifers, wells, and streams. Lining the floor and the sides of the sewage lagoon or the trench sanitary landfill with relatively impervious material can minimize the potential for contamination. Shallow excavations are susceptible to caving or sloughing, but this limitation can be overcome by shoring the sidewalls.

The Sauz soil is severely limited as a site for all urban uses. The main limitation is the wetness, which is difficult and costly to overcome. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. The corrosion of concrete can be reduced by using cement with special pozzolanic admixtures.

In areas where the soils are dry and bare of vegetation, the sandy surface layer is a limitation affecting recreational development. These soils do not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation. The excess sodium and salt in the subsoil of the Sauz soil also can interfere with plant growth.

The abundant perennial legumes and forbs on the Sarita soil attract dove, quail, and nongame birds. Deer and javelinas inhabit areas where brush and trees have replaced grasses. Wildlife seldom use areas of the Sauz soil because of insufficient food and cover.

The Sarita soil is in capability subclass VIe and in the Sandy range site. The Sauz soil is in capability subclass VIs and in the Sandy Flat range site.

SZA—Sauz fine sand, nearly level. This very deep soil is in shallow depressions and poorly defined drainageways. Individual areas are about 6 inches to 2 feet lower than the surrounding soils. The surface is plane or slightly concave. Areas of this soil are long and narrow or irregular in shape and range from 20 to 300 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is friable, mildly alkaline fine sand about 9 inches thick. It is grayish brown in the upper part and light gray in the lower part. The subsoil is firm, strongly alkaline sandy clay loam. The upper part, from a depth of 9 to 28 inches, has yellowish and brownish mottles. It is grayish brown in the upper part and light brownish gray in the lower part. The lower part, from a depth of 28 to 45 inches, is light gray and has yellowish mottles. The underlying material, from a depth of 45 to 70 inches, is friable, very strongly alkaline, light gray sandy clay loam that has yellowish mottles.

This soil is somewhat poorly drained. Runoff is slow. Permeability is moderately slow. The available water capacity is low because salinity restricts the intake of water by plants. From September through May in most years, the water table is within a depth of 3 feet. The root zone is deep, but the blocky structure of the subsoil restricts the movement of air and water and the penetration of roots. Because of sodium and the more soluble salts, vegetation is limited to salt-tolerant species. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Sauz soil and similar soils make up 80 to 95 percent of the unit, and included soils make up 5 to 20 percent. The included soils are the Padrones, Quiteria, Sarita, and Yturria soils.

The Sauz soil is used exclusively for rangeland. It is not suited to improved pasture and cultivated crops because of the hazard of wind erosion, the low available water capacity, the salinity, and wetness.

The climax plant community consists of open grassland plants interspersed with scattered mesquite trees in some areas. Where the range is in excellent condition, forage production is high but palatability is low during most of the year. Most of the mapped areas are dominated by gulf cordgrass. A planned grazing system and controlled burning can improve and maintain forage production.

This soil is severely limited for all urban uses. The wetness is the main limitation. It is difficult and costly to overcome. Corrosivity is a limitation affecting uncoated steel and concrete. Corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. Cements that have pozzolanic admixtures can be used to reduce the rate of concrete deterioration.

Excess sodium and salt in the subsoil and the sandy surface layer are limitations affecting recreational development. The excess sodium and salt in the subsoil interfere with plant growth. The sandy surface layer is subject to soil blowing in areas where the soil is bare of vegetation. It does not provide a good base for roads and streets or for paths and trails. Backfilling with loamy material can help to overcome this limitation.

This soil is seldom used by wildlife except as a fawning area by deer.

This soil is in capability subclass VIs and in the Sandy Flat range site.

TSA—Tasajal loamy fine sand, nearly level. This soil is moderately deep or deep to a cemented pan. It is on broad, smooth uplands. The surface is plane or slightly convex. Individual areas are irregular in shape and range from 15 to 350 acres in size. Slopes are 0 to 1 percent.

Typically, the surface layer is very friable, medium acid, pale brown loamy fine sand about 12 inches thick. The upper part of the subsoil, from a depth of 12 to 19 inches, is firm, neutral, dark brown fine sandy loam. The next part, from a depth of 19 to 28 inches, is firm, moderately alkaline, light yellowish brown fine sandy loam. The lower part, from a depth of 28 to 34 inches, is friable, moderately alkaline, very pale brown fine sandy loam. The underlying material is white caliche that is indurated in the upper part. It becomes less cemented with increasing depth.

This soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is low. The root zone is moderately deep, but the cemented pan restricts the movement of air and water and the penetration of roots. In areas where the soil is bare of vegetation, the hazard of water erosion is slight and the hazard of wind erosion is severe.

The Tasajal soil makes up 75 to 90 percent of the unit, and included soils make up 10 to 25 percent. The included soils are the Nueces, Quiteria, and Sarita soils.

The Tasajal soil is used as rangeland or wildlife habitat.

The climax plant community consists of open grassland plants interspersed with a few woody species and an abundance of forbs. Where the range is in excellent condition, forage production is only medium because of the low available water capacity and a low fertility level. A planned grazing system and brush management can improve and maintain forage production.

Establishing pasture grasses is difficult because the soil dries out rapidly and is subject to wind erosion. Salinity, the low fertility level, and the low available water capacity reduce yields. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity. Suitable pasture species are coastal bermudagrass, kleingrass, buffelgrass, Wilman lovegrass, and alamo switchgrass (fig. 9).

This soil is marginally suited to cultivated crops. Suitable crops are watermelons, grain sorghum, and forage sorghum. Limitations include salinity, the low fertility level, and the low available water capacity. Applications of fertilizer, conservation tillage, crop residue management, and cover crops are needed. Leaving crop residue on the surface can help to improve tilth, control wind erosion, and conserve soil moisture. Planting wind stripcrops or stripcropping can help to control wind erosion by reducing wind velocity near the soil surface.

This soil is severely limited as a site for some urban uses. It is limited as a site for septic tank absorption fields, sewage lagoons, sanitary landfills, shallow excavations, and dwellings with basements because of the depth to the cemented pan. In most areas the cemented pan can be excavated with a backhoe. In areas used as sites for septic tank absorption fields, properly designing the absorption field or increasing the size of the field can help to overcome this limitation. Seepage is a limitation on sites for sewage lagoons. Excess sodium is the main limitation on sites for trench sanitary landfills. Corrosion of uncoated steel and concrete are hazards. The corrosion of uncoated steel can be overcome by providing cathodic protection or by using galvanized steel. The corrosion of cement can be reduced by using special pozzolanic admixtures.

This soil is limited for recreational development because of excess sodium. Backfilling with loamy material can help to overcome this limitation.

Quail, dove, and nongame birds use areas of this soil for food and cover. As the density of brush and trees increases, areas become better suited to deer and javelinas.

This soil is in capability subclass IVs and in the Loamy Sand range site.

TuC—Turcotte fine sandy loam, 2 to 8 percent slopes. This very deep, gently sloping to strongly sloping soil is on loamy eolian dunes. These dunes commonly form elongated ridges along the leeward margins of saline playas. Some ridges are as much as 30 feet high. The surface is convex. Areas range from 50 to 200 acres in size.

Typically, the surface layer is very friable, dark grayish brown fine sandy loam about 10 inches thick. The subsoil is friable sandy clay loam. The upper part, from a depth of 10 to 25 inches, is light brownish gray. The next part, from a depth of 25 to 38 inches, is pale brown. The lower part, from a depth of 38 to 80 inches, is very pale brown. The soil is calcareous and moderately alkaline throughout.

This soil is well drained. Runoff is medium or rapid. Permeability is moderate, and the available water capacity also is moderate. The root zone is deep and can be easily penetrated by plant roots. In areas where the soil is bare of vegetation, the hazard of water erosion is severe and the hazard of wind erosion is moderate.

The Turcotte soil and a similar soil make up 70 to 90 percent of the unit, and included soils make up 10 to 30 percent. The similar soil has a surface layer that is lighter in color than that of the Turcotte soil. The included soils are the Sauz and Yturria soils. Also included is a soil that has hard caliche at a depth of 20 to 40 inches.

The Turcotte soil is used mainly as rangeland, improved pasture, or wildlife habitat.

The climax plant community consists of open grassland plants of dominantly mid grasses interspersed with some forbs and woody species. Where the range is in excellent condition, forage production is only medium because of the moderate available water capacity. Continuous overgrazing reduces the amount of quality forage by replacing the more desirable grasses and forbs with less desirable grasses, brush, and trees. A planned grazing system and brush management can improve and maintain forage production.

Buffelgrass and coastal bermudagrass are the main pasture grasses. Other suitable species are kleingrass, alamo switchgrass, and Wilman lovegrass. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

The Turcotte soil is moderately suited to cropland. The main limitations are wind erosion, water erosion, the slope, and runoff. Management objectives include controlling erosion, improving tilth, and conserving soil

Figure 9.—A vigorous stand of alamo switchgrass in an area of Tasajal loamy fine sand, nearly level. Brush has been removed, and the area has been seeded.

moisture. Terracing and farming on the contour help to slow runoff and control erosion. Growing closely spaced crops and leaving crop residue on the surface help to slow runoff, improve tilth, and conserve soil moisture.

This soil is limited as a site for most urban uses. It is limited as a site for septic tank absorption fields because of the slow movement of water through the profile. This limitation can be overcome by properly designing the absorption field and by increasing the size of the field. The soil is limited as a site for sewage lagoons because of the slope and the hazard of seepage. It is moderately limited as a site for trench sanitary landfills in areas where the subsoil is clay loam. The shrink-swell potential is a limitation affecting the construction of buildings. It can be overcome by strengthening the foundation of buildings or by stabilizing the moisture content of the adjacent soil. The moderate shrink-swell potential and the low soil strength are limitations affecting the construction of roads and streets. These limitations can be overcome by stabilizing, strengthening, or replacing the base material. Corrosion of uncoated steel is a hazard. It can be overcome by providing cathodic protection or by using galvanized steel.

This soil is only slightly limited as a site for most recreational uses. The slope is the main limitation affecting sites for playgrounds. It is difficult to overcome.

Areas of this soil are used by deer, dove, turkey, quail, and javelinas. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for game birds and animals.

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

VRA—Vargas-Jardin complex, nearly level. These soils are moderately deep or shallow to a cemented pan. They are on broad, smooth uplands. The surface is plane or slightly concave. Individual areas are irregular in shape and range from 10 to 100 acres in size. Slopes are 0 to 1 percent.

The Vargas soil makes up 50 to 60 percent of the complex, the Jardin soil makes up 35 to 45 percent, and included soils make up 5 to 15 percent. These soils occur as areas so intricately mixed that mapping them separately was not practical at the selected scale.

Typically, the surface layer of the Vargas soil is very friable, mildly alkaline, grayish brown fine sandy loam about 10 inches thick. The subsoil is friable and moderately alkaline. The upper part, from a depth of 10 to 17 inches, is brown fine sandy loam. The next part, from a depth of 17 to 27 inches, is light brownish gray fine sandy loam. The lower part, from a depth of 27 to 33 inches, is pale brown gravelly sandy loam that has, by volume, about 30 percent concretions and nodules of calcium carbonate. The underlying material is white, strongly cemented caliche that has pockets and seams of weakly cemented caliche.

The Vargas soil is well drained. Runoff is slow. Permeability is moderate, and the available water capacity is low. The root zone is moderately deep. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Typically, the surface layer of the Jardin soil is friable, mildly alkaline, brown fine sandy loam about 15 inches thick. The underlying material is white caliche that is indurated in the upper part. It becomes less cemented and massive with increasing depth.

The Jardin soil is well drained. Runoff is medium. Permeability is moderate, and the available water capacity is very low. The root zone is shallow because the cemented pan restricts the movement of air and water and the penetration of roots. The hazard of water erosion is slight, and the hazard of wind erosion is moderate.

Included in mapping are small areas of Comitas, Delmita, Nueces, and Yturria soils. Also included are small areas of soils that have caliche at or near the surface.

The Vargas and Jardin soils are used mainly as rangeland or wildlife habitat. A few areas are used as improved pasture. These soils are not suited to cultivated crops because of the intricate pattern of the Jardin soil within the unit and its shallowness to a cemented pan.

The climax plant community consists of open grassland plants interspersed with scattered brush and forbs. Forage production is low. It is limited by the low fertility level and the limited available water capacity, both of which result from the shallowness to a cemented pan. Controlled grazing and brush management can improve and maintain forage production.

Coastal bermudagrass and buffelgrass are the main pasture grasses. Pasture yields are reduced by a low fertility level and the limited available water capacity. Applying fertilizer, controlling weeds and grazing, and managing brush are management needs.

These soils are severely limited as sites for some urban uses because of the depth to the cemented pan. In most areas the cemented pan can be excavated with a backhoe. Overcoming this limitation can be difficult and costly on sites for septic tank absorption fields, sewage lagoons, and sanitary landfills. Increasing the size of the absorption field helps to overcome this limitation in areas of the Vargas soil. When a septic tank absorption system is installed in areas of the Jardin soil, excavating the cemented pan and the underlying material and backfilling with loamy material can help to overcome the limitation. Foundations for small buildings, roads, and other structures can be built on the cemented pan in areas of the Jardin soil. Corrosion of uncoated steel is a hazard in areas of this soil. It can be overcome by providing cathodic protection or by using galvanized steel.

The Vargas soil is only slightly limited for recreational development, and the Jardin soil is severely limited. Backfilling with loamy material can help to overcome the shallowness to a cemented pan in the Jardin soil.

Brush growth on these soils is normally heavy. The brush provides food and cover for a variety of wildlife. The carrying capacity for deer, javelinas, turkey, and quail is generally lower than that of the more productive adjacent soils.

The unit is in capability subclass VIs and in the Shallow Sandy Loam range site.

YtB—Yturria fine sandy loam, 0 to 3 percent slopes. This very deep, nearly level to gently sloping soil is on loamy eolian ridges. These ridges are along the leeward and windward margins of depressions or saline playas. The surface is convex. Individual areas are irregular in shape and range from 10 to 400 acres in size.

Typically, the surface layer is very friable, mildly alkaline, dark brown fine sandy loam about 22 inches thick. The subsoil is friable, moderately alkaline fine sandy loam. The upper part, from a depth of 22 to 33 inches, is pale brown. The next part, from a depth of 33 to 47 inches, is very pale brown and has a few fine concretions of calcium carbonate. The lower part, from a depth of 47 to 80 inches, also is very pale brown.

This soil is well drained. Runoff is slow. Permeability is moderately rapid, and the available water capacity is moderate. The root zone is deep and can be easily penetrated by plant roots. In areas where the soil is bare of vegetation, the hazards of water erosion and wind erosion are moderate.

The Yturria soil and a similar soil make up 80 to 90 percent of the unit, and included soils make up 10 to 20 percent. The similar soil has a dark surface layer that is 10 to 20 inches thick. The included soils are the Delmita, Edroy, Turcotte, and Sauz soils. Also included are depressions less than 10 acres in size. These depressions are intermittently filled with water.

The Yturria soil is used mainly as rangeland, wildlife habitat, or improved pasture. A few areas are used as cropland.

The climax plant community consists of open grassland plants of dominantly mid grasses interspersed with some forbs and woody species. Where the range is in excellent condition, forage production is high but is limited by the moderate available water capacity. Overgrazing reduces the amount of quality forage by replacing desirable grasses and forbs with those of lower forage value and by increasing the amount of brush and trees. A planned grazing system and brush management can improve and maintain forage production.

Buffelgrass and coastal bermudagrass are the main pasture grasses. Other suitable species are kleingrass, Wilman lovegrass, and alamo switchgrass. Applying fertilizer, controlling weeds and grazing, and managing brush can help to improve and maintain productivity.

Grain sorghum, forage sorghum, and watermelons are the main cultivated crops. The main limitations are the hazards of wind erosion and water erosion and the slope. Management objectives include controlling erosion, improving tilth, and conserving soil moisture. Terracing and farming on the contour help to slow runoff and control erosion. Growing closely spaced crops and leaving crop residue on the surface help to slow runoff, improve tilth, and conserve soil moisture.

This soil has few limitations affecting urban uses. Seepage is a hazard on sites for sewage lagoons and sanitary landfills. Only slight limitations affect recreational uses.

Areas of this soil are used by deer, dove, turkey, quail, and javelinas. Several of the woody plants, forbs, and grasses provide good cover, browse, mast, and seeds for game birds and animals.

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

Prime Farmland

In this section, prime farmland is defined and the soils in Brooks County that are considered prime farmland are listed.

Prime farmland is one of several kinds of important farmland defined by the U.S. Department of Agriculture. It is of major importance in meeting the Nation's short- and long-range needs for food and fiber. The acreage of high-quality farmland is limited, and the U.S. Department of Agriculture recognizes that government at local, state, and federal levels, as well as individuals, must encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland soils, as defined by the U.S. Department of Agriculture, are soils that are best suited to food, feed, forage, fiber, and oilseed crops. Such soils have properties that favor the economic production of sustained high yields of crops. The soils need only to be treated and managed by using acceptable farming methods. The moisture supply must be adequate, and the growing season must be sufficiently long. Prime farmland soils produce the highest yields with minimal expenditure of energy and economic resources. Farming these soils results in the least damage to the environment.

Prime farmland soils may presently be used as cropland or pasture or for other purposes. They are used for food or fiber or are available for these uses. Urban or built-up land, public land, and water areas cannot be considered prime farmland. Urban or built-up land is any contiguous unit of land 10 acres or more in size that is used for such purposes as housing, industrial, and commercial sites, sites for institutions or public buildings, small parks, golf courses, cemeteries, railroad yards, airports, sanitary landfills, sewage treatment plants, and water-control structures. Public land is land not available for farming in national forests, national parks, military reservations, and state parks.

Prime farmland soils usually receive an adequate and dependable supply of moisture from precipitation or irrigation. The temperature and growing season are favorable. The acidity or alkalinity level of the soils is acceptable. The soils have few or no rocks and are permeable to water and air. They are not excessively erodible or saturated with water for long periods and are not frequently flooded during the growing season. The slope ranges mainly from 0 to 3 percent.

The following map units are considered prime farmland in Brooks County. The location of each map unit is shown on the detailed soil maps at the back of this publication. The extent of each unit is given in table 4. The soil qualities that affect use and management are described in the section "Detailed Soil Map Units." This list does not constitute a recommendation for a particular land use.

Soils that have an inadequate supply of moisture may qualify as prime farmland if this limitation is overcome by irrigation. If applicable, the need for irrigation is indicated in parentheses after the map unit name in the following list. Onsite evaluation is necessary to determine if the limitation has been overcome by the corrective measures.

The soils identified as prime farmland in Brooks County are:

COB	Comitas loamy fine sand, gently undulating (where irrigated)
CzA	Czar fine sandy loam, rarely flooded
DeB	Delfina loamy fine sand, 0 to 2 percent slopes (where irrigated)
DfB	Delfina fine sandy loam, 0 to 2 percent slopes
YtB	Yturria fine sandy loam, 0 to 3 percent slopes (where irrigated)

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help avoid soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis for predicting soil behavior.

Information in this section can be used to plan the use and management of soils for crops and pasture; as rangeland; as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreation facilities; and for wildlife habitat. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern that is in harmony with nature.

Contractors can use this survey to locate sources of sand and gravel, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

Crops and Pasture

Mike Black, range conservationist, Soil Conservation Service, helped prepare this section.

General management needed for crops and pasture is suggested in this section. The crops or pasture plants best suited to the soils, including some not commonly grown in the survey area, are identified; the system of land capability classification used by the Soil Conservation Service is explained; and the estimated yields of the main crops and hay and pasture plants are listed for each soil.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "Detailed Soil Map Units." Specific information can be obtained from the local office of the Soil Conservation Service or the Cooperative Extension Service.

According to estimated resource data for Brooks County, 49,344 acres in the survey area is used for crops and pasture. Of this total, 13,849 acres is used for row crops, mostly grain sorghum and corn; 1,700 acres for vegetation, mostly watermelons; 2,410 acres for close-growing crops; and 31,385 acres for permanent pasture.

Wind erosion is the major management concern on nearly all of the cropland because of the coarse textured surface layer of the soils. Water erosion is an additional concern in some areas where the slope is more than 2 percent. Loss of the surface layer through erosion is damaging for two reasons. First, productivity is reduced as the surface layer is lost and part of the subsoil is incorporated into the plow layer. Second, soil erosion on farmland results in sediment entering streams and watercourses. Controlling erosion minimizes the pollution of streams and lakes by sediment and improves the quality of water for livestock and for fish and other wildlife.

Residue management practices, such as conservation tillage, delayed seedbed preparation, and crop residue management help to control erosion. Leaving crop residue on the surface helps to protect the soil against surface crusting and the impact of raindrops, reduce wind erosion, and decrease the runoff rate. It also provides shade for the soil and thus reduces the soil temperature and evaporation rate. Crop residue increases the content of organic matter, improves tilth, and minimizes compaction caused by farm machinery. It should be protected from overgrazing and burning. Using noninversion tillage equipment that leaves crop residue on the surface is very effective in controlling erosion and minimizing compaction. Stripcropping also helps to control wind erosion.

Parallel terraces are effective in controlling water erosion because they reduce the length of the slope. They are most practical in areas of deep and moderately deep soils that have a slope of more than 1 percent.

Field crops suited to the soils and climate of Brooks County include cotton, grain sorghum, corn, watermelons, wheat, barley, and forage sorghum. Wheat, barley, and forage sorghum are the most commonly grown crops. The number of irrigation systems for field crops and pastures has slightly increased in areas that have sufficient ground water of good quality.

Because raising beef cattle is the main agricultural enterprise in the county, pasture management is important. The trend for the past several years has been to convert land from other uses to pasture and hayland. Introduced grasses that respond to good management practices are generally planted. They are used mainly in combination with native range to provide year-round grazing. They are also used for supplemental grazing or haying.

Perennial grasses that are well adapted to the county include coastal bermudagrass, kleingrass, Wilman lovegrass, common buffelgrass, and alamo switchgrass.

Good management practices for pasture include fertilization, rotation grazing, proper grazing use, weed control, and brush management. Good management practices for hayland include applying fertilizer and cutting at the proper height and stage of plant growth to maintain plant vigor.

Yields per Acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors. The land capability classification of each map unit also is shown in the table.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations are also considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for use as cropland *(5)*. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major, and generally expensive, landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit. Only class and subclass are used in this survey.

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

Class I soils have few limitations that restrict their use.

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

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

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

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

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

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

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

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

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

The capability classification of each map unit is given in the section "Detailed Soil Map Units" and in the yields table.

Rangeland

Mike Black, range conservationist, Soil Conservation Service, helped prepare this section.

Rangeland occurs as areas where native vegetation consists of a wide variety of grasses, grasslike plants, forbs, shrubs, and trees. The vegetation is generally suitable for grazing by domestic livestock and native wildlife. Rangeland, or native grassland, receives no regular or frequent cultural treatment. The composition and production of the plant community are directly related to soil, climate, topography, overstory canopy, and grazing management.

About 90 percent of the county, or 550,000 acres, is rangeland. A savannah makes up the central and east-central portions of the county. It was originally characterized by tall and mid grasses, forbs, and live oak trees. The rest of the county is characterized by widely scattered mesquite and mixed brush motts. Most of the rangeland is currently used for cow-calf production. On the larger ranches, some horses are raised for general ranch work.

The plant communities in Brooks County have changed drastically during the past 100 years. Continuous heavy grazing has resulted in a deteriorated and depleted plant community. Most of the high producing, high quality vegetation has been grazed out and now only grows in a few places. In most areas the higher quality plants have been replaced by a mixture of lower quality grasses, forbs, and brush. In areas where remnants of the higher quality plant communities still occur, good grazing management can help to reestablish these plants.

Approximately 30 percent of the annual rainfall occurs in April, May, and June. Rainfall during these months produces about 70 percent of the annual growth of warm-season plants. A mid-summer growth slump occurs in July and August because of the lower amounts of rainfall and the higher temperatures. A secondary growth period occurs in September, October, and early November, when fall rains and somewhat cooler temperatures are common. This production period, however, is limited because of the increasingly cooler temperatures and shorter periods of daylight.

Different kinds of soil vary in their capacity to produce grasses and other plants for grazing. Soils that produce about the same kinds, amounts, and proportions of forage make up a range site.

The climax vegetation on a range site is the potential natural plant community. It reproduces itself and changes very little as long as the environment remains unchanged. It consists of plants that grew in the area when it was first settled. The most productive combination of forage plants on a range site is generally the climax vegetation.

Range management requires a knowledge of the kinds of soil and of the climax plant community. It also requires an evaluation of the present range condition. Range condition is determined by comparing the present plant community with the climax plant community on a particular range site. The more closely the existing community resembles the climax community, the better the range condition. Range condition is an ecological rating only. It does not have a specific meaning that pertains to the present plant community in a given use.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation for that site. A range is in excellent condition if 76 to 100 percent of the vegetation is the same kind as that in the climax stand, in good condition if the percentage is 51 to 75, in fair condition if the percentage is 26 to 50, and in poor condition if the percentage is 25 or less.

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

Table 6 shows, for nearly all soils, the range site and the potential yearly production of vegetation in favorable, average, and unfavorable years. Only those soils that are used as rangeland or are suited to use as rangeland are listed. An explanation of the column headings in table 6 follows.

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, or proportion of range plants. The relationship between soils and vegetation was ascertained during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

Potential yearly production is the amount of vegetation that can be expected to grow annually on well managed rangeland that is in excellent condition. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants, but it does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, average, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture.

Yields are adjusted to a common percent of air-dry moisture content. The relationship of green weight to air-dry weight varies according to such factors as exposure, amount of shade, recent rains, and unseasonable dry periods.

A primary objective of range management is to keep the range in excellent or good condition. If the range is well managed, water is conserved, yields are improved, and the soils are protected. The main management concern is recognizing important changes that occur in the kinds of plants on a range site. These changes take place gradually and can be misinterpreted or overlooked. Plant growth that occurs because of heavy rainfall can lead to the conclusion that the range is in good condition when actually the cover may be weedy and the long-term trend may be toward lower production. On the other hand, rangeland that has been closely grazed for short periods under careful management may have a degraded appearance that temporarily conceals its quality and ability to recover.

Following years of prolonged overuse of rangeland, seed sources of desirable vegetation will be eliminated. Under these conditions, the vegetation must be reestablished before management can be effective. The condition of the range can be improved by controlling brush, range seeding, fencing, and developing water sources. Thereafter, deferred grazing, proper grazing use, and a planned grazing system can help to maintain or improve the range.

The county has nine range sites. These are Lakebed, Loamy Sand, Ramadero, Red Sandy Loam, Sand Hill, Sandy, Sandy Flat, Sandy Loam, and Shallow Sandy Loam.

Lakebed range site. The Edroy soil in map unit EdA is in this range site. The climax vegetation grows on an open grassland that has varying degrees of wetness. The composition, by weight, is about 95 percent grasses and 5 percent forbs.

About 70 percent of the climax vegetation is made up of a combination of hartweg paspalum, spike lovegrass, white tridens, switchgrass, and vine-mesquite. The other grasses are buffalograss, knotroot bristlegrass, knotgrass paspalum, and grasslike sedges and rushes. Almost all of the forbs are annual.

If retrogression occurs as a result of heavy grazing, switchgrass, hartweg paspalum, and vine-mesquite are replaced by common bermudagrass, sedges, rushes, knotroot bristlegrass, and some woody plants. If heavy grazing continues for many years, woody plants, such as huisache, retama, mesquite, and sesbania, increase in abundance and form dense stands that have an understory of threeawns, broomweed, and ragweed.

Loamy Sand range site. The Comitas, Delfina, Palobia, Quiteria, and Tasajal soils in map units COB, DeB, DfB, PbA, PfA, QTA, and TSA are in this range site. The climax vegetation grows on an open grassland that is dominated by mid and tall grasses interspersed with scattered trees and shrubs and a wide variety of forbs. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

About 65 percent of the climax vegetation is made up of a combination of little bluestem, seacoast bluestem, switchgrass, tanglehead, brownseed paspalum, plains bristlegrass, southwestern bristlegrass, hooded windmillgrass, Arizona cottontop, and feather bluestem. The other grasses include knotroot panicum, fall witchgrass, balsamscale, fringeleaf paspalum, pink pappusgrass, and threeawns. Forbs include bushsunflower, orange zexmania, dalea, snoutbean, western indigo, sensitive briar, dayflower, verbena, mallow, and croton. Woody plants include live oak, mesquite, and spiny hackberry.

If retrogression occurs as a result of heavy grazing, little bluestem, seacoast bluestem, switchgrass, tanglehead, and perennial forbs are replaced by brownseed paspalum, plains bristlegrass, hooded windmillgrass, balsamscale, pink pappusgrass, threeawns, and annuals. If heavy grazing continues for many years, balsamscale, threeawns, annual grasses, annual weeds, croton, and mesquite significantly increase in abundance.

Ramadero range site. The Papagua soil in map unit PpA is in this range site. The climax vegetation grows on an open grassland. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

About 70 percent of the climax vegetation is made up of a combination of fourflower trichloris, Arizona cottontop, sideoats grama, fall witchgrass, plains bristlegrass, pink pappusgrass, and feather bluestem. The other grasses are buffalograss, curlymesquite, lovegrass tridens, hooded windmillgrass, and vine-mesquite. Forbs include Engelmann daisy, bushsunflower, and sensitive briar. Woody plants include spiny hackberry, sugar hackberry, vine ephedra, and Texas columbrina.

If retrogression occurs as a result of heavy grazing, fourflower trichloris, Arizona cottontop, and plains bristlegrass are replaced by hooded windmillgrass, pink pappusgrass, tumble windmillgrass, and threeawns. Perennial forbs are replaced by annual forbs and an increase of woody species. If heavy grazing continues for many years, mesquite, huisache, lotebush, and whitebrush significantly increase in abundance.

Red Sandy Loam range site. The Delmita soils in map units DMB and DtB are in this range site. The climax vegetation grows on an open grassland interspersed with scattered low shrubs and a variety of forbs. The composition, by weight, is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

About 50 percent of the climax vegetation is made up of a combination of Arizona cottontop, fourflower trichloris, tanglehead, plains lovegrass, feather bluestem, plains bristlegrass, and Texas bristlegrass. The other grasses are fringeleaf paspalum, pink pappusgrass, slim tridens, hooded windmillgrass, threeawns, and fall witchgrass. Forbs include bushsunflower, orange zexmania, partridge pea, sensitive briar, bundleflower, snoutbean, Engelmann daisy, dalea, and knotweed leafflower. Woody plants include condalia, desert yaupon, guayacan, pricklyash, vine ephedra, bumelia, Texas columbrina, guajillo, leatherstem, and kidneywood.

If retrogression occurs as a result of heavy grazing, Arizona cottontop, fourflower trichloris, tanglehead, plains lovegrass, and perennial forbs are replaced by plains bristlegrass, Texas bristlegrass, slim tridens, hooded windmillgrass, annuals, mat sandbur, tumblegrass, red threeawn, fringed signalgrass, and red lovegrass. If heavy grazing continues for many years, mesquite, catclaw, pricklypear, and leatherstem significantly increase in abundance.

Sand Hill range site. The Falfurrias soil in map unit FAB is in this range site. The climax vegetation grows on an open prairie interspersed with motts of live oak. The composition, by weight, is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

About 60 percent of the climax vegetation is made up of a combination of seacoast bluestem, indiangrass, crinkleawn, tanglehead, brownseed paspalum, and Texasgrass. The other grasses are fringeleaf paspalum, knotroot panicum, threeawns, gulfdune paspalum, and balsamscale. Forbs include bundleflower, sensitive briar, snoutbean, yellow neptunia, and gayfeather. Woody plants include live oak, pricklypear, spiny hackberry, mesquite, and condalia.

If retrogression occurs as a result of heavy grazing, seacoast bluestem, crinkleawn, indiangrass, tanglehead, Texasgrass, and perennial forbs are replaced by brownseed paspalum, fringeleaf paspalum, knotroot panicum, threeawns, balsamscale, annuals, and some woody species. If heavy grazing continues for many years, threeawns, balsamscale, annual grasses, and annual weeds significantly increase in abundance and mesquite increases to a lesser degree. An overstory of live oak has become dominant on much of this site.

Sandy range site. The Nueces, Padrones, and Sarita soils in map units NFB, NSB, PAA, and SAB and the Sarita soil in map unit SSB are in this range site. The climax vegetation grows on an open grassland interspersed with a variety of forbs, a few mesquite trees, and an occasional large live oak. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

About 70 percent of the climax vegetation is made up of a combination of seacoast bluestem, switchgrass, indiangrass, crinkleawn, and brownseed paspalum. The other grasses are fringeleaf paspalum, balsamscale, gulfdune paspalum, hooded windmillgrass, Wright threeawn, and fall switchgrass. Forbs include snoutbean, sensitive briar, partridge pea, croton, western indigo, and beebalm. Woody plants include mesquite, lantana, and live oak.

If retrogression occurs as a result of heavy grazing, seacoast bluestem, switchgrass, crinkleawn, and snoutbean are replaced by brownseed paspalum, fringeleaf paspalum, balsamscale, Wright threeawn, croton, and partridge pea. If heavy grazing continues for many years, balsamscale, Wright threeawn, annual grasses, queen's delight, mesquite, and annual forbs significantly increase in abundance.

Sandy Flat range site. The Sauz soils in map units SZA and SSB are in this range site. The climax vegetation grows on an open prairie. The composition, by weight, is about 95 percent grasses, 5 percent forbs, and a trace of woody plants.

About 65 percent of the climax vegetation is made up of a combination of gulf cordgrass, seacoast bluestem, bushy bluestem, broomsedge bluestem, and switchgrass. The other grasses are alkali sacaton, hartweg paspalum, Florida paspalum, sprangletop, windmillgrass, fringed signalgrass, red lovegrass, and tumble lovegrass. Forbs include American snoutbean, sensitive briar, croton, and partridge pea. Woody plants include mesquite.

If retrogression occurs as a result of heavy grazing, seacoast bluestem and switchgrass are replaced by broomsedge bluestem, bushy bluestem, lovegrass, signalgrass, croton, and partridge pea. If heavy grazing continues for many years, gulf cordgrass, hartweg paspalum, partridge pea, croton, and other annual forbs significantly increase in abundance.

Sandy Loam range site. The Czar, Turcotte, and Yturria soils in map units CzA, TuC, and YtB are in this range site. The climax vegetation grows on an open grassland interspersed with a variety of mixed brush and forbs. The composition, by weight, is about 90 percent grasses, 5 percent forbs, and 5 percent woody plants.

About 80 percent of the climax vegetation is made up of a combination of fourflower trichloris, tanglehead, little bluestem, Arizona cottontop, feather bluestem, pink pappusgrass, plains bristlegrass, and hooded windmillgrass. The other grasses are slim tridens, knotroot panicum, lovegrass tridens, fall witchgrass, threeawns, and fringeleaf paspalum. Forbs include orange zexmania, bushsunflower, sensitive briar, velvet bundleflower, Engelmann daisy, dalea, partridge pea, croton, and other annuals. Woody plants include kidneywood, vine ephedra, spiny hackberry, blackbrush, desert yaupon, condalia, wolfberry, guyacan, and mesquite.

If retrogression occurs as a result of heavy grazing, fourflower trichloris, tanglehead, plains bristlegrass, bushsunflower, bundleflower, and lovegrass tridens are replaced by pink pappusgrass, slim tridens, threeawns, fringeleaf paspalum, orange zexmania, and annual forbs. If heavy grazing continues for many years, fringeleaf paspalum, threeawns, annual forbs, blackbrush, mesquite, spiny hackberry, condalia, and cacti significantly increase in abundance.

Shallow Sandy Loam range site. The Jardin and Vargas soils in map units JDB and VRA are in this range site. The climax vegetation grows on grassland interspersed with a variety of brush and forbs. The composition, by weight, is about 85 percent grasses, 10 percent forbs, and 5 percent woody plants.

About 65 percent of the climax vegetation is made up of a combination of feather bluestem, Arizona cottontop, plains bristlegrass, slim tridens, tanglehead, pink pappusgrass, fall witchgrass, and hooded windmillgrass. The other grasses are sand dropseed, threeawns, red grama, gummy lovegrass, and fringeleaf paspalum. Forbs include orange zexmania, bushsunflower, sensitive briar, dalea, snoutbean, evening primrose, and croton. Woody plants include guajillo, spiny hackberry, blackbrush, condalia, vine ephedra, desert yaupon, shrubby bluesage, kidneywood, and southwest bernardia.

If retrogression occurs as a result of heavy grazing, plains bristlegrass, Arizona cottontop, bushsunflower, snoutbean, tanglehead, and feather bluestem are replaced by pink pappusgrass, sand dropseed, gummy lovegrass, fringeleaf paspalum, and annual forbs. If heavy grazing continues for many years, guajillo, condalia, blackbrush, threeawns, red grama, and annual grasses and forbs significantly increase in abundance.

Recreation

In table 7, the soils of the survey area are rated according to the limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 7, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 7 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 10 and interpretations for dwellings without basements and for local roads and streets in table 9.

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

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

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

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

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes and no stones or boulders on the surface. The suitability of the soil for tees or greens is not considered in rating the soils.

Wildlife Habitat

Jerry Turrentine, area biologist, Soil Conservation Service, helped prepare this section.

Wildlife provides a major source of income and recreational opportunities in Brooks County. Most of the land that supports wildlife is leased for hunting or is used by the owners for hunting. Careful management of the wildlife habitat has increased the number of many wildlife species in the county. Special emphasis has been given to the improvement of the habitat for game species. Some of the largest white-tailed deer in the state can be found in Brooks County. The county also offers some of the best quail hunting in the state, and in localized areas of live oak, the turkey population is high.

The major game species are white-tailed deer, bobwhite quail, turkey, javelina, and mourning dove. Other species include fox, raccoon, badger, skunk, opossum, armadillo, cottontail, jackrabbit, squirrel, bats, and numerous rodents. Common predators include coyote, bobcat, and an occasional mountain lion.

The extent of surface water areas is limited but can increase dramatically in wet years or following hurricanes. These areas are widely used by animals and birds and provide habitat for amphibians. Several species of reptiles inhabit the county. The diamondback rattlesnake is the best known of these species.

During the migratory period, waterfowl use areas of water and cropland in the county as sources of food and as resting sites. The waterfowl species include the Canada goose, white-fronted goose, widgeon, pintail, gadwall, teal, ring-necked duck, and sandhill crane. Other birds in the county include numerous species of songbirds, white-fronted dove, some water-associated species, and vultures. Many raptors, such as the white-tailed kite, sharp-shinned hawk, red-tailed hawk, and harris hawk, inhabit the county or migrate through it.

The successful management of wildlife habitat relies on a suitable combination of food, cover, and water. A lack of any one of these or an unfavorable balance or inadequate distribution of them can severely limit the kinds and abundance of wildlife. Information about the soil can provide a valuable tool for establishing, improving, or maintaining suitable food, cover, and water for wildlife. It also is useful in selecting sites for wildlife habitat.

Most areas of wildlife habitat can be established or improved by planting suitable vegetation, by managing existing vegetation for its natural regeneration, by increasing the number of or improving the quality of desired plants, or by applying a combination of these measures.

Proper management of habitat for openland wildlife is important. Areas of corn and grain sorghum provide food for dove and quail. Small grain can provide food for quail and for deer if suitable cover is nearby. Leaving crop residue on the surface provides forage for numerous species of wildlife. Small areas of unharvested grain provide food and cover. Properly managed waterways can provide cover for small mammals and birds. Additional cover can be provided by leaving brush in fence rows. Disking field borders can greatly increase the food supply available in pastures. Brush in pastured areas provides food and cover. Kleingrass and switchgrass provide seed for birds.

Management of habitat for rangeland wildlife should include several rangeland improvement practices. Proper grazing use, planned grazing systems, and deferred grazing can increase the amount of forage available to wildlife. Proper stocking rates for livestock help to maintain the food supply for wildlife. The population of deer should not exceed the food supply. A good vegetative cover can provide cover for quail and turkey and fawning areas for deer. If allowed to mature many grasses can provide seed for dove, quail, and turkey. Brush management is important. If brush is cleared in strips and other patterns, a diversity of food sources for various species of wildlife is created (fig. 10). Other measures that can improve the habitat include disking, planting food plots, and prescribed burning.

In table 8, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

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

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, grain sorghum, oats, and winter peas.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, flooding, and slope. Soil temperature and soil moisture are also considerations. Examples of grasses and legumes are switchgrass, lovegrass, kleingrass, and clover.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flooding. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are buckwheat, partridge pea, paspalum, tephrosia, and snoutbean.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are spiny hackberry, common pricklyash, and big lantana.

Wetland plants are annual and perennial, wild herbaceous plants that grow on moist or wet sites. Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, slope, and surface stoniness. Examples of wetland plants are smartweed, wild millet, saltgrass, cordgrass, rushes, sedges, and reeds.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water control structures. Soil properties and features affecting shallow water areas are depth to bedrock, wetness, surface

Figure 10.—An area of Palobia loamy fine sand, 0 to 1 percent slopes, where brush has been cleared in strips. The seeded grass is kleingrass.

stoniness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. Wildlife attracted to these areas include bobwhite quail, dove, coyote, cottontail, and gray fox.

Habitat for wetland wildlife consists of open, marshy or swampy shallow water areas. Some of the wildlife attracted to such areas are ducks, geese, herons, shore birds, muskrat, and mink.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include white-tailed deer, turkey, quail, coyote, bobcat, and javelinas.

Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. The ratings are given in the following tables: Building site development, Sanitary facilities, Construction materials, and Water management. The ratings are based on observed performance of the soils and on the estimated data and test data in the "Soil Properties" section.

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet, and because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, earthfill, and topsoil; plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

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

Building Site Development

Table 9 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet for basements, graves, utility lines, open ditches, and other purposes. The ratings are based on soil properties, site features, and observed performance of the soils. The ease of digging, filling, and compacting is affected by the depth to bedrock, a cemented pan, or a very firm dense layer, stone content, soil texture, and slope. The time of the year that excavations can be made is affected by the depth to a seasonal high water table and the susceptibility of the soil to flooding. The resistance of the excavation walls or banks to sloughing or caving is affected by soil texture and depth to the water table.

Dwellings and *small commercial buildings* are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. The ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, shrink-swell potential, and organic layers can cause the movement of footings. Depth to a high water table, depth to bedrock or to a cemented pan, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 or 6 feet are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet. The ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or to a cemented pan, depth to a high water table, flooding, large stones, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soil), shrink-swell potential, frost-action potential, and depth to a high water table affect the traffic-supporting capacity.

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, depth to a high water table, depth to bedrock or to a cemented pan, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

Sanitary Facilities

Table 10 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 10 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and that good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches is evaluated. The ratings are based on soil properties, site features, and observed performance of the soils. Permeability, depth to a high water table, depth to bedrock or to a cemented pan, and flooding affect absorption of the effluent. Large stones and bedrock or a cemented pan interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet below the base of the absorption field, if slope is excessive, or if the water table is near the surface. There must be unsaturated soil material beneath the absorption field to filter the effluent effectively. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Lagoons generally are designed to hold the sewage within a depth of 2 to 5 feet. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water.

Table 10 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, depth to a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

Excessive seepage resulting from rapid permeability in the soil or a water table that is high enough to raise the level of sewage in the lagoon causes a lagoon to function unsatisfactorily. Pollution results if seepage is excessive or if floodwater overtops the lagoon. A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed of by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench. It is spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site.

Both types of landfill must be able to bear heavy vehicular traffic. Both types involve a risk of ground-water pollution. Ease of excavation and revegetation should be considered.

The ratings in table 10 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, depth to a water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 11 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help to determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by large stones, a high water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, many stones, or slopes of more than 25 percent. They are wet, and depth to the water table is less than 1 foot. These soils may have layers of suitable material, but the material is less than 3 feet thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In table 11, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick and less than 50 percent, by weight, large stones. All other soils are rated as an improbable source. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by rock fragments, slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, rock fragments, bedrock, and toxic material.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches. They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of gravel, stones, or soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of gravel, stones, or soluble salts, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and releases a variety of plant nutrients as it decomposes.

Water Management

Table 12 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives the restrictive features that affect each soil for drainage, irrigation, and terraces and diversions.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, to a cemented pan, or to other layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and the potential for frost action. Excavating and grading and the stability of ditchbanks are affected by depth to bedrock or to a cemented pan, large stones, slope, and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The construction of a system is affected by large stones and depth to bedrock or to a cemented pan. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Terraces and diversions are embankments or a combination of channels and ridges constructed across a slope to control erosion and conserve moisture by intercepting runoff. Slope, wetness, large stones, and depth to bedrock or to a cemented pan affect the construction of terraces and diversions. A restricted rooting depth, a severe hazard of wind or water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 19.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

Table 13 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil Series and Their Morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the "Glossary."

Classification of the soils is determined according to the Unified soil classification system *(2)* and the system adopted by the American Association of State Highway and Transportation Officials *(1)*.

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20, or higher, for the poorest.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

Physical and Chemical Properties

Table 14 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence the shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at ⅓ bar moisture tension. Weight is determined after drying the soil at 105 degrees C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of movement of water through the soil when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage in each major soil layer is stated in inches of water per inch of soil. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

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

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion. Losses are expressed in tons per acre per year. These estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur over a sustained period without affecting crop productivity. The rate is expressed in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the following distinctions:

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

2. Loamy coarse sands, loamy sands, loamy fine sands, loamy very fine sands, and sapric soil material. These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

3. Coarse sandy loams, sandy loams, fine sandy loams, and very fine sandy loams. These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.

4L. Calcareous loams, silt loams, clay loams, and silty clay loams. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

4. Clays, silty clays, noncalcareous clay loams, and silty clay loams that are more than 35 percent clay. These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.

5. Noncalcareous loams and silt loams that are less than 20 percent clay and sandy clay loams, sandy clays, and hemic soil material. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. Noncalcareous loams and silt loams that are more than 20 percent clay and noncalcareous silty clay loams that are less than 35 percent clay. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

7. Silts, noncalcareous clay loams that are less than 35 percent clay, and fibric soil material. These soils are very slightly erodible. Crops can be grown if ordinary measures to control wind erosion are used.

8. Soils that are not subject to wind erosion because of coarse fragments on the surface or because of surface wetness.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In table 14, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

Soil and Water Features

Table 15 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils are assigned to one of four groups. They are grouped according to the infiltration of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

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

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

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

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

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflowing streams, by runoff from adjacent slopes, or by inflow from high tides. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in swamps and marshes or in a closed depression is considered ponding.

Table 15 gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency generally is expressed as *none, rare, occasional,* or *frequent. None* means that flooding is not probable. *Rare* means that flooding is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 percent to 5 percent in any year). *Occasional* means that flooding occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year). *Frequent* means that flooding occurs often under normal weather conditions (the chance of flooding is more than 50 percent in any year). Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 days to 1 month), and *very long* (more than 1 month). The time of year that floods are most likely to occur is expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely, thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and absence of distinctive horizons characteristic of soils that are not subject to flooding.

Also considered is local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 15 are the depth to the seasonal high water table; the kind of water table, that is, *perched* or *apparent;* and the months of the year that the water table commonly is highest. A water table that is seasonally high for less than 1 month is not indicated in table 15.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. When this layer is penetrated, the water level rises in an uncased borehole. A *perched* water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Cemented pans are cemented or indurated subsurface layers within a depth of 5 feet. Such pans cause difficulty in excavation. Pans are classified as thin or thick. A thin pan is less than 3 inches thick if continuously indurated, or less than 18 inches thick if discontinuous or fractured. Excavations can be made by trenching machines, backhoes, or small rippers. A thick pan is more than 3 inches thick if continuously indurated, or more than 18 inches thick if discontinuous or fractured. Such a pan is so thick or massive that blasting or special equipment is needed in excavation.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severely corrosive environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and the amount of sulfates in the saturation extract.

Physical and Chemical Analyses of Selected Soils

The results of physical analysis of several typical pedons in the survey area are given in table 16 and the results of chemical analysis in table 17. Information on the mineralogy of several pedons is given in table 18. The data are for soils sampled at carefully selected sites. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." Soil samples were analyzed by the Soil Survey Laboratory Staff, Lincoln, Nebraska.

Most determinations, except those for grain-size analysis and bulk density, were made on soil material smaller than 2 millimeters in diameter. Measurements reported as percent or quantity of unit weight were calculated on an ovendry basis. The methods used in obtaining the data are indicated in the list that follows. The codes in parentheses refer to published methods *(7)*.

Sand—(0.05-2.0 mm fraction) weight percentages of material less than 2 mm (3A1).
Silt—(0.002-0.05 mm fraction) pipette extraction, weight percentages of all material less than 2 mm (3A1).
Clay—(fraction less than 0.002 mm) pipette extraction, weight percentages of material less than 2 mm (3A1).
Water retained—pressure extraction, percentage of ovendry weight of less than 2 mm material; ⅓ or ⅒ bar (4B1), 15 bars (4B2).
Water-retention difference—between ⅓ bar and 15 bars for whole soil (4C1).
Bulk density—of less than 2 mm material, saran-coated clods field moist (4A1a), ⅓ bar (4A1d), ovendry (4A1h).
Organic carbon—wet combustion. Walkley-Black modified acid-dichromate, ferric sulfate titration (6A1c).
Extractable cations—ammonium acetate pH 7.0, atomic absorption; calcium (6N2e), magnesium (6O2d), sodium (6P2b), potassium (6Q2b).
Extractable acidity—barium chloride-triethanolamine IV (6H5a).
Base saturation—sum of cations, TEA, pH 8.2 (5C3).
Reaction (pH)—1:1 water dilution (8C1f).
Reaction (pH)—calcium chloride (8C1f).
Iron—acid oxalate extraction (6C9a).
Electrical conductivity—saturation extract (8A3a).
Sodium adsorption ratio (5E).
Exchangeable sodium percentage (5D2).
X-ray diffraction (7A2B).
Differential thermal analysis (7A3).
Grain studies (7B1).

Engineering Index Test Data

Table 19 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil Series and Their Morphology." The soil samples were tested by the Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 422 (ASTM), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 4318 (ASTM); Plasticity index—T 90 (AASHTO), D 4318 (ASTM); Specific gravity—T 100 (AASHTO), D 854 (ASTM); and Shrinkage—T 92 (AASHTO), D 427 (ASTM).

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories *(6)*. Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or on laboratory measurements. Table 20 shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Eleven soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders, primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning dry or 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 development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplustolls (*Hapl*, meaning minimal horizonation, plus *ustoll*, the suborder of the Mollisols that has a ustic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplustolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, hyperthermic Typic Haplustolls.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. There can be some variation in the texture of the surface layer or of the underlying material within a series.

Soil Series and Their Morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" *(4)*. Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" *(6)*. Unless otherwise stated, matrix colors in the descriptions are for dry soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed Soil Map Units."

Comitas Series

The Comitas series consists of very deep, well drained, moderately rapidly permeable, sandy soils on uplands and stream terraces. These soils formed in sandy and loamy sediments that have been reworked by the wind and by water. Slopes range from 0 to 3 percent.

Typical pedon of Comitas loamy fine sand, gently undulating; from the junction of U.S. Highway 281 and Texas Highway 285 in Falfurrias, 9.8 miles west on Texas Highway 285 to the Mills-Bennett Ranch entrance, 4.6 miles south on a ranch road, 1.8 miles east on a ranch road, and 50 feet south in an area of rangeland:

A1—0 to 9 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; slightly hard, very friable; few fine and very fine roots; slightly acid; gradual smooth boundary.

A2—9 to 25 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) moist; weak coarse prismatic structure parting to weak medium subangular blocky; slightly hard, very friable; few fine and very fine roots and pores; slightly acid; clear smooth boundary.

Bt1—25 to 34 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; weak coarse prismatic structure parting to weak medium subangular blocky; very hard, firm; few fine and very fine roots and pores; thin patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt2—34 to 40 inches; brown (7.5YR 5/4) sandy clay loam, strong brown (7.5YR 4/6) moist; weak medium subangular blocky structure; very hard, firm; few fine and very fine roots and pores; thin patchy clay films on faces of peds; slightly acid; gradual smooth boundary.

Bt3—40 to 51 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; weak medium subangular blocky structure; very hard, firm; few fine and very fine pores; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

Bt4—51 to 60 inches; strong brown (7.5YR 5/6) sandy clay loam, strong brown (7.5YR 4/6) moist; weak fine subangular blocky structure; hard, friable; few fine and very fine pores; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

Btk—60 to 80 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; hard, friable; few fine and very fine pores; few thin clay films on faces of peds; few fine soft segregations of calcium carbonate; neutral.

The thickness of the solum ranges from 60 to more than 80 inches. The depth to secondary carbonates is 36 inches or more.

The A horizon is grayish brown, brown, dark grayish brown, light brownish gray, or pale brown. Reaction is slightly acid or neutral.

The Bt horizon is light brown, brown, yellowish brown, dark grayish brown, pale brown, reddish yellow, light brownish gray, light yellowish brown, or strong brown. It is fine sandy loam or sandy clay loam. The content of clay in this horizon is 12 to 24 percent. Reaction ranges from slightly acid to mildly alkaline in the upper part of the horizon and from neutral to moderately alkaline in the lower part.

The Btk horizon is light brown, reddish yellow, pale brown, pink, light yellowish brown, brownish yellow, or very pale brown. It is fine sandy loam or sandy clay loam. Reaction ranges from neutral to moderately alkaline in the matrix. The content of weakly cemented concretions and soft accumulations of calcium carbonate ranges from 2 to 8 percent, by volume.

Czar Series

The Czar series consists of very deep, well drained, moderately permeable, loamy soils that formed in loamy, calcareous sediments. These soils are on stream terraces. Slopes are 0 to 1 percent.

Typical pedon of Czar fine sandy loam, rarely flooded; from the intersection of Texas Highway 285 and U.S. Highway 281 in Falfurrias, 1.6 miles west on Texas Highway 285, and 200 feet south in a pasture:

Ap—0 to 6 inches; dark brown (10YR 3/3) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; many very fine and common fine roots; few very fine pores; few wormcasts; slightly effervescent; mildly alkaline; clear wavy boundary.

Bt—6 to 22 inches; dark brown (10YR 3/3) sandy clay loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; very hard, firm; common very fine and fine roots; few very fine pores; few wormcasts; thin patchy clay films on faces of peds; strongly effervescent; mildly alkaline; clear wavy boundary.

Btk1—22 to 30 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine and medium subangular blocky structure; very hard, firm; common very fine and fine roots; few very fine pores; few soft segregations of calcium carbonate; common fine very dark gray (10YR 3/1) stains; thin patchy clay films on faces of peds; violently effervescent;

moderately alkaline; clear wavy boundary.

Btk2—30 to 46 inches; grayish brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate fine and medium subangular blocky structure; very hard, firm; few very fine roots; few very fine pores; thin patchy clay films on faces of peds; few soft segregations of calcium carbonate; violently effervescent; moderately alkaline; clear wavy boundary.

BC1—46 to 62 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few very fine pores; slightly effervescent; moderately alkaline; clear wavy boundary.

BC2—62 to 80 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few very fine pores; slightly effervescent; moderately alkaline.

The solum is more than 60 inches thick. The depth to secondary carbonates ranges from 20 to 36 inches. The mollic epipedon is 20 to 30 inches thick.

The A horizon is very dark grayish brown, dark brown, dark gray, dark grayish brown, grayish brown, or very dark gray. Reaction is neutral or mildly alkaline.

The Bt and Btk horizons are dark grayish brown, dark brown, grayish brown, or brown. They are sandy clay loam or fine sandy loam. Reaction is mildly alkaline or moderately alkaline. The Btk horizon has few or common segregations of calcium carbonate.

The BC horizon is pale brown, brown, dark brown, or very pale brown. It is sandy clay loam or fine sandy loam. Reaction is mildly alkaline or moderately alkaline, and the soil matrix is calcareous.

Delfina Series

The Delfina series consists of very deep, moderately well drained, moderately slowly permeable, sandy and loamy soils on uplands. These soils formed in sandy sediments and calcareous, loamy sediments, some of which have been reworked by the wind. Slopes range from 0 to 2 percent.

Typical pedon of Delfina loamy fine sand, 0 to 2 percent slopes; from the intersection of Farm Road 1418 and U.S. Highway 281 north of Falfurrias, 1.1 miles west on Farm Road 1418, about 0.35 mile north on a county road, and about 100 feet east in an area of rangeland:

A1—0 to 7 inches; yellowish brown (10YR 5/4) loamy fine sand, dark yellowish brown (10YR 4/4) moist; weak fine granular and subangular blocky structure; soft, very friable; common very fine and fine roots; few fine pores; slightly acid; clear smooth boundary.

A2—7 to 16 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular and subangular blocky structure; soft, very friable; common very fine and fine roots; few fine pores; slightly acid; abrupt smooth boundary.

2Bt—16 to 23 inches; dark grayish brown (10YR 4/2) sandy clay loam, dark gray (10YR 4/1) moist; common fine and medium distinct strong brown (7.5YR 5/6) mottles; moderate medium prismatic structure parting to moderate medium and coarse subangular blocky; extremely hard, firm; few very fine and fine roots; few very fine pores; thick continuous clay films on faces of peds; mildly alkaline; clear smooth boundary.

2Btk1—23 to 31 inches; brownish yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; few fine prominent yellowish red (5YR 5/8) mottles; weak medium prismatic structure parting to moderate fine and medium subangular blocky; extremely hard, firm; few fine roots; few very fine pores; thin patchy clay films on faces of peds; few fine clean sand grains on faces of peds; common fine and medium concretions and few soft segregations of calcium carbonate; moderately alkaline; clear smooth boundary.

2Btk2—31 to 44 inches; reddish yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; common medium distinct pink (7.5YR 7/4) and yellowish red (5YR 5/6) mottles; moderate fine and medium subangular blocky structure; hard, friable; few fine roots; few very fine pores; thin patchy clay films on faces of peds; common fine and medium concretions and few soft segregations of calcium carbonate; moderately alkaline; gradual wavy boundary.

2Btk3—44 to 57 inches; reddish yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; weak fine and medium subangular blocky structure; hard, friable; few very fine pores; thin patchy clay films on faces of peds; few fine and medium concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

2B't—57 to 80 inches; reddish yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; weak fine subangular blocky structure; thin patchy clay films on faces of peds; moderately alkaline.

The solum is 60 to more than 80 inches thick. Secondary carbonates are within a depth of 36 inches.

The A horizon is yellowish brown, grayish brown, or brown. It is fine sandy loam or loamy fine sand. It is slightly acid or neutral.

The 2Bt horizon is dark grayish brown, brownish yellow, brown, strong brown, or yellowish brown. It has few or common, fine or medium, distinct brownish, grayish, or yellowish mottles. It is sandy clay loam in which the content of clay is 25 to 35 percent. This horizon is neutral or mildly alkaline.

The 2Btk and 2B′t horizons are brownish yellow, reddish yellow, light yellowish brown, brown, light brown, or strong brown. They have few or common reddish or yellowish mottles. These horizons have few or common soft segregations or concretions of calcium carbonate. They are mildly alkaline or moderately alkaline.

The Delfina soils in this county are shallower to free carbonates than is typical for the series. This difference, however, does not significantly affect use and management of the soils.

Delmita Series

The Delmita series consists of well drained, moderately permeable, loamy and sandy soils that are moderately deep to a petrocalcic horizon (fig. 11). These soils formed in loamy sediments on uplands. Slopes range from 0 to 2 percent.

Typical pedon of Delmita fine sandy loam, 0 to 2 percent slopes; from the junction of Farm Roads 755 and 430, about 7 miles west of Rachal, 2 miles north on Farm Road 430, about 3.1 miles west to the Alta Colorado Ranch entrance, 1.7 miles west on a ranch road, 0.9 mile north on a ranch road, and 50 feet east in an area of rangeland:

A1—0 to 5 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak fine subangular blocky structure; hard, friable; few fine and very fine roots and pores; neutral; clear smooth boundary.

A2—5 to 14 inches; reddish brown (5YR 5/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine and very fine roots and pores; neutral; clear smooth boundary.

Bt1—14 to 25 inches; red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine and very fine roots and pores; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

Bt2—25 to 38 inches; red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate medium prismatic structure parting to moderate medium blocky; very hard, firm; few fine and very fine roots; thin common clay films on faces of peds; neutral; abrupt wavy boundary.

Bkm—38 to 45 inches; white (10YR 8/2), strongly cemented caliche; platy and fractured; laminar in the upper part; less cemented with increasing depth.

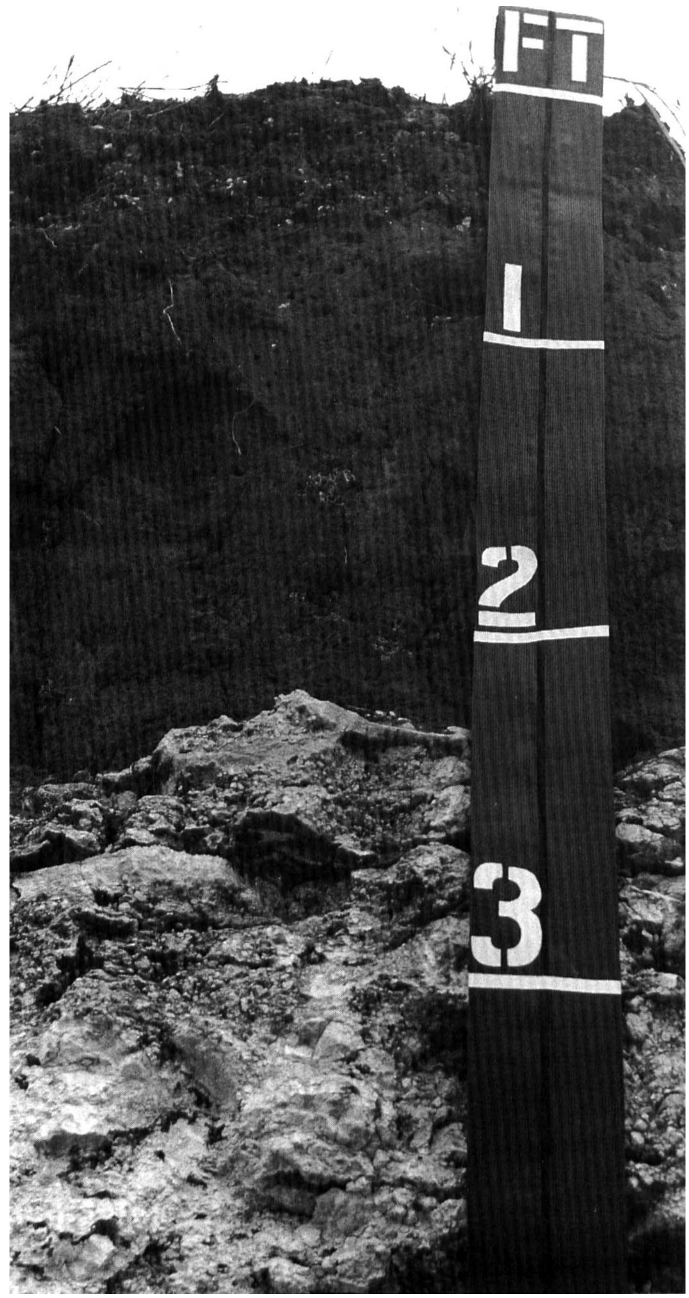

Figure 11.—Profile of a Delmita fine sandy loam. The upper boundary of the petrocalcic horizon is at a depth of 29 inches. The cemented caliche and gravel are used as material for road construction.

The thickness of the solum ranges from 20 to 40 inches, depending on the depth to the petrocalcic horizon. Above the petrocalcic horizon, reaction is neutral or mildly alkaline.

The A horizon is reddish brown, brown, or yellowish red. It is fine sandy loam or loamy fine sand.

The Bt horizon is red, yellowish red, reddish brown, or brown. It is fine sandy loam or sandy clay loam. The content of clay ranges from 18 to 30 percent. The lower few inches of some pedons have a few mottles.

The Bkm horizon is strongly cemented or indurated caliche. It becomes less cemented with increasing depth.

Edroy Series

The Edroy series consists of very deep, poorly drained, very slowly permeable, clayey soils that formed in clayey sediments over sandy or loamy materials. These soils are in depressions and weakly defined, discontinuous drainageways. Slopes are 0 to 1 percent.

Typical pedon of Edroy clay, depressional; from Falfurrias, 2.6 miles east on Farm Road 2191, about 2 miles south on a county road, and 0.6 mile east:

A1—0 to 4 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine blocky structure; extremely hard, firm, plastic and sticky; many fine and medium roots; few fine and very fine pores; slightly acid; clear wavy boundary.

A2—4 to 10 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate fine and medium blocky structure; extremely hard, firm, plastic and sticky; many fine and common medium roots; few fine and very fine pores; common clean sand grains on faces of peds; neutral; clear wavy boundary.

Bg1—10 to 16 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; common fine distinct light brownish gray (2.5Y 6/2) mottles; common fine distinct dark yellowish brown (10YR 4/4) stains along root channels; moderate fine and medium blocky structure; extremely hard, firm, very plastic and very sticky; common fine and very fine and few medium roots; few fine and very fine pores; common cracks filled with very dark gray material from above; mildly alkaline; gradual wavy boundary.

Bg2—16 to 26 inches; light gray (10YR 6/1) clay, gray (10YR 5/1) moist; common medium distinct light brownish gray (2.5Y 6/2) and light yellowish brown (2.5Y 6/4) mottles; moderate fine and medium blocky structure; extremely hard, very firm, very plastic and very sticky; common fine and few medium roots; few fine and very fine pores; common cracks filled with dark gray material from above; few fine and medium concretions of calcium carbonate; moderately alkaline; gradual wavy boundary.

Bkgc1—26 to 42 inches; light gray (10YR 6/1) clay loam, gray (10YR 5/1) moist; many medium and coarse distinct light brownish gray (2.5Y 6/2) mottles; moderate medium blocky structure; extremely hard, firm, very plastic and very sticky; few fine roots; few very fine and fine pores; few cracks filled with very dark gray material from above; common fine concretions of calcium carbonate; few fine dark concretions and stains of iron and manganese oxides; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bkgc2—42 to 48 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; common medium distinct light gray (10YR 6/1) mottles; moderate medium blocky structure; extremely hard, firm, plastic and sticky; few fine roots; few very fine pores; common fine concretions and soft masses of calcium carbonate; common fine dark concretions and stains of iron and manganese oxides; slightly effervescent; moderately alkaline; gradual wavy boundary.

Bkgc3—48 to 56 inches; light gray (2.5Y 7/2) clay loam, light brownish gray (2.5Y 6/2) moist; common fine and medium faint light brownish gray (10YR 6/2) mottles; weak fine and medium subangular blocky structure; very hard, firm, plastic and sticky; few very fine pores; common fine concretions and soft masses of calcium carbonate; common fine dark concretions and stains of iron and manganese oxides; moderately alkaline; gradual wavy boundary.

Ckgc—56 to 75 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; common fine and medium faint grayish brown (2.5Y 5/2) mottles; massive; hard, firm, slightly plastic and sticky; common coarse soft masses of calcium carbonate; common fine dark concretions and stains of iron and manganese oxides; moderately alkaline.

The thickness of the solum ranges from 40 to 70 inches. Cracks 0.5 to 1.0 inch wide extend from the surface to a depth of at least 28 inches. The electrical conductivity is as much as 8 millimhos per centimeter within a depth of 80 inches.

The A horizon is gray, very dark gray, or dark gray. It is slightly acid or neutral.

The Bg horizon is gray, grayish brown, or light gray. It is clay, sandy clay, or clay loam. The number of faint or distinct mottles in shades of gray, brown, or yellow ranges from none to common. The number of slickensides ranges from none to common. Reaction is mildly alkaline or moderately alkaline.

The Bkgc horizon is gray or light gray. It is clay loam, sandy clay loam, or loam. It has few to many, faint or distinct mottles in shades of gray, brown, or yellow. This horizon has few or common soft masses and concretions of calcium carbonate. It has few or common iron and manganese concretions. It is moderately alkaline.

The Ckgc horizon is gray, light gray, white, or very pale brown. It is sandy clay loam or loam. It has few to many, faint or distinct mottles in shades of gray, brown, or yellow. Most pedons have few or common soft masses of calcium carbonate and few or common iron and manganese concretions. This horizon is moderately alkaline or strongly alkaline.

Falfurrias Series

The Falfurrias series consists of very deep, somewhat excessively drained, rapidly permeable, sandy soils on uplands (fig. 12). These soils formed in thick, sandy eolian sediments. Slopes range from 0 to 8 percent.

Typical pedon of Falfurrias fine sand, undulating; from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 7.3 miles east on a paved road, 6.8 miles north on a paved ranch road, and 100 feet west of a road, in an area of rangeland:

A1—0 to 3 inches; very pale brown (10YR 7/3) fine sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; slightly acid; clear smooth boundary.

A2—3 to 16 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose; common fine roots; medium acid; gradual smooth boundary.

A3—16 to 38 inches; light yellowish brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) moist; single grained; loose; common fine to coarse roots; strongly acid; gradual smooth boundary.

C1—38 to 57 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine black mottles; few very fine roots; strongly acid; diffuse smooth boundary.

C2—57 to 80 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; few fine brownish yellow (10YR 6/6) mottles; strongly acid.

The combined thickness of the A and C horizons ranges from 80 to more than 100 inches. These horizons are loamy fine sand or fine sand throughout.

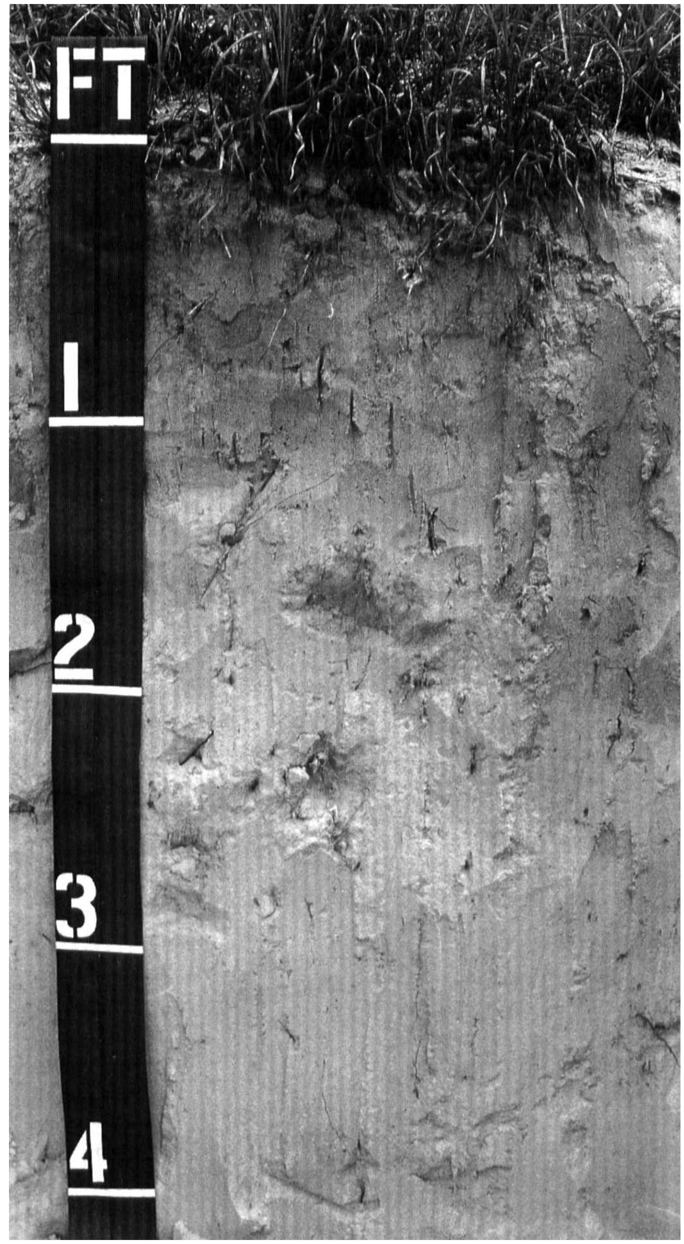

Figure 12.—Profile of a Falfurrias fine sand.

They are strongly acid to slightly acid.

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

The C horizon is very pale brown or light yellowish brown. In some pedons one or more statistically significant changes in the very fine sand to fine sand ratios indicate a lithologic discontinuity at a depth below 20 inches. The number of mottles in shades of brown or yellow ranges from none to few.

In many pedons a 2Bt horizon is at a depth of 80 to 150 inches.

Jardin Series

The Jardin series consists of well drained, moderately permeable, loamy soils that are shallow to a petrocalcic horizon. These soils formed in loamy sediments on uplands. Slopes range from 0 to 3 percent.

Typical pedon of Jardin fine sandy loam, gently undulating; from the junction of Farm Roads 755 and 430, about 7 miles west of Rachal, 5.1 miles north and west on Farm Road 430 to the Alta Colorado Ranch entrance, 1.7 miles west on a ranch road, 0.6 mile north on a ranch road, 3.4 miles west on a ranch road, and 50 feet north in an area of rangeland:

A1—0 to 9 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine granular and subangular blocky structure; hard, friable; common fine and very fine roots; few fine and very fine pores; few fine root channels and insect tunnels; few indurated caliche fragments as much as 2.5 centimeters along the longest axis; mildly alkaline; clear smooth boundary.

A2—9 to 17 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) moist; weak medium prismatic structure parting to weak fine and medium subangular blocky; hard, friable; few fine and very fine roots and pores; few fine root channels and insect tunnels; few indurated caliche fragments as much as 2.5 centimeters along the longest axis; mildly alkaline; abrupt wavy boundary.

Bkm—17 to 22 inches; white (10YR 8/2), strongly cemented caliche; somewhat platy and fractured in the upper 2 to 3 inches, massive below; etched upper surface that has a few brownish bands; gradual wavy boundary.

Bk—22 to 60 inches; white (10YR 8/2), weakly cemented caliche; massive but has a few fractures.

The thickness of the solum ranges from 7 to 20 inches, depending on the depth to the petrocalcic horizon. Reaction above the petrocalcic horizon ranges from neutral to moderately alkaline. The A horizon generally is noncalcareous, but in some pedons it is calcareous in the lower part. The content of caliche fragments and gravel ranges from 0 to 10 percent on the surface and from 0 to 25 percent in the lower part of the solum.

The A horizon is brown, dark brown, grayish brown, or dark grayish brown. The content of clay is less than 18 percent.

The Bkm horizon is strongly cemented or indurated. It becomes less cemented with increasing depth.

Nueces Series

The Nueces series consists of very deep, moderately well drained, moderately slowly permeable, sandy soils on uplands. These soils formed in loamy alluvial and sandy eolian sediments. Slopes range from 0 to 3 percent.

Typical pedon of Nueces fine sand, gently undulating; from the junction of U.S. Highway 281 and Farm Road 755 in Rachal, 6.45 miles west on Farm Road 755, about 2.1 miles south to the dead end of a caliche road, and 150 feet east in an area of rangeland:

A1—0 to 10 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose, very friable; neutral; gradual smooth boundary.

A2—10 to 23 inches; brown (7.5YR 5/4) fine sand, dark brown (7.5YR 4/4) moist; single grained; loose, very friable; neutral; gradual smooth boundary.

E—23 to 30 inches; light brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose, very friable; neutral; abrupt wavy boundary.

2Bt1—30 to 40 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; common fine and medium distinct reddish yellow (7.5YR 6/6) mottles; moderate coarse prismatic structure; extremely hard, firm; common fine pores; thin patchy clay films and organic coatings on faces of peds; neutral; gradual smooth boundary.

2Bt2—40 to 48 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; many medium and coarse prominent reddish yellow (5YR 6/8) mottles; moderate medium prismatic structure; extremely hard, firm; few fine pores; thin patchy clay films and organic coatings on faces of peds; neutral; gradual wavy boundary.

2Bt3—48 to 80 inches; yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) moist; weak medium blocky structure; very hard, firm; thin patchy dark grayish brown (10YR 4/2) clay films and organic stains on faces of peds; moderately alkaline.

The thickness of the solum ranges from 60 to about 100 inches. Reaction ranges from medium acid to neutral in the upper part of the solum and from medium acid to moderately alkaline in the lower part.

The A and E horizons are brown, pale brown, light yellowish brown, grayish brown, light brownish gray, light brown, very pale brown, or yellowish brown.

The 2Bt horizon is very pale brown, yellow, pale brown, light gray, grayish brown, brown, light brownish gray, or yellowish brown. The analyses of particle-size distribution and the ratios of coarse silt to very fine sand indicate a lithologic discontinuity at the upper boundary of the argillic horizon. Most pedons have common or many reddish, brownish, grayish, or yellowish mottles. This horizon is sandy clay loam or fine sandy loam in which the content of clay is 18 to 35 percent. The content of organic matter is less than 1 percent. In some pedons a darker horizon that is enriched with organic matter overlies the Bt horizon. It is 1 to 3 inches thick.

Padrones Series

The Padrones series consists of very deep, moderately well drained, moderately slowly permeable, sandy soils on uplands. These soils formed in loamy alluvial and sandy eolian sediments. Slopes are 0 to 1 percent.

Typical pedon of Padrones fine sand, nearly level; from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 5.7 miles east on a paved ranch road, 5 miles south on a paved ranch road, and 55 feet west in an area of rangeland:

A—0 to 17 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose, very friable; common fine and very fine roots; neutral; clear smooth boundary.

E—17 to 28 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose, very friable; few fine and very fine roots; few krotovinas; neutral; abrupt smooth boundary.

2Btn1—28 to 30 inches; light brownish gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) moist; common fine distinct brownish yellow (10YR 6/8) and few fine distinct strong brown (7.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine and very fine roots; thin patchy clay films, clean sand grains, and organic coatings on faces of peds; few fine black mottles and segregations; neutral; clear smooth boundary.

2Btn2—30 to 34 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; few fine and medium distinct brownish yellow (10YR 6/8) mottles; strong coarse prismatic structure parting to moderate medium blocky; extremely hard, very firm; few fine and very fine roots; thin patchy clay films, clean sand grains, and organic coatings on faces of peds; few fine black mottles and segregations; mildly alkaline; clear smooth boundary.

2Btn3—34 to 40 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; many medium distinct yellow (10YR 7/8) and few fine prominent red (2.5YR 5/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm; few very fine roots; thin patchy clay films on faces of peds; few fine black mottles and segregations; mildly alkaline; gradual smooth boundary.

2Btn4—40 to 59 inches; white (2.5Y 8/2) fine sandy loam, light gray (2.5Y 7/2) moist; common fine distinct yellow (10YR 8/8) and few fine prominent red (2.5YR 5/6) mottles; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; thin patchy clay films on faces of peds; few fine black mottles and segregations; few white spots about 1 centimeter in diameter, which are probably skeletans; moderately alkaline; gradual smooth boundary.

2Btn5—59 to 80 inches; white (2.5Y 8/2) fine sandy loam, light gray (2.5Y 7/2) moist; few fine distinct yellow (10YR 7/6) mottles; weak moderate subangular blocky structure; very hard, firm; thin patchy clay films on faces of peds; few fine black mottles and segregations; few white spots about 1 centimeter in diameter, which are probably skeletans; few calcareous nodules as much as 3.5 centimeters in diameter; strongly alkaline.

The thickness of the solum ranges from 60 to more than 100 inches. The electrical conductivity of the saturation extract increases somewhat irregularly with increasing depth but is less than 4 millimhos per centimeter above a depth of 80 inches.

The A and E horizons are pale brown, light yellowish brown, or very pale brown. They are medium acid to neutral.

The 2Btn horizon is light gray, light brownish gray, grayish brown, white, very pale brown, or pale brown. Most pedons have few to many reddish, brownish, grayish, or yellowish mottles. The content of exchangeable sodium is more than 15 percent within the upper 16 inches. This horizon is loamy fine sand, fine sandy loam, or sandy clay loam in which the average content of clay is 8 to 24 percent in the upper 20 inches. It is neutral to strongly alkaline.

Palobia Series

The Palobia series consists of very deep, moderately well drained, slowly permeable, loamy and sandy soils on uplands. They formed in sandy and loamy eolian sediments. Slopes are 0 to 1 percent.

Typical pedon of Palobia loamy fine sand, 0 to 1 percent slopes (fig. 13); from Falfurrias, 6 miles east on

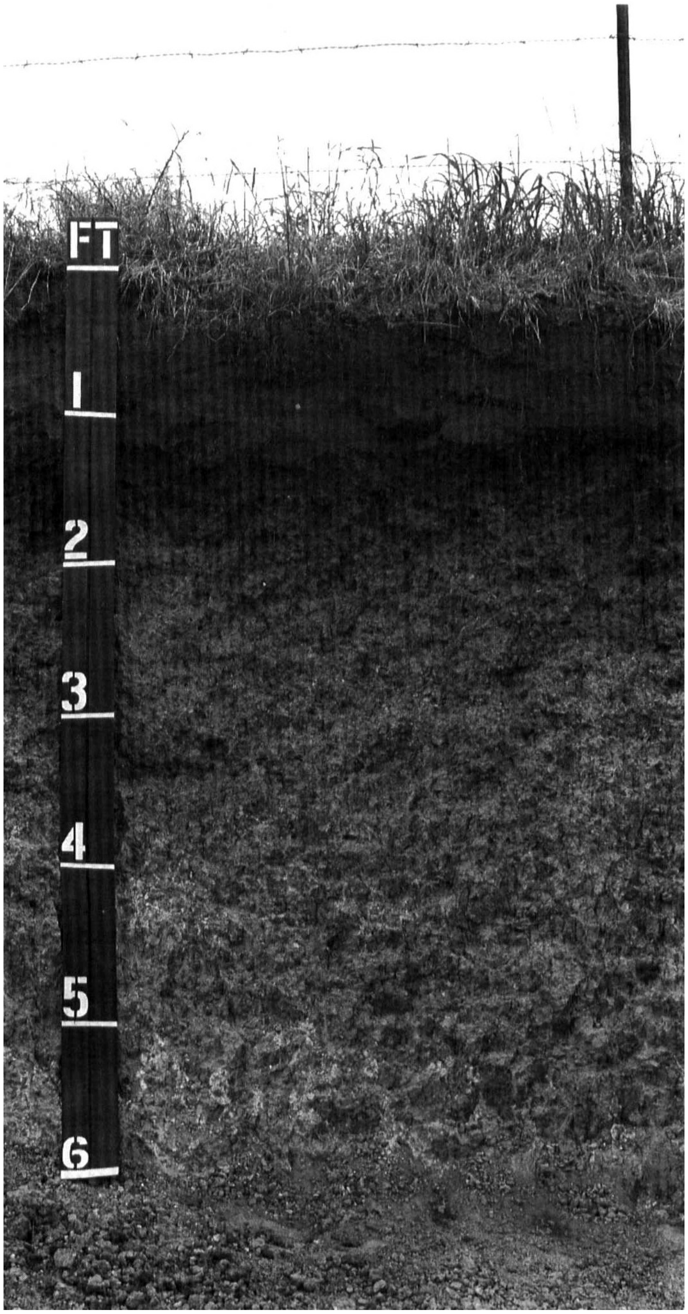

Figure 13.—Profile of a Palobia loamy fine sand. The upper boundary of the natric horizon is at a depth of about 14 inches.

State Highway 285, about 3.8 miles north and west on Farm Road 2191, and 30 feet south in an area of cropland:

Ap—0 to 5 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; weak fine granular and subangular blocky structure; slightly hard, very friable; common very fine and fine roots; few fine pores; slightly acid; clear smooth boundary.

A—5 to 9 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; common very fine and fine roots; few fine pores; neutral; abrupt smooth boundary.

2Btn1—9 to 14 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; common medium distinct grayish brown (10YR 5/2) and few fine distinct strong brown (7.5YR 5/6) and yellowish red (5YR 4/6) mottles; strong coarse prismatic structure parting to moderate medium blocky; extremely hard, firm; few very fine and fine roots; common fine pores; thick continuous clay films and few clean sand grains on faces of peds; slightly saline (electrical conductivity 3 millimhos per centimeter); mildly alkaline; clear smooth boundary.

2Btn2—14 to 21 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; few fine faint strong brown (7.5YR 4/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; extremely hard, firm; few very fine and fine roots; few fine pores; thin continuous clay films and few clean sand grains on faces of peds; slightly saline (electrical conductivity 3.5 millimhos per centimeter); mildly alkaline; clear smooth boundary.

2Btknc—21 to 40 inches; very pale brown (10YR 7/4) sandy clay loam, light yellowish brown (10YR 6/4) moist; moderate coarse prismatic structure parting to moderate medium blocky; extremely hard, firm; few very fine roots; thin patchy clay films on faces of peds; few fine and medium dark concretions of iron and manganese oxides; few fine concretions of calcium carbonate; moderately saline (electrical conductivity 6.7 millimhos per centimeter); moderately alkaline; gradual smooth boundary.

2BCknc1—40 to 56 inches; pale yellow (2.5Y 7/4) sandy clay loam, light yellowish brown (2.5Y 6/4) moist; moderate medium subangular blocky structure; very hard, firm; common fine and medium dark concretions and stains of iron and manganese oxides; few fine concretions of calcium carbonate; strongly saline (electrical conductivity 8.3 millimhos per centimeter); strongly alkaline; gradual smooth boundary.

2BCknc2—56 to 80 inches; pale yellow (2.5Y 7/4) sandy clay loam, light yellowish brown (2.5Y 6/4) moist; weak fine subangular blocky structure; very hard, firm; common fine and medium dark concretions and stains of iron and manganese oxides; few fine concretions of calcium carbonate; strongly saline (electrical conductivity 10.5 millimhos per centimeter); strongly alkaline.

The thickness of the solum ranges from 60 to more than 80 inches. The depth to secondary carbonates ranges from 20 to 36 inches. The content of clay in the control section ranges from 21 to 35 percent. The electrical conductivity of the saturation extract is less than 2 millimhos per centimeter in the A horizon and ranges to as much as 16 millimhos per centimeter within a depth of 80 inches.

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

The 2Btn horizon is dark brown, brown, pinkish gray, light brown, dark grayish brown, dark yellowish brown, grayish brown, yellowish brown, light brownish gray, pale brown, or light yellowish brown. The darker colors are in the upper part. Most pedons have few to many grayish, reddish, brownish, or yellowish mottles. Some pedons have a few iron and manganese concretions. The content of exchangeable sodium in the upper 16 inches is more than 15 percent and increases with increasing depth. This horizon is neutral to moderately alkaline.

The 2Btkn horizon is grayish brown, brown, yellowish brown, light brownish gray, pale brown, light yellowish brown, light gray, or very pale brown. Some pedons have few or common brownish, reddish, or yellowish mottles. Most pedons have few or common soft bodies and concretions of calcium carbonate and few or common iron and manganese concretions. This horizon is neutral to strongly alkaline.

The 2BC horizon is light brownish gray, pale brown, light yellowish brown, light gray, very pale brown, pale yellow, or white. It has few or common soft bodies and concretions of calcium carbonate. It has common or many iron and manganese concretions. The content of exchangeable sodium is more than 15 percent and increases with increasing depth. This horizon is sandy clay loam or sandy loam. It is moderately alkaline or strongly alkaline.

Papagua Series

The Papagua series consists of very deep, moderately well drained, slowly permeable, loamy soils on upland drainageways. These soils formed in sandy and loamy marine sediments. Slopes are 0 to 1 percent.

Typical pedon of Papagua fine sandy loam, 0 to 1 percent slopes; 5.5 miles east of Falfurrias on Texas Highway 285, about 2.4 miles north and west on Farm Road 2191, and about 1,000 feet south in a pasture:

A—0 to 12 inches; light brownish gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; hard, friable; common fine roots and pores; neutral; abrupt smooth boundary.

Btg—12 to 19 inches; grayish brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; common fine distinct brownish yellow (10YR 6/6) mottles; moderate medium prismatic structure parting to moderate medium and coarse blocky; extremely hard, firm; common fine roots and few fine pores; thin continuous clay films on faces of peds; neutral; gradual wavy boundary.

Btgc—19 to 41 inches; light brownish gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; few fine distinct yellowish brown (10YR 5/6) mottles; moderate fine and medium blocky structure; hard, firm; few fine roots and pores; streaks of dark grayish brown (10YR 4/2) material; few fine dark concretions of iron and manganese oxides; thin patchy clay films on faces of peds; neutral; gradual wavy boundary.

Btgkc—41 to 52 inches; light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; few fine and medium distinct brownish yellow and yellow (10YR 6/6, 7/6) mottles; moderate fine and medium subangular blocky structure; hard, firm; few fine roots and pores; common very fine and fine dark concretions of iron and manganese oxides; thin patchy clay films on faces of peds; few fine soft segregations of calcium carbonate; streaks of very pale brown (10YR 7/3) material; coatings of grayish brown (10YR 5/2) material on faces of peds; mildly alkaline; gradual wavy boundary.

Btkc—52 to 70 inches; very pale brown (10YR 8/3) sandy clay loam, very pale brown (10YR 7/3) moist; few fine faint brownish yellow (10YR 6/6) mottles; moderate fine subangular blocky structure; hard, firm; few very fine roots; common very fine and fine dark concretions of iron and manganese oxides; few fine concretions of calcium carbonate; thin patchy clay films on faces of peds; few dark streaks; moderately alkaline; gradual smooth boundary.

BCkc—70 to 80 inches; very pale brown (10YR 8/3) sandy clay loam, very pale brown (10YR 7/3) moist; weak fine subangular blocky structure; hard, firm; common fine and medium concretions and soft segregations of calcium carbonate; common fine dark concretions of iron and manganese oxides; moderately alkaline; gradual smooth boundary.

Ckc—80 to 90 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; massive; hard, firm; many fine and medium concretions and soft segregations of calcium carbonate; common fine dark concretions of iron and manganese oxides; slightly effervescent; moderately alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. Depth of secondary carbonates ranges from 36 to 50 inches.

The A horizon is dark grayish brown, grayish brown, light brownish gray, or brown. It is slightly acid or neutral.

The Btg and Btgc horizons are dark grayish brown, grayish brown, light brownish gray, or light gray. They are sandy clay or sandy clay loam. The average content of clay in the upper 20 inches is more than 35 percent. These horizons have mottles in shades of brown, yellow, or red. They are slightly acid or neutral.

The Btgkc, Btkc, and BCkc horizons are light brownish gray, light gray, or very pale brown. They are sandy clay loam. They have mottles in shades of brown, yellow, or red. They have few or common concretions and soft segregations of calcium carbonate. They are mildly alkaline or moderately alkaline.

The Ck horizon is white, light gray, very pale brown, or pale brown. It is sandy clay loam. It is moderately alkaline and is calcareous or noncalcareous. It has few or common concretions and soft segregations of calcium carbonate.

Quiteria Series

The Quiteria series consists of very deep, moderately well drained, moderately slowly permeable, sandy soils on uplands (fig. 14). These soils formed in loamy alluvial and sandy eolian sediments. Slopes are 0 to 1 percent.

Typical pedon of Quiteria fine sand, nearly level; from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 5.7 miles east on a paved ranch road, 3.6 miles south on a paved ranch road, and 155 feet east in an area of rangeland:

A1—0 to 5 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; loose, friable; common fine and very fine roots; few insect tunnels and root channels; medium acid; clear smooth boundary.

A2—5 to 15 inches; pale brown (10YR 6/3) fine sand, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; loose, very friable; common fine and very fine roots; few fine root channels; medium acid; abrupt smooth boundary.

2Btn1—15 to 18 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; few fine distinct yellowish brown (10YR 5/4) and light gray (10YR 7/2) mottles; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine and very fine roots; few very fine pores; thin patchy clay films, clean sand grains, and organic coatings on faces of peds; neutral; clear smooth boundary.

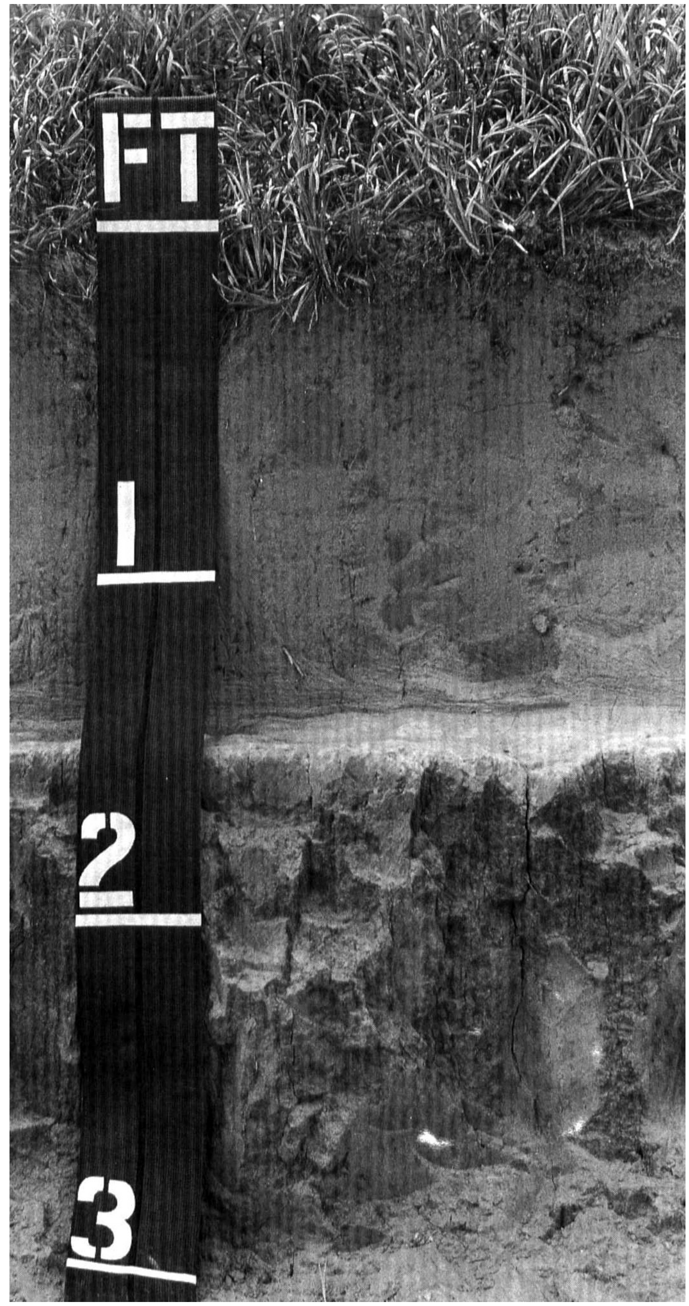

Figure 14.—Profile of a Quiteria fine sand. The upper boundary of the natric horizon is at a depth of about 17 inches. This horizon has prismatic structure.

2Btn2—18 to 22 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; many medium distinct yellow (10YR 7/6) and few fine distinct brownish yellow (10YR 6/8) mottles; strong coarse prismatic structure parting to moderate medium blocky; extremely hard, very firm; few fine and very fine roots; thin patchy clay films, clean sand grains, and organic coatings on faces of peds; mildly alkaline; clear smooth boundary.

2Btn3—22 to 31 inches; yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) moist; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine and very fine roots; thin patchy clay films and clean sand grains on faces of peds; few fine root channels; moderately alkaline; gradual smooth boundary.

2Btn4—31 to 43 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; few fine distinct brownish yellow (10YR 6/8) and reddish yellow (7.5YR 6/6 and 5YR 6/8) mottles; moderate coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine and very fine roots; thin patchy clay films on faces of peds; few fine black mottles and segregations; few calcareous nodules as much as 1 centimeter in diameter; strongly alkaline; gradual smooth boundary.

2Btn5—43 to 59 inches; white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; few medium distinct reddish yellow (7.5YR 7/6) mottles; weak coarse prismatic structure parting to moderate medium blocky; very hard, firm; few fine roots; thin patchy clay films on faces of peds; few fine black mottles and segregations; few calcareous nodules as much as 1 centimeter in diameter; strongly alkaline; gradual smooth boundary.

2BCn—59 to 80 inches; white (2.5Y 8/2) fine sandy loam, light gray (2.5Y 7/2) moist; weak moderate subangular blocky structure; very hard, firm; few calcareous nodules as much as 1 centimeter in diameter; strongly alkaline.

The thickness of the solum ranges from 50 to more than 80 inches. The electrical conductivity of the saturation extract is less than 2 millimhos per centimeter in the A horizon and increases somewhat irregularly with increasing depth. It is less than 8 millimhos per centimeter in the 2Btn horizon.

The A horizon is pale brown, light yellowish brown, or very pale brown. It is medium acid to neutral.

The 2Btn horizon is brown, pale brown, very pale brown, light yellowish brown, light brownish gray, light gray, grayish brown, yellow, reddish yellow, or white. Most pedons have few to many reddish, brownish, grayish, or yellowish mottles. The content of exchangeable sodium is more than 15 percent within the upper 16 inches. This horizon is loamy fine sand, fine sandy loam, or sandy clay loam in which the average content of clay is 8 to 18 percent in the upper 20 inches. It is neutral to strongly alkaline.

The 2BCn horizon is white or very pale brown. Some pedons have few or common yellowish mottles. This horizon is loamy fine sand, fine sandy loam, or sandy clay loam. It is moderately alkaline or strongly alkaline.

Sarita Series

The Sarita series consists of very deep, well drained, sandy soils on broad uplands. These soils are rapidly permeable in the upper part and moderately rapidly permeable in the lower part. They formed in loamy alluvial and sandy eolian sediments. Slopes range from 0 to 5 percent.

Typical pedon of Sarita fine sand, gently undulating; from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 7.8 miles east on a paved ranch road, and 100 feet south of a road, in an area of rangeland:

A—0 to 22 inches; brown (10YR 5/3) fine sand, dark brown (10YR 4/3) moist; single grained; loose, very friable; few fine and very fine roots; neutral; clear smooth boundary.

E—22 to 48 inches; very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose, very friable; few very fine roots; neutral; abrupt smooth boundary.

2Bt1—48 to 50 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; few fine distinct yellow mottles; moderate medium blocky structure; very hard, friable; few very fine roots; thin patchy clay films on faces of peds; neutral; clear smooth boundary.

2Bt2—50 to 55 inches; light gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) moist; common fine distinct yellow (10YR 7/6) mottles; moderate coarse prismatic structure parting to moderate medium blocky; extremely hard, friable; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

2Bt3—55 to 68 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; many fine distinct yellow (10YR 8/8) mottles; moderate coarse prismatic structure parting to moderate fine and medium blocky; extremely hard, friable; thin patchy clay films on faces of peds; neutral; gradual smooth boundary.

2Bt4—68 to 80 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; common fine distinct yellow (10YR 8/8) mottles; weak fine and medium blocky structure; extremely hard, firm; thin patchy clay films on faces of peds; neutral.

The solum ranges from 60 to more than 100 inches in thickness.

The A and E horizons are grayish brown, light brownish gray, brown, pale brown, very pale brown, light yellowish brown, or light gray. They are slightly acid or neutral.

The 2Bt horizon is grayish brown, light brownish gray, light gray, light yellowish brown, pale brown, or very pale brown. It is mottled in shades of red, yellow, or gray. It is fine sandy loam or sandy clay loam. It is slightly acid to moderately alkaline.

Sauz Series

The Sauz series consists of very deep, somewhat poorly drained, moderately slowly permeable, sandy soils that formed in sandy and loamy sediments. These soils are in shallow depressions and drainageways. Slopes are 0 to 1 percent.

Typical pedon of Sauz fine sand, nearly level; from the post office in Encino, 9.1 miles north on U.S. Highway 281, about 8.3 miles east on King Ranch road, and 50 feet north of a road, in an area of rangeland:

A1—0 to 4 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine subangular blocky structure; slightly hard, friable; many fine and common medium roots; few fine pores; mildly alkaline; clear smooth boundary.

A2—4 to 9 inches; light gray (10YR 7/2) fine sand, light brownish gray (10YR 6/2) moist; weak fine subangular blocky structure; slightly hard, friable; common fine and few medium roots; few fine pores; mildly alkaline; abrupt smooth boundary.

Btn—9 to 15 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; few fine distinct light yellowish brown (10YR 6/4) mottles; moderate coarse prismatic structure parting to moderate coarse blocky; extremely hard, firm; common fine and few medium roots; thin patchy clay films on faces of peds and common clean sand grains on faces of peds; few fine concretions and soft masses of calcium carbonate; moderately saline; strongly alkaline; clear smooth boundary.

Btkn—15 to 28 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; few fine distinct light yellowish brown and brownish yellow (10YR 6/4, 6/6) mottles; weak coarse prismatic structure parting to weak medium blocky; extremely hard, firm; common fine roots; few very fine pores; thin patchy clay films on faces of peds and common clean sand grains on faces of peds; common soft masses and fine concretions of calcium carbonate; moderately saline; strongly alkaline; gradual smooth boundary.

Btknc—28 to 45 inches; light gray (2.5Y 7/2) fine sandy loam, light brownish gray (2.5Y 6/2) moist; few fine distinct brownish yellow (10YR 6/6) mottles; weak medium blocky structure; hard, firm; few fine roots; few very fine pores and thin patchy clay films on faces of peds; common medium concretions and few fine soft masses of calcium carbonate; common medium dark concretions of iron and manganese oxides; moderately saline; strongly alkaline; gradual smooth boundary.

2Cknc—45 to 70 inches; light gray (2.5Y 7/2) sandy clay loam, light brownish gray (2.5Y 6/2) moist; few fine distinct brownish yellow (10YR 6/6) mottles; massive; hard, friable; few very fine pores; common medium soft masses and concretions of calcium carbonate; common medium dark concretions of iron and manganese oxides; strongly saline; very strongly alkaline.

The thickness of the solum ranges from 40 to more than 60 inches. The depth to secondary carbonates ranges from 9 to 20 inches. The content of clay in the upper 20 inches of the Bt horizon ranges from 10 to 18 percent. Sodium saturation is more than 15 percent in the B and C horizons and increases with increasing depth.

The A horizon is light brownish gray, light gray, or grayish brown. It is neutral or mildly alkaline.

The Bt horizon is gray, light gray, grayish brown, or light brownish gray. It is fine sandy loam or sandy clay loam. Most pedons have few to many brownish or yellowish mottles. Some pedons have a few iron and manganese concretions. Most pedons have few or common soft masses and concretions of calcium carbonate. The electrical conductivity ranges from 2 to 16 millimhos per centimeter. This horizon ranges from moderately alkaline to very strongly alkaline.

The Btk horizon is gray, light gray, grayish brown, or light brownish gray. It is fine sandy loam or sandy clay loam. Most pedons have few to many brownish or yellowish mottles. This horizon has few to many soft masses and concretions of calcium carbonate. Most pedons have few or common iron and manganese concretions. The electrical conductivity ranges from 4 to 16 millimhos per centimeter. This horizon ranges from moderately alkaline to very strongly alkaline.

The 2C horizon is gray, light gray, or light olive gray. It is sandy clay loam or fine sandy loam. It has few to many yellowish or brownish mottles. Most pedons have few to many soft masses and concretions of calcium carbonate. This horizon has few or common iron and manganese concretions. The electrical conductivity ranges from 8 to 30 millimhos per centimeter. This horizon is strongly alkaline or very strongly alkaline.

The Sauz soils in this county are shallower to free carbonates than is typical for the series, and the salinity is less than 2 millimhos per centimeter in the surface layer. These differences, however, do not significantly affect use and management of the soils.

Tasajal Series

The Tasajal series consists of well drained, moderately permeable, sandy soils that are moderately deep to deep to a petrocalcic horizon. These soils formed in loamy alluvial and sandy eolian sediments. Slopes are 0 to 1 percent.

Typical pedon of Tasajal loamy fine sand, nearly level; 7.2 miles west of Rachal on Farm Road 755, about 5.1 miles north and west on Farm Road 430, about 1 mile south on a paved road to a ranch entrance, 6.3 miles west on a ranch road, 1.6 miles south on a ranch road, and 1,300 feet west in an area of rangeland:

A1—0 to 3 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular and subangular blocky structure; slightly hard, very friable; many very fine and fine roots; few fine pores; medium acid; clear smooth boundary.

A2—3 to 12 inches; pale brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; many very fine and fine roots; few fine pores; medium acid; abrupt smooth boundary.

2Btn1—12 to 19 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to moderate medium blocky; extremely hard, firm; few very fine and fine roots; few fine pores; thin patchy clay films on faces of peds; grayish brown (10YR 5/2) organic coatings along the contact of the A and Btn horizons; very slightly saline (electrical conductivity 3.2 millimhos per centimeter); neutral; clear smooth boundary.

2Btn2—19 to 28 inches; light yellowish brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; weak medium prismatic structure parting to weak fine and medium blocky; very hard, firm; few very fine and fine roots; few fine pores; thin patchy clay films on faces of peds; moderately saline (electrical conductivity 9.3 millimhos per centimeter); very slightly effervescent; moderately alkaline; clear smooth boundary.

2Btkn—28 to 34 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak fine and medium subangular blocky structure; slightly hard, friable; few very fine and fine roots; thin patchy clay films on faces of peds; moderately saline (electrical conductivity 10.8 millimhos per centimeter); few fine and medium concretions of calcium carbonate; very slightly effervescent; moderately alkaline; abrupt wavy boundary.

3Bkm—34 to 36 inches; white (10YR 8/2), indurated caliche; platy and etched; hardness greater than 3 on the Mohs scale, dry; clear smooth boundary.

3Bk—36 to 50 inches; white (10YR 8/2), weakly cemented caliche; massive but has a few fractures.

The thickness of the solum ranges from 30 to 50 inches, depending on the depth to the petrocalcic horizon. Secondary calcium carbonates are below a depth of 20 inches. The electrical conductivity of the saturation extract is less than 2 millimhos per centimeter in the A horizon and ranges to as much as 16 millimhos per centimeter in the 2B horizons.

The A horizon is grayish brown, brown, light brownish gray, or pale brown. It is medium acid to neutral.

The 2Btn horizon is dark grayish brown, dark brown, brown, dark yellowish brown, grayish brown, yellowish brown, light brownish gray, pale brown, or light yellowish brown. Some pedons have a few brownish mottles. The content of exchangeable sodium in the upper 16 inches is more than 15 percent and increases with increasing depth. This horizon ranges from neutral to strongly alkaline.

The 2Btkn horizon is pale brown, light yellowish brown, or very pale brown. Some pedons have a few brownish mottles. Calcium carbonate concretions and soft bodies are few or common. This horizon is moderately alkaline or strongly alkaline.

The 3Bk horizon is strongly cemented or indurated in the upper part. It becomes less cemented with increasing depth.

Turcotte Series

The Turcotte series consists of very deep, well drained, moderately permeable, loamy soils on eolian dunes. The loamy dunes form elongated ridges along the margins of saline playas. Slopes range from 2 to 8 percent.

Typical pedon of Turcotte fine sandy loam, 2 to 8 percent slopes; 2.5 miles east of Falfurrias on Farm Road 2191, about 1.9 miles south on County Road to a ranch gate, 0.7 mile east on a ranch road, and 100 feet north in an area of rangeland:

A1—0 to 5 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine subangular blocky structure parting to weak fine granular; slightly hard, very friable; many very fine and fine and few medium roots; common very fine and fine pores; few wormcasts; very slightly effervescent; moderately alkaline; clear smooth boundary.

A2—5 to 10 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; many very fine and fine and common medium roots; common very fine and fine pores; few pockets of clean sand grains between peds; slightly effervescent; moderately alkaline; clear smooth boundary.

Bk1—10 to 25 inches; light brownish gray (10YR 6/2) sandy clay loam, grayish brown (10YR 5/2) moist; moderate fine and medium subangular blocky structure; hard, friable; common very fine, fine, and medium roots; few fine pores; few snail shells; few wormcasts; few fine concretions and common fine and medium soft segregations of calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary.

Bk2—25 to 38 inches; pale brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; hard, friable; few very fine and fine roots; few very fine pores; few snail shells; few fine concretions and common fine and medium soft segregations of calcium carbonate; violently effervescent; moderately alkaline; gradual wavy boundary.

BCk—38 to 80 inches; very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; slightly hard, friable; few very fine and fine roots; few very fine pores; few snail shells; common fine and medium and few coarse soft segregations of calcium carbonate; violently effervescent; moderately alkaline.

The solum is more than 60 inches thick. The depth to secondary carbonates ranges from 10 to 20 inches.

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

The B horizon is brown, pale brown, light brownish gray, light brown, or grayish brown. It is sandy clay loam or clay loam.

The BC horizon is very pale brown, pale brown, light brownish gray, brown, light brown, or light gray. It is sandy clay loam or clay loam.

Vargas Series

The Vargas series consists of well drained, moderately permeable, loamy soils that are moderately deep to a petrocalcic horizon. These soils formed in calcareous, loamy sediments on uplands. Slopes are 0 to 1 percent.

Typical pedon of Vargas fine sandy loam, in an area of Vargas-Jardin complex, nearly level; from the junction of Farm Roads 755 and 430, about 7 miles west of Rachal, 5.1 miles north and west on Farm Road 430 to the Alta Colorado Ranch entrance, 1.7 miles west on a ranch road, 0.6 mile north on a ranch road, 2.7 miles west on a ranch road, 0.4 mile south along a fence, and 50 feet east in an area of rangeland:

A—0 to 10 inches; grayish brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; weak fine granular and subangular blocky structure; slightly hard, very friable; few fine and very fine roots; few fine pores; few root channels and insect tunnels; mildly alkaline; clear smooth boundary.

Bw—10 to 17 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak moderate subangular blocky structure; hard, friable; few fine and very fine roots and pores; few root channels and insect tunnels; mildly alkaline; clear smooth boundary.

Bk1—17 to 27 inches; light brownish gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) moist; weak moderate subangular blocky structure; hard, friable; few fine roots and pores; few root channels and insect tunnels; few fine threads and segregations of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—27 to 33 inches; pale brown (10YR 6/3) gravelly sandy loam, brown (10YR 5/3) moist; moderate fine subangular blocky structure; hard, friable; few fine roots; about 30 percent, by volume, concretions and nodules of calcium carbonate and strongly cemented, calcareous sandstone and indurated caliche fragments as much as 7 centimeters along the longest axis; strongly effervescent; moderately alkaline; abrupt wavy boundary.

Bkm—33 to 38 inches; white (10YR 8/2), strongly cemented caliche that has pockets and seams of weakly cemented caliche; gradual wavy boundary.

BCk—38 to 60 inches; white (10YR 8/2), weakly cemented caliche; massive but has a few fractures.

The thickness of the solum is 20 to 40 inches, depending on the depth to the petrocalcic horizon. The soil is mildly alkaline or moderately alkaline throughout but is noncalcareous in the upper 14 to 30 inches.

The A horizon is brown or grayish brown.

The Bw horizon is grayish brown or brown. It is loam or fine sandy loam that has less than 18 percent clay.

The Bk horizon is light gray, very pale brown, light brownish gray, or pale brown. It is fine sandy loam, loam, gravelly loam, or gravelly sandy loam. The content of clay ranges from 10 to 18 percent. This horizon has 10 to 30 percent, by volume, concretions and nodules of calcium carbonate and indurated caliche fragments.

The Bkm horizon is white or very pale brown. It is fractured and is cemented or indurated calcium carbonate that has seams and pockets of weakly cemented caliche. It becomes less cemented with increasing depth.

Yturria Series

The Yturria series consists of very deep, well drained, moderately rapidly permeable, loamy soils that formed in loamy sediments. These soils are on upland ridges that have been reworked by the wind. Slopes range from 0 to 3 percent.

Typical pedon of Yturria fine sandy loam, 0 to 3 percent slopes; from the junction of U.S. Highway 281 and Texas Highway 285 in Falfurrias, 4.8 miles south on U.S. Highway 281, about 1.3 miles east on a ranch road, and 0.4 mile north in a pasture:

A—0 to 22 inches; dark brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) moist; weak fine subangular blocky structure; slightly hard, very friable; common fine and medium roots; common fine pores; few wormcasts; mildly alkaline; clear smooth boundary.

Bk1—22 to 33 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable; common fine and few medium roots; common fine pores; few snail shells; few wormcasts; few fine concretions and soft masses of calcium carbonate; strongly effervescent; moderately alkaline; clear smooth boundary.

Bk2—33 to 47 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak fine and medium subangular blocky structure; slightly hard, friable; few fine roots; few fine pores; common fine concretions and soft masses of calcium carbonate; violently effervescent; moderately alkaline; gradual smooth boundary.

BCk—47 to 80 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak fine subangular blocky structure; slightly hard, friable; few fine and very fine pores; common fine and medium concretions and soft masses of calcium carbonate; violently effervescent; moderately alkaline.

The thickness of the solum ranges from 36 to more than 80 inches. The depth to secondary carbonates ranges from 22 to 36 inches.

The A horizon is dark brown, brown, grayish brown, or dark grayish brown. It is neutral or mildly alkaline.

The B horizon is brown, yellowish brown, pale brown, very pale brown, dark brown, light brownish gray, light brown, or light yellowish brown. It is fine sandy loam or loam. It has few to many concretions and soft masses of calcium carbonate. It is mildly alkaline or moderately alkaline.

The BCk horizon is pale brown, light yellowish brown, very pale brown, or yellowish brown. It is fine sandy loam or loam. It has few to many soft masses and concretions of calcium carbonate. It is moderately alkaline.

Formation of the Soils

This section describes the factors of soil formation and relates them to the formation of the soils in Brooks County. It also describes the processes of horizon differentiation and the geology of the county.

Factors of Soil Formation

Soil is a natural, three-dimensional body of the earth's surface that supports plants and has specific properties. Soil properties result from the integrated effect of climate and living matter acting on parent material, as conditioned by relief over periods of time.

The interaction of five main factors results in differences among the soils. These factors are the physical and chemical composition of the parent material, the climate under which the soil material has accumulated and has existed since accumulation, the plant and animal life on and in the soil, the relief of the land and its effect on runoff, and the length of time the soils had to form. The effect of a factor can differ from place to place. It is the interaction of all the factors that determines the kind of soil that forms.

Climate

Rainfall, temperature, humidity, and wind are important in the formation of soils in Brooks County. Summers in the county are hot, and winters are mild. The annual rainfall ranges from 24 inches in the western part of the county to about 26 inches in the eastern part.

The accumulation of organic matter in the soils is limited by high temperatures and low rainfall. The low rainfall in most years generally is not sufficient to leach calcium carbonate or soluble salts below the root zone. As a result, calcium carbonate or soluble salts have accumulated in horizons of most of the soils.

Wind, mainly from the southeast, is a major factor in soil development. It has deposited sand over preexisting loamy fluviatile sediments and presently continues the shifting of sand on the surface.

Living Organisms

Plants, animals, earthworms, insects, and micro-organisms are important in the formation of soils. Living organisms are largely responsible for the amount of organic matter and nitrogen in the soil, for the gain or loss of plant nutrients, and for changes in soil structure and porosity.

Vegetation, mostly grasses and brush, has a major effect on soil formation in Brooks County. Decayed plant roots contribute organic matter to the soils and leave channels and pores that allow the intake of air and water. Brush plants that have deep roots bring nutrients from the lower layers of the soil to the surface.

Earthworms, insects, and burrowing animals mix soil material and create channels that facilitate the downward movement of air, water, and plant roots into the soil. Bacteria and fungi break down organic matter and thus improve fertility and tilth.

Human activities have greatly affected the soils in the county. In the past ranchers overstocked many areas of rangeland. In the overgrazed areas the better grasses decreased in abundance and were replaced by the less desirable grasses and brush. More recently, production on rangeland has been increased through brush management, seeding to suitable grasses, and grazing systems that increase or maintain the quality of the vegetative cover.

Topography

Topography, or relief, affects soil formation through its influence on drainage, runoff, erosion, plant cover, and temperature. The topography of the county is a nearly level to undulating eolian sand plain. The plain is characterized by a series of elongated dunes separated by nearly level areas and blowouts or wind-eroded depressions.

Time

A great length of time is required for the formation of soils that have distinct horizons. Differences in the length of time that the parent material has been in place are reflected in the degree of development of the horizons. Young soils have very little horizon development, and old soils have well expressed horizons.

The soils in Brooks County range from young to old. Yturria soils are young. They formed in recent windblown sediments on the leeward and windward sides of depressional areas. Older soils are generally nearly level or gently sloping and are in stable upland positions on the landscape. Delmita soils are old. Calcium carbonate has been leached from the upper part of the profile and has accumulated below as a layer of cemented caliche. Also, clay has been translocated from the upper part of the profile to the subsoil.

Parent Material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soil. For more information about the parent material in the county see "Geology" at the end of this section.

Processes of Horizon Differentiation

Several processes are involved in the formation of horizons in the soil. They include the accumulation of organic matter, the leaching and accumulation of calcium carbonates and other soluble salts, the reduction and transfer of iron, and the formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of horizons.

The accumulation of organic matter in the upper part of a profile results in the formation of a distinct dark surface layer. The soils in Brooks County range from low to moderate in content of organic matter. Czar and Turcotte soils have accumulated a moderate amount of organic matter and have a dark surface layer.

Calcium carbonate and other soluble salts have been leached downward and have accumulated in the root zone in many of the soils. Padrones, Palobia, and Quiteria soils have horizons with a high content of salts. Calcium carbonate has accumulated in the subsoil of the Turcotte and Yturria soils.

The reduction and transfer of iron, or gleying, is evident in poorly drained and somewhat poorly drained soils. Gray colors in the Sauz, Papagua, and Edroy soils indicate the reduction and loss of iron. Yellowish brown, strong brown, and yellowish red mottles and concretions in some horizons indicate the segregation of iron. Palobia, Delfina, and Quiteria soils have such mottles.

The translocation of clay minerals has also contributed to horizon development in many soils. Clay minerals are produced by the weathering of primary minerals. The subsoil in many soils has accumulations of clay, or clay films, in pores and on peds. These soils were probably leached of carbonates and bases before the translocation of silicate clay took place. A horizon that has accumulations of translocated clay is called an argillic horizon. Delmita soils have an argillic horizon.

Geology

John L. Russell, geologist, Department of Geosciences, Texas A & I University, Kingsville, Texas, prepared this section.

Surface Geology

Brooks County is in the west Coastal Plain of Texas. The maximum elevations are approximately 400 feet and occur in the northwest corner of the county, and the minimum elevations are nearly 40 feet and occur in the southeast corner. The slope is 13 feet per mile toward the east in the northern one-third of the county and 8 feet per mile toward the southeast in the southern two-thirds.

Topographic features in the county have primarily been created by wind action and by running water. Landscapes created by wind action, particularly features of the South Texas Sand Sheet, cover much of the county. The eolian, or wind-created, landforms and related soils commonly have southeast-trending grains, or lineations, that are parallel to the predominate wind direction. The lineations result from the deposition of windblown sand into elongated dunes and from the erosion of elongated blowouts or wind-eroded depressions.

The part of the South Texas Sand Sheet in Brooks County is subdivided into the Encino lobe, the Rachal dune field, and the Falfurrias and Armstrong base-level plains *(8)*.

The Encino lobe extends east-southeast across the center of the county. It is approximately 170 square miles in size and consists of active and stabilized sand dunes and associated blowouts. Active dune fields are especially prominent in the downwind margin of the Encino lobe in the northwest corner of the county.

The Rachal dune field is a smaller area of stabilized and active sand dunes located in the southeastern part of the county. The Falfurrias base-level plain is north of the Encino lobe. It occurs as thin sand-sheet deposits that do not have well defined eolian lineation or relict topographic grain. The Armstrong base-level plain has similar features. It is south of the Encino lobe. In the base-level plain areas, the older Lissie or Goliad sediments generally are covered by less than 10 feet of recent sand-sheet deposits.

The eolian processes in the eastern part of the base-level plains are controlled by the shallow depth to the water table, which creates the base level to which wind erosion may occur. In these areas, erosion and deposition caused by the wind are greatest during droughts, when the water table is at a greater depth.

The soils of the South Texas Sand Sheet developed during the Holocene Epoch, but the duration of soil formation on landforms in the Sand Sheet depends on when the processes of eolian erosion and deposition ended. Soil formation initiated when the stabilization of sand dunes and blowouts occurred. Soils in the Nueces-Sarita and Falfurrias general soil map units are commonly in areas of eolian sands in the Encino lobe. Falfurrias soils commonly occur as deep sands on stabilized sand dunes. Sarita and Nueces soils are in the lower interdune areas adjacent to the Falfurrias soils, on the smaller stabilized dunes, and in broad hummocky areas.

Soils of the Sarita-Sauz and Padrones-Quiteria general soil map units are on the base-level plain portion of the Sand Sheet, east of U.S. Highway 281. In these soils, the thinner sand deposits, the shallow depth to the water table, and the saline ground water result in higher levels of salinity, as compared to soils in other areas of the Sand Sheet.

Wind-deposited silts and fine sands of the Riviera Loess Sheet are in the extreme northeast corner of the county. Soils of the Palobia-Czar general soil map unit are dominant in this area. Palobia soils formed on broad, smooth plains. They have a higher content of clay and salts, especially in the subsoil, than similar soils that are in areas of the Sand Sheet.

Loamy dunes, which are referred to locally as clay dunes, border the western and northern margins of playa lakes. They were created by eolian deposition of sand-sized silty and clayey aggregates that eroded from dry sediments of the playa lakebeds. Clay dunes bordering the northern margin of Laguna Salada, approximately 6 miles southeast of Falfurrias, have relief of 50 feet above the surrounding land surface. Turcotte and Yturria soils formed in these dune areas in the late Holocene Epoch.

No well integrated drainage by streams occurs in most of the South Texas Sand Sheet. In the northern portion of the county, streams of the Los Olmos drainage basin flow eastward. They deposited alluvium, or stream-deposited sand, silt, and clay, during geologically recent times. Streams in the southeastern region of the county have also deposited recent alluvium on narrow flood plains. Czar soils are on stream terraces along the drainageways.

Recent (Holocene) alluvium and wind-deposited sand sheet, silt sheet, clay dune, and base-level plain sediments were deposited on the much older Lissie and Goliad Formations and conceal these formations in most of the county. The Goliad Formation was deposited during the late Miocene and Pliocene Epochs of the late Tertiary Period about 10 to 5 million years ago. It consists primarily of sand or sandstone interbedded with silt and clay layers. It has a maximum thickness of approximately 1,000 feet. Exposures of the formation commonly are capped by caliche. Small quarries in the caliche provide material for surfacing local roads. Thin layers of gravel are in places in the Goliad and Lissie Formations. The Lissie Formation contains sand interbedded with finer grained sediments but includes less sand and caliche than the Goliad Formation. It was deposited during the Pliocene and Pleistocene Epochs less than 5 million years ago. It has a maximum thickness of approximately 300 feet at the eastern border of the county. It occurs in one-third of the county, east of U.S. Highway 281. The Goliad Formation, which is older and underlies the Lissie Formation, is in the western two-thirds of the county. It is covered by recent sediments or is exposed where recent sediments do not occur. The Lissie Formation, the Goliad Formation, and older sedimentary rock units under the Goliad Formation dip eastward. Sands and sandstones of the Goliad Formation are the chief water-bearing units in the Evangeline Aquifer and provide water to most wells in the county.

In areas where the Goliad Formation is exposed, soils in the Delmita-Yturria general soil map unit are dominant. Delmita, Jardin, and Vargas soils have developed on caliche, which occurs as a cap rock on Goliad sediments. These soils are among the oldest in the county. Yturria soils formed in eolian depositions downwind from playas and are much younger.

Geologic History

The deposition of sediments in Brooks County occurred during much of the Tertiary and Quaternary Periods in the deeply subsiding Rio Grande Embayment of the Gulf Coast sedimentary basin. The subsurface sandstones and shales are fractured by normal faults, which commonly parallel the coast and are downthrown on the side nearest the coast. Faulting occurred simultaneously with and shortly after the deposition of sediments. It has not caused clearly defined topographic lineaments or lithologic discontinuities in surface exposures. Many oil and gas fields in the county are associated with traps created by these faults.

The Goliad Formation was deposited by streams transporting large amounts of sand, and the Lissie Formation was deposited by streams that transported more silt and clay. The Goliad and Lissie Formations dip toward the Gulf of Mexico at an angle greater than the slope of the land surface. A period of nondeposition of sediments and erosion occurred between the deposition of the Lissie Formation and the Recent (Holocene) deposition of eolian and alluvial sediments during the last 11,000 years. Intermittent deposition during the Recent Epoch has been greatly affected by long-term climatic variations and short-term meteorological events. Eolian activity is greater during dry periods when the water table is lower and the extent of plant cover decreases. Stream action is greatest in occurrence with runoff from heavy rainfall, which commonly is associated with tropical storms and hurricanes.

Gyp Hill is a prominent local landmark 5 miles southeast of Falfurrias. It has relief of 70 feet above Laguna Salada, which is a lake directly to the north of Gyp Hill. The hill is the surface expression of the gypsum cap rock on a salt plug. Salt from the Lou Anne Formation of Jurassic Age, which is at a depth of more than 20,000 feet, has pierced younger sediments to a depth of about 1,000 feet. The arms of Laguna Salada were eroded along faults marginal to the salt plug. The Alta Verde salt plug is about 15 miles west-southwest of Falfurrias and has no well defined topographic expression.

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Glossary

ABC soil. A soil having an A, a B, and a C horizon.

AC soil. A soil having only an A and a C horizon. Commonly, such soil formed in recent alluvium or on steep rocky slopes.

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well-aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali (sodic) soil. Soil having so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that plant growth is restricted.

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 map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Bisequum. Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material but that have different characteristics as a result of differences in relief and drainage.

Cation. An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

Cation-exchange capacity. The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

Chiseling. Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Claypan. A slowly permeable soil horizon that contains much more clay than the horizons above it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15 to 38 centimeters (6 to 15 inches) long.

Coarse textured soil. Sand or loamy sand.

Complex slope. Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are:

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping. Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cutbanks cave (in tables). The walls of excavations tend to cave in or slough.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or resting grazingland for a prescribed period.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay are in the soil. The soil is not a source of gravel or sand for construction purposes.

Excess sodium (in tables). Excess exchangeable sodium is in the soil. The resulting poor physical properties restrict the growth of plants.

Fallow. Cropland left idle in order to restore productivity through accumulation of moisture. Summer fallow is common in regions of limited rainfall where cereal grains are grown. The soil is tilled for at least one growing season for weed control and decomposition of plant residue.

Fast intake (in tables). The movement of water into the soil is rapid.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Fine textured soil. Sandy clay, silty clay, or clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant that is not a grass or a sedge.

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.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

Green manure crop (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric and the more decomposed sapric material.

High-residue crops. Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next crop in the rotation is established. These crops return large amounts of organic matter to the soil.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the "Soil Survey Manual." The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

E horizon.—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

B horizon.—The mineral horizon below an O, A, or E horizon. The B horizon is, in part, a layer of transition from the overlying horizon to the underlying C horizon. The B horizon also has distinctive characteristics, such as accumulation of clay, sesquioxides, humus, or a combination of these; prismatic or blocky structure; redder or browner colors than those in the A horizon; or a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Arabic numeral 2 precedes the letter C.

Cr horizon.—Soft, consolidated bedrock beneath the soil.

R layer.—Consolidated rock (unweathered bedrock) beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the plants that are the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material. This contrasts with percolation, which is movement of water through soil layers or material.

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

Less than 0.2	very low
0.2 to 0.4	low
0.4 to 0.75	moderately low
0.75 to 1.25	moderate
1.25 to 1.75	moderately high
1.75 to 2.5	high
More than 2.5	very high

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Basin.—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Drip (or trickle).—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage.

Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan.*

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affects the specified use.

Permeability. The quality of the soil that enables water to move through the profile. Permeability is measured as the number of inches per hour that water moves through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Subsurface tunnels or pipelike cavities are formed by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Ponding. Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

Poor filter (in tables). Because of rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor on the basis of how much the present plant community has departed from the potential.

Rangeland. Land on which the potential climax vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of the acidity or alkalinity of a soil expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Extremely acid	below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
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

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

Relief. The elevations or inequalities of a land surface, considered collectively.

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Rill. A steep-sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rippable. Rippable bedrock or hardpan can be excavated using a single-tooth ripping attachment mounted on a tractor with a 200-300 draw bar horsepower rating.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Saline soil. A soil containing soluble salts in an amount that impairs the growth of plants. A saline soil does not contain excess exchangeable sodium.

Salty water (in tables). Water is too salty for consumption by livestock.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-sized particles.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Sedimentary rock. Rock made up of particles deposited from suspension in water. The chief kinds of sedimentary rock are conglomerate, formed from gravel; sandstone, formed from sand; shale, formed from clay; and limestone, formed from soft masses of calcium carbonate. There are many intermediate types. Some wind-deposited sand is consolidated into sandstone.

Seepage (in tables). The movement of water through the soil adversely affects the specified use.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina and iron oxide. The more highly weathered soils or their clay fractions in warm-temperate, humid regions, and especially those in the tropics, generally have a low ratio.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Sinkhole. A depression in the landscape where limestone has been dissolved.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slick spot. A small area of soil having a puddled, crusted, or smooth surface and an excess of exchangeable sodium. The soil is generally silty or clayey, is slippery when wet, and is low in productivity.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Slow refill (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity and their respective ratios are:

Slight	less than 13:1
Moderate	13-30:1
Strong	more than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stone line. A concentration of coarse fragments in a soil. Generally, it is indicative of an old weathered surface. In a cross section, thickness of the line can be one fragment or more. It generally overlies material that weathered in place, and it is overlain by recent sediment of variable thickness.

Stripcropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Breaking up a compact subsoil by pulling a special chisel through the soil.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in organic matter content than the overlying surface layer.

Summer fallow. The tillage of uncropped land during the summer to control weeds and allow storage of moisture in the soil for the growth of a later crop. A practice common in semiarid regions, where annual precipitation is not enough to produce a crop every year. Summer fallow is frequently practiced before planting winter grain.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). An otherwise suitable soil material that is too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Trace elements. Chemical elements, such as zinc, cobalt, manganese, copper, and iron, that are in soils in extremely small amounts. They are essential to plant growth.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the lowlands along streams.

Weathering. All physical and chemical changes produced by atmospheric agents in rocks or other deposits at or near the earth's surface. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. This contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

Tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

(Recorded in the period 1951-84 at Falfurrias)

Month	Temperature						Precipitation				
				2 years in 10 will have--				2 years in 10 will have--			
	Average daily maximum	Average daily minimum	Average	Maximum temperature higher than--	Minimum temperature lower than--	Average number of growing degree days*	Average	Less than--	More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January-----	67.8	43.4	55.6	90	22	241	1.42	0.22	2.32	3	0.1
February----	71.9	46.1	59.0	92	25	278	1.58	.20	2.57	3	.0
March-------	79.1	53.4	66.3	98	32	505	.56	.03	.79	2	.0
April-------	86.3	62.4	74.4	103	41	732	1.36	.11	2.11	2	.0
May---------	90.0	67.8	78.9	103	50	896	2.99	.81	4.53	4	.0
June--------	94.8	72.3	83.6	103	61	1,008	3.18	.42	5.19	4	.0
July--------	97.6	73.5	85.6	105	68	1,104	1.69	.09	2.81	3	.0
August------	97.4	72.6	85.0	105	65	1,085	2.85	.17	4.49	3	.0
September---	92.5	69.8	81.2	102	54	936	5.13	.96	7.73	6	.0
October-----	85.4	61.1	73.3	97	41	722	2.71	.40	4.26	4	.0
November----	76.5	51.8	64.2	92	31	432	1.19	.20	1.90	3	.0
December----	69.8	45.8	57.8	90	26	270	1.08	.21	1.71	3	.0
Yearly:											
Average---	84.1	60.0	72.1	---	---	---	---	---	---	---	---
Extreme---	---	---	---	107	22	---	---	---	---	---	---
Total-----	---	---	---	---	---	8,209	25.74	17.52	34.10	40	.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 degrees F).

TABLE 2.--FREEZE DATES IN SPRING AND FALL

(Recorded in the period 1951-84 at Falfurrias)

Probability	Temperature		
	24 °F or lower	28 °F or lower	32 °F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	Feb. 13	Mar. 1	Mar. 14
2 years in 10 later than--	Jan. 31	Feb. 18	Mar. 5
5 years in 10 later than--	Dec. 13	Jan. 27	Feb. 15
First freezing temperature in fall:			
1 year in 10 earlier than--	Dec. 17	Dec. 1	Nov. 11
2 years in 10 earlier than--	Jan. 3	Dec. 11	Nov. 21
5 years in 10 earlier than--	*	Jan. 3	Dec. 10

* The probability of the threshold temperature is less than the indicated probability.

TABLE 3.--GROWING SEASON

(Recorded in the period 1951-84 at Falfurrias)

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	340	295	257
8 years in 10	364	309	272
5 years in 10	>365	348	300
2 years in 10	>365	>365	333
1 year in 10	>365	>365	>365

TABLE 4.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
COB	Comitas loamy fine sand, gently undulating	18,800	3.1
CzA	Czar fine sandy loam, rarely flooded	8,200	1.4
DeB	Delfina loamy fine sand, 0 to 2 percent slopes	7,590	1.3
DfB	Delfina fine sandy loam, 0 to 2 percent slopes	2,388	0.4
DMB	Delmita loamy fine sand, gently undulating	3,580	0.6
DtB	Delmita fine sandy loam, 0 to 2 percent slopes	12,670	2.1
DU	Dune land	10,210	1.7
EdA	Edroy clay, depressional	850	0.1
FAB	Falfurrias fine sand, undulating	120,950	20.0
JDB	Jardin fine sandy loam, gently undulating	1,900	0.3
NFB	Nueces fine sand, gently undulating	137,200	22.7
NSB	Nueces-Sarita association, gently undulating	19,000	3.2
PAA	Padrones fine sand, nearly level	19,460	3.2
PbA	Palobia loamy fine sand, 0 to 1 percent slopes	25,370	4.2
PfA	Palobia fine sandy loam, 0 to 1 percent slopes	3,310	0.5
PpA	Papagua fine sandy loam, 0 to 1 percent slopes	3,380	0.6
QTA	Quiteria fine sand, nearly level	21,740	3.6
SAB	Sarita fine sand, gently undulating	124,050	20.5
SSB	Sarita-Sauz association, gently undulating	10,120	1.7
SZA	Sauz fine sand, nearly level	30,880	5.1
TSA	Tasajal loamy fine sand, nearly level	1,490	0.3
TuC	Turcotte fine sandy loam, 2 to 8 percent slopes	2,000	0.3
VRA	Vargas-Jardin complex, nearly level	1,560	0.3
YtB	Yturria fine sandy loam, 0 to 3 percent slopes	15,890	2.6
	Water	1,405	0.2
	Total	603,993	100.0

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE

(Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

Soil name and map symbol	Land capability	Grain sorghum	Corn	Sorghum hay	Improved bermudagrass	Watermelons
		Bu	Bu	Tons	AUM*	Tons
COB----------------------- Comitas	IVe	35	35	2.0	3.5	4.0
CzA----------------------- Czar	IIc	45	45	3.0	5.0	5.0
DeB----------------------- Delfina	IIIe	28	30	2.0	3.5	4.0
DfB----------------------- Delfina	IIIe	35	35	2.5	4.0	4.0
DMB----------------------- Delmita	IVe	25	25	2.0	3.0	2.5
DtB----------------------- Delmita	IIIe	30	28	2.0	3.0	2.5
DU**---------------------- Dune land	VIIIe	---	---	---	---	---
EdA----------------------- Edroy	Vw	---	---	---	---	---
FAB----------------------- Falfurrias	VIIe	---	---	---	2.0	---
JDB----------------------- Jardin	VIs	---	---	---	1.0	---
NFB----------------------- Nueces	IVe	35	25	2.0	3.0	3.5
NSB**:						
Nueces--------------------	IVe	35	25	2.0	3.0	3.5
Sarita--------------------	VIe	---	---	---	2.5	1.8
PAA----------------------- Padrones	IVe	30	22	1.8	3.0	2.5
PbA, PfA------------------ Palobia	IVs	35	30	2.5	4.0	4.0
PpA----------------------- Papagua	IIIw	40	40	2.5	5.0	---
QTA----------------------- Quiteria	IVs	25	20	1.8	2.5	2.0
SAB----------------------- Sarita	VIe	---	---	---	2.5	1.8
SSB**:						
Sarita--------------------	VIe	---	---	---	2.5	1.8
Sauz----------------------	VIs	---	---	---	---	---

See footnotes at end of table.

TABLE 5.--LAND CAPABILITY AND YIELDS PER ACRE OF CROPS AND PASTURE--Continued

Soil name and map symbol	Land capability	Grain sorghum	Corn	Sorghum hay	Improved bermudagrass	Watermelons
		Bu	Bu	Tons	AUM*	Tons
SZA----------------------- Sauz	VIs	---	---	---	---	---
TSA----------------------- Tasajal	IVs	25	20	1.8	2.5	2.0
TuC----------------------- Turcotte	IIIe	33	38	2.5	4.0	3.0
VRA**:						
Vargas--------------------	VIs	---	---	---	2.0	---
Jardin--------------------	VIs	---	---	---	---	---
YtB----------------------- Yturria	IIe	40	40	2.5	4.5	4.0

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

** See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6.--RANGELAND PRODUCTIVITY

(Only the soils that support rangeland vegetation suitable for grazing are listed)

Soil name and map symbol	Range site	Potential yearly production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
COB Comitas	Loamy Sand	4,500	3,500	2,000
CzA Czar	Sandy Loam	5,000	4,000	3,000
DeB, DfB Delfina	Loamy Sand	4,500	3,800	2,000
DMB Delmita	Red Sandy Loam	4,000	3,000	1,500
DtB Delmita	Red Sandy Loam	4,000	3,000	1,500
EdA Edroy	Lakebed	5,000	4,000	3,000
FAB Falfurrias	Sand Hill	4,500	3,500	1,500
JDB Jardin	Shallow Sandy Loam	3,000	1,800	1,000
NFB Nueces	Sandy	6,000	5,000	3,200
NSB*:				
Nueces	Sandy	6,000	5,000	3,200
Sarita	Sandy	5,000	4,000	2,000
PAA Padrones	Sandy	5,500	4,500	3,000
PbA, PfA Palobia	Loamy Sand	3,500	3,000	2,000
PpA Papagua	Ramadero	5,200	3,500	2,500
QTA Quiteria	Loamy Sand	3,800	3,000	1,800
SAB Sarita	Sandy	5,000	4,000	2,000
SSB*:				
Sarita	Sandy	5,000	4,000	2,000
Sauz	Sandy Flat	5,000	4,000	2,000
SZA Sauz	Sandy Flat	5,000	4,000	2,000
TSA Tasajal	Loamy Sand	4,000	3,000	1,800

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY--Continued

Soil name and map symbol	Range site	Potential yearly production for kind of growing season		
		Favorable	Average	Unfavorable
		Lb/acre	Lb/acre	Lb/acre
TuC Turcotte	Sandy Loam	4,500	3,500	2,500
VRA*:				
Vargas	Shallow Sandy Loam	3,200	2,500	1,500
Jardin	Shallow Sandy Loam	3,000	1,800	1,000
YtB Yturria	Sandy Loam	5,000	3,500	2,000

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--RECREATIONAL DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe")

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
COB------------------- Comitas	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: droughty.
CzA------------------- Czar	Severe: flooding.	Slight----------	Slight----------	Slight----------	Slight.
DeB------------------- Delfina	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
DfB------------------- Delfina	Slight----------	Slight----------	Slight----------	Slight----------	Slight.
DMB------------------- Delmita	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: cemented pan.
DtB------------------- Delmita	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: cemented pan.
DU*------------------- Dune land	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
EdA------------------- Edroy	Severe: ponding, percs slowly, too clayey.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
FAB------------------- Falfurrias	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: droughty.
JDB------------------- Jardin	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight----------	Severe: cemented pan.
NFB------------------- Nueces	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
NSB*:					
Nueces---------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Sarita---------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
PAA------------------- Padrones	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy, excess sodium.	Severe: too sandy.	Severe: excess sodium, droughty.
PbA, PfA-------------- Palobia	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight----------	Severe: excess sodium.
PpA------------------- Papagua	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.	Severe: ponding.
QTA------------------- Quiteria	Severe: excess sodium, too sandy.	Severe: excess sodium, too sandy.	Severe: excess sodium, too sandy.	Severe: too sandy.	Severe: excess sodium, droughty.

See footnote at end of table.

TABLE 7.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
SAB------------------- Sarita	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
SSB*:					
Sarita---------------	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty.
Sauz-----------------	Severe: wetness, too sandy, excess sodium.	Severe: too sandy, excess sodium, excess salt.	Severe: too sandy, wetness, excess sodium.	Severe: wetness, too sandy.	Severe: excess sodium, wetness.
SZA------------------- Sauz	Severe: wetness, too sandy, excess sodium.	Severe: too sandy, excess sodium, excess salt.	Severe: too sandy, wetness, excess sodium.	Severe: wetness, too sandy.	Severe: excess sodium, wetness.
TSA------------------- Tasajal	Severe: excess sodium.	Severe: excess sodium.	Severe: excess sodium.	Slight----------	Severe: excess sodium, droughty.
TuC------------------- Turcotte	Slight----------	Slight----------	Moderate: slope.	Slight----------	Slight.
VRA*:					
Vargas---------------	Slight----------	Slight----------	Slight----------	Slight----------	Moderate: cemented pan.
Jardin---------------	Severe: cemented pan.	Severe: cemented pan.	Severe: cemented pan.	Slight----------	Severe: cemented pan.
YtB------------------- Yturria	Slight----------	Slight----------	Slight----------	Slight----------	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--WILDLIFE HABITAT

(See text for definitions of "good," "fair," "poor," and "very poor")

Soil name and map symbol	Potential for habitat elements: Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Potential as habitat for--: Openland wildlife	Wetland wildlife	Rangeland wildlife
COB---------------- Comitas	Fair	Good	Good	Fair	Poor	Very poor	Good	Very poor	Fair.
CzA---------------- Czar	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
DeB, DfB----------- Delfina	Good	Good	Good	Good	Poor	Poor	Good	Poor	Good.
DMB---------------- Delmita	Poor	Poor	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
DtB---------------- Delmita	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
DU*---------------- Dune land	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
EdA---------------- Edroy	Very poor	Poor	Poor	Poor	Poor	Good	Poor	Fair	Poor.
FAB---------------- Falfurrias	Very poor	Very poor	Fair	Good	Very poor	Very poor	Poor	Very poor	Fair.
JDB---------------- Jardin	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
NFB---------------- Nueces	Fair	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
NSB*:									
Nueces------------	Fair	Fair	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
Sarita------------	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
PAA---------------- Padrones	Poor	Poor	Fair	Fair	Poor	Poor	Poor	Poor	Fair.
PbA, PfA----------- Palobia	Poor	Poor	Good	Fair	Poor	Poor	Fair	Poor	Fair.
PpA---------------- Papagua	Fair	Fair	Fair	Good	Fair	Poor	Fair	Poor	Fair.
QTA---------------- Quiteria	Poor	Poor	Good	Fair	Poor	Poor	Fair	Poor	Fair.
SAB---------------- Sarita	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
SSB*:									
Sarita------------	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.
Sauz--------------	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair.

See footnote at end of table.

TABLE 8.--WILDLIFE HABITAT--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
SZA----------------- Sauz	Poor	Poor	Fair	Fair	Fair	Poor	Poor	Poor	Fair.
TSA----------------- Tasajal	Poor	Poor	Good	Fair	Poor	Very poor	Fair	Very poor	Fair.
TuC----------------- Turcotte	Fair	Good	Good	Good	Poor	Very poor	Fair	Very poor	Good.
VRA*:									
Vargas------------	Fair	Fair	Fair	Good	Poor	Very poor	Fair	Very poor	Fair.
Jardin------------	Poor	Poor	Fair	Fair	Poor	Very poor	Poor	Very poor	Fair.
YtB----------------- Yturria	Fair	Fair	Fair	Fair	Poor	Very poor	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
COB: Comitas	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
CzA: Czar	Slight	Severe: flooding.	Severe: flooding.	Severe: flooding.	Moderate: flooding.	Slight.
DeB: Delfina	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
DfB: Delfina	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: low strength, shrink-swell.	Slight.
DMB: Delmita	Moderate: cemented pan.	Slight	Moderate: cemented pan.	Slight	Slight	Moderate: cemented pan.
DtB: Delmita	Moderate: cemented pan.	Slight	Moderate: cemented pan.	Slight	Slight	Moderate: cemented pan.
DU*: Dune land	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
EdA: Edroy	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding, too clayey.
FAB: Falfurrias	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight	Severe: droughty.
JDB: Jardin	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.
NFB: Nueces	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
NSB*:						
Nueces	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Sarita	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
PAA: Padrones	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: excess sodium, droughty.
PbA, PfA: Palobia	Moderate: wetness.	Moderate: shrink-swell.	Moderate: wetness, shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Severe: excess sodium.

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	Lawns and landscaping
PpA: Papagua	Severe: ponding.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding.
QTA: Quiteria	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Severe: excess sodium, droughty.
SAB: Sarita	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
SSB*:						
Sarita	Severe: cutbanks cave.	Slight	Slight	Slight	Slight	Moderate: droughty.
Sauz	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: excess sodium, wetness.
SZA: Sauz	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: excess sodium, wetness.
TSA: Tasajal	Moderate: cemented pan.	Slight	Moderate: cemented pan.	Slight	Slight	Severe: excess sodium, droughty.
TuC: Turcotte	Slight	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell.	Moderate: shrink-swell, low strength.	Slight.
VRA*:						
Vargas	Moderate: cemented pan.	Slight	Moderate: cemented pan.	Slight	Slight	Moderate: cemented pan.
Jardin	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.
YtB: Yturria	Slight	Slight	Slight	Slight	Slight	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "good," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
COB Comitas	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Good.
CzA Czar	Moderate: percs slowly, flooding.	Moderate: seepage.	Moderate: flooding.	Moderate: flooding.	Good.
DeB, DfB Delfina	Severe: percs slowly.	Moderate: seepage.	Slight	Slight	Good.
DMB Delmita	Severe: cemented pan.	Severe: seepage, cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan.
DtB Delmita	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan.
DU*. Dune land	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
EdA Edroy	Severe: ponding, percs slowly.	Severe: ponding.	Severe: ponding, too clayey.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
FAB Falfurrias	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
JDB Jardin	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan.
NFB Nueces	Severe: percs slowly.	Severe: seepage.	Slight	Severe: seepage.	Good.
NSB*:					
Nueces	Severe: percs slowly.	Severe: seepage.	Slight	Severe: seepage.	Good.
Sarita	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
PAA Padrones	Severe: percs slowly.	Severe: seepage.	Severe: excess sodium.	Severe: seepage.	Poor: excess sodium.
PbA, PfA Palobia	Severe: wetness, percs slowly.	Moderate: seepage.	Severe: excess sodium.	Moderate: wetness.	Poor: excess sodium.
PpA Papagua	Severe: ponding, percs slowly.	Severe: seepage, ponding.	Severe: ponding.	Severe: ponding.	Poor: ponding, 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
QTA: Quiteria	Severe: percs slowly.	Severe: seepage.	Severe: excess sodium.	Slight	Poor: excess sodium.
SAB: Sarita	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
SSB*:					
Sarita	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
Sauz	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, excess sodium, excess salt.	Severe: wetness.	Poor: wetness, excess salt, excess sodium.
SZA: Sauz	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness, excess sodium, excess salt.	Severe: wetness.	Poor: wetness, excess salt, excess sodium.
TSA: Tasajal	Severe: cemented pan.	Severe: cemented pan.	Severe: excess sodium.	Severe: cemented pan.	Poor: cemented pan, thin layer, excess sodium.
TuC: Turcotte	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
VRA*:					
Vargas	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan.
Jardin	Severe: cemented pan.	Severe: cemented pan.	Moderate: cemented pan.	Severe: cemented pan.	Poor: cemented pan.
YtB: Yturria	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "good," "fair," and other terms. The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
COB------------------- Comitas	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Fair: too sandy.
CzA------------------- Czar	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Good.
DeB, DfB-------------- Delfina	Fair: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
DMB, DtB-------------- Delmita	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: cemented pan, thin layer.
DU*------------------- Dune land	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
EdA------------------- Edroy	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
FAB------------------- Falfurrias	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
JDB------------------- Jardin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: cemented pan, thin layer.
NFB------------------- Nueces	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
NSB*:				
Nueces---------------	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: too sandy.
Sarita---------------	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.
PAA------------------- Padrones	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium, too sandy.
PbA, PfA-------------- Palobia	Fair: shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
PpA------------------- Papagua	Poor: wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
QTA------------------- Quiteria	Good-----------------	Improbable: excess fines.	Improbable: excess fines.	Poor: excess sodium.
SAB------------------- Sarita	Good-----------------	Probable-------------	Improbable: too sandy.	Poor: too sandy.

See footnote at end of table.

TABLE 11.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
SSB*:				
Sarita	Good	Probable	Improbable: too sandy.	Poor: too sandy.
Sauz	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness, excess sodium.
SZA: Sauz	Poor: wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness, excess sodium.
TSA: Tasajal	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium.
TuC: Turcotte	Fair: shrink-swell, low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
VRA*:				
Vargas	Fair: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Fair: cemented pan, small stones, thin layer.
Jardin	Poor: thin layer.	Improbable: excess fines.	Improbable: excess fines.	Poor: cemented pan, thin layer.
YtB: Yturria	Good	Improbable: excess fines.	Improbable: excess fines.	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--WATER MANAGEMENT

(Some terms that describe restrictive soil features are defined in the "Glossary." See text for definitions of "slight," "moderate," and "severe." The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation)

Soil name and map symbol	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions
COB Comitas	Severe: seepage.	Severe: piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Soil blowing, too sandy.
CzA Czar	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Droughty, soil blowing.	Soil blowing.
DeB Delfina	Moderate: seepage.	Slight	Severe: no water.	Deep to water	Fast intake, soil blowing.	Soil blowing.
DfB Delfina	Moderate: seepage.	Slight	Severe: no water.	Deep to water	Soil blowing	Soil blowing.
DMB Delmita	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Cemented pan, soil blowing.
DtB Delmita	Severe: seepage.	Severe: thin layer.	Severe: no water.	Deep to water	Soil blowing	Cemented pan, soil blowing.
DU* Dune land	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
EdA Edroy	Moderate: seepage.	Severe: ponding.	Severe: slow refill.	Ponding, percs slowly.	Ponding, slow intake, percs slowly.	Ponding, percs slowly.
FAB Falfurrias	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
JDB Jardin	Severe: cemented pan.	Severe: thin layer, piping.	Severe: no water.	Deep to water	Soil blowing, cemented pan.	Soil blowing, cemented pan.
NFB Nueces	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
NSB*:						
Nueces	Severe: seepage.	Moderate: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
Sarita	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
PAA Padrones	Severe: seepage.	Severe: seepage, piping, excess sodium.	Severe: no water.	Deep to water, excess sodium.	Droughty, fast intake, soil blowing.	Soil blowing. too sandy.

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	Aquifer-fed excavated ponds	Features affecting-- Drainage	Irrigation	Terraces and diversions
PbA: Palobia	Moderate: seepage.	Severe: excess sodium.	Severe: no water.	Percs slowly, excess salt, excess sodium.	Droughty, fast intake, percs slowly.	Wetness, soil blowing, percs slowly.
PfA: Palobia	Moderate: seepage.	Severe: excess sodium.	Severe: no water.	Percs slowly, excess salt, excess sodium.	Droughty, percs slowly, excess sodium.	Wetness, soil blowing, percs slowly.
PpA: Papagua	Slight	Severe: ponding.	Severe: no water.	Ponding, percs slowly.	Ponding, percs slowly.	Ponding, percs slowly.
QTA: Quiteria	Moderate: seepage.	Severe: seepage, piping, excess sodium.	Severe: no water.	Deep to water, excess sodium.	Fast intake, excess sodium, soil blowing.	Soil blowing.
SAB: Sarita	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
SSB*:						
Sarita	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Droughty, fast intake, soil blowing.	Too sandy, soil blowing.
Sauz	Moderate: seepage.	Severe: piping, wetness, excess sodium.	Severe: slow refill, salty water.	Excess salt, excess sodium.	Wetness, fast intake, excess salt.	Wetness, soil blowing.
SZA: Sauz	Moderate: seepage.	Severe: piping, wetness, excess sodium.	Severe: slow refill, salty water.	Excess salt, excess sodium.	Wetness, fast intake, excess salt.	Wetness, soil blowing.
TSA: Tasajal	Moderate: seepage, cemented pan.	Severe: piping, excess sodium.	Severe: no water.	Deep to water, excess sodium.	Droughty, fast intake, soil blowing.	Cemented pan, soil blowing.
TuC: Turcotte	Moderate: seepage.	Moderate: piping.	Severe: no water.	Deep to water	Slope, soil blowing.	Soil blowing.
VRA*:						
Vargas	Moderate: seepage, cemented pan.	Severe: piping.	Severe: no water.	Deep to water	Soil blowing, cemented pan.	Cemented pan, soil blowing.
Jardin	Severe: cemented pan.	Severe: thin layer, piping.	Severe: no water.	Deep to water	Soil blowing, cemented pan.	Soil blowing, cemented pan.
YtB: Yturria	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Deep to water	Soil blowing	Soil blowing.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated)

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
COB-------------- Comitas	0-25	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	95-100	85-100	15-25	<25	NP-4
	25-80	Fine sandy loam, sandy clay loam.	SM, SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0	95-100	90-100	80-100	23-50	<34	NP-14
CzA-------------- Czar	0-6	Fine sandy loam	SM-SC, SC	A-2-4, A-2-6, A-4, A-6	0	100	100	90-100	30-50	<30	4-11
	6-80	Sandy clay loam, fine sandy loam.	SC, CL	A-6	0	97-100	90-100	85-95	36-55	30-39	11-18
DeB-------------- Delfina	0-16	Loamy fine sand	SM, SM-SC	A-2-4, A-4	0	100	100	85-100	20-45	<25	NP-7
	16-31	Sandy clay loam	SC, CL	A-6, A-7-6	0	100	95-100	90-100	38-55	31-48	18-35
	31-80	Sandy clay loam	SC	A-6, A-7-6	0	90-100	75-100	70-100	36-50	30-46	16-31
DfB-------------- Delfina	0-12	Fine sandy loam	SM-SC, SC, SM	A-2-4, A-4	0	100	100	90-100	25-50	19-30	3-10
	12-34	Sandy clay loam	SC, CL	A-6, A-7-6	0	100	95-100	90-100	38-55	31-48	18-35
	34-80	Sandy clay loam	SC	A-6, A-7-6	0	90-100	75-100	70-100	36-50	30-46	16-31
DMB-------------- Delmita	0-15	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4	0	100	95-100	85-100	11-25	<25	NP-7
	15-34	Sandy clay loam, fine sandy loam.	SC	A-2-4, A-2-6, A-4, A-6	0	100	100	90-100	30-50	27-39	8-18
	34-60	Cemented---------	---	---	---	---	---	---	---	---	---
DtB-------------- Delmita	0-14	Fine sandy loam	SM, SM-SC	A-2-4	0	100	100	90-100	20-35	<27	NP-7
	14-38	Sandy clay loam, fine sandy loam.	SC	A-2-4, A-2-6, A-4, A-6	0	100	100	90-100	30-50	27-39	8-18
	38-60	Cemented---------	---	---	---	---	---	---	---	---	---
DU*-------------- Dune land	0-80	Fine sand--------	SP-SM, SM	A-2-4, A-3	0	100	100	75-100	5-25	<25	NP-3
EdA-------------- Edroy	0-10	Clay-------------	CH	A-7-6	0	100	100	90-100	75-95	51-60	27-35
	10-42	Clay loam, clay, sandy clay.	CL, CH	A-7-6	0	100	95-100	90-100	70-90	41-55	20-30
	42-56	Sandy clay loam, clay loam, loam.	SC, CL	A-7-6, A-6	0	100	95-100	80-95	40-55	30-42	11-20
	56-75	Sandy clay loam, loam.	SC, CL	A-7-6, A-6	0	100	95-100	80-95	40-55	30-42	11-20
FAB-------------- Falfurrias	0-80	Fine sand, loamy fine sand.	SP-SM, SM	A-2-4, A-3	0	100	100	75-100	5-25	<25	NP-3
JDB-------------- Jardin	0-17	Fine sandy loam	SM, SM-SC, SC	A-2-4	0-5	80-100	80-100	80-100	20-35	<30	NP-9
	17-60	Cemented---------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--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	
NFB-------------- Nueces	0-30	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	0	100	95-100	90-100	8-35	<25	NP-6
	30-80	Sandy clay loam, fine sandy loam.	SC	A-2-6, A-6, A-4, A-2-4	0	90-100	90-100	80-100	20-50	25-40	8-20
NSB*:											
Nueces----------	0-33	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	0	100	95-100	90-100	8-35	<25	NP-6
	33-80	Sandy clay loam, fine sandy loam.	SC	A-2-6, A-6, A-4, A-2-4	0	90-100	90-100	80-100	20-50	25-40	8-20
Sarita----------	0-42	Fine sand--------	SM-SC, SP-SM, SM	A-2-4, A-3	0	100	100	65-100	7-35	<25	NP-7
	42-80	Sandy clay loam, fine sandy loam.	SC, SM-SC	A-2-6, A-6, A-2-4, A-4	0	100	100	80-100	17-50	22-40	5-22
PAA-------------- Padrones	0-28	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	0	100	95-100	90-100	8-25	<25	NP-6
	28-80	Fine sandy loam, sandy clay loam, loamy fine sand.	SC, SM, SM-SC	A-4, A-6, A-2-4, A-2-6	0	90-100	85-100	50-99	15-49	20-35	3-16
PbA-------------- Palobia	0-9	Loamy fine sand	SM, SM-SC, SP-SM	A-2-4	0	100	100	90-100	10-25	<25	NP-7
	9-40	Sandy clay loam	SC	A-6, A-7, A-2	0	95-100	90-100	80-95	30-50	30-45	15-27
	40-80	Sandy clay loam, fine sandy loam.	SC	A-6, A-7, A-2	0	95-100	90-100	80-95	30-50	30-45	15-27
PfA-------------- Palobia	0-12	Fine sandy loam	SM, SC, SM-SC	A-2-4	0	100	100	90-100	20-35	<30	3-10
	12-38	Sandy clay loam	SC	A-6, A-7, A-2	0	95-100	90-100	80-95	30-50	30-45	15-27
	38-80	Sandy clay loam, fine sandy loam.	SC	A-6, A-7, A-2	0	95-100	90-100	80-95	30-50	30-45	15-27
PpA-------------- Papagua	0-12	Fine sandy loam	SM-SC, SC	A-2-4, A-4	0	95-100	95-100	90-100	25-50	<25	4-10
	12-41	Sandy clay, sandy clay loam.	SC, CL	A-7-6	0	95-100	95-100	85-95	45-60	43-50	24-30
	41-80	Sandy clay loam	SC, CL	A-6, A-7-6	0	95-100	95-100	80-95	36-60	30-48	18-28
QTA-------------- Quiteria	0-15	Fine sand--------	SP-SM, SM, SM-SC	A-2-4, A-3	0	100	95-100	90-100	8-25	<25	NP-6
	15-59	Fine sandy loam, sandy clay loam, loamy fine sand.	SC, SM, SM-SC	A-4, A-6, A-2-4, A-2-6	0	90-100	85-100	50-99	15-49	20-35	3-16
	59-80	Fine sandy loam, sandy clay loam, loamy fine sand.	SC, SM, SM-SC	A-4, A-6, A-2-4, A-2-6	0	90-100	85-100	50-95	15-49	20-35	3-16

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
SAB-------------- Sarita	0-48	Fine sand--------	SM-SC, SP-SM, SM	A-2-4, A-3	0	100	100	65-100	7-35	<25	NP-7
	48-80	Sandy clay loam, fine sandy loam.	SC, SM-SC	A-2-6, A-6, A-2-4, A-4	0	100	100	80-100	17-50	22-40	5-22
SSB*:											
Sarita----------	0-43	Fine sand--------	SM-SC, SP-SM, SM	A-2-4, A-3	0	100	100	65-100	7-35	<25	NP-7
	43-72	Sandy clay loam, fine sandy loam.	SC, SM-SC	A-2-6, A-6, A-2-4, A-4	0	100	100	80-100	17-50	22-40	5-22
Sauz------------	0-7	Fine sand--------	SM, SM-SC, SP-SM	A-2-4, A-3	0	100	95-100	90-100	8-35	<25	NP-6
	7-44	Fine sandy loam, sandy loam, sandy clay loam.	SC, CL, SM, ML	A-4, A-6, A-2-4, A-2-6	0	90-100	85-100	50-99	24-60	20-35	3-16
	44-70	Fine sandy loam, sandy clay loam, sandy loam.	SC, SM-SC, SM	A-2-4, A-2-6, A-4, A-6	0	90-100	85-100	50-95	25-49	20-38	3-21
SZA-------------- Sauz	0-9	Fine sand--------	SM, SM-SC, SP-SM	A-2-4, A-3	0	100	95-100	90-100	8-35	<25	NP-6
	9-45	Fine sandy loam, sandy clay loam.	SC, CL, SM, ML	A-4, A-6, A-2-4, A-2-6	0	90-100	85-100	50-100	24-60	20-35	3-16
	45-70	Fine sandy loam, sandy clay loam, sandy loam.	SC, SM-SC, SM	A-2-4, A-2-6, A-4, A-6	0	90-100	85-100	50-95	25-49	20-38	3-21
TSA-------------- Tasajal	0-12	Loamy fine sand	SM, SP-SM, SM-SC	A-3, A-2-4	0	100	95-100	90-100	8-25	<25	NP-6
	12-34	Fine sandy loam	SC, SM, SM-SC	A-4, A-2-4	0	97-100	95-100	80-99	23-50	<30	3-10
	34-36	Cemented---------	---	---	---	---	---	---	---	---	---
TuC-------------- Turcotte	0-10	Fine sandy loam	SC, SM-SC	A-4	0	100	95-100	90-100	36-50	20-30	4-10
	10-38	Sandy clay loam, clay loam.	SC, CL	A-6	0	100	95-100	90-100	36-80	30-40	11-20
	38-80	Sandy clay loam, clay loam.	SC, CL	A-6, A-7-6	0	90-100	80-100	75-99	44-80	30-44	11-23
VRA*:											
Vargas----------	0-10	Fine sandy loam	SM, SM-SC, ML, CL-ML	A-4	0	100	100	70-90	40-55	<30	NP-10
	10-27	Fine sandy loam, loam.	CL, SC, SM-SC, CL-ML	A-4	0	98-100	95-100	70-95	35-75	21-28	4-9
	27-33	Gravelly sandy loam, gravelly loam, loam, fine sandy loam.	CL, SC, SM-SC, CL-ML	A-4, A-2-4	0-5	50-85	45-75	35-70	30-55	21-28	4-9
	33-60	Cemented---------	---	---	---	---	---	---	---	---	---
Jardin----------	0-15	Fine sandy loam	SM, SM-SC, SC	A-2-4	0-5	80-100	80-100	80-100	20-35	<30	NP-9
	15-60	Cemented---------	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 13.--ENGINEERING INDEX PROPERTIES--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number-- 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
YtB: Yturria	0-22	Fine sandy loam	SM, SM-SC, SC, SP-SM	A-2-4, A-3	0	100	95-100	90-100	8-35	<25	NP-10
	22-80	Fine sandy loam, loam	SM, SM-SC, SC, SP-SM	A-2-4, A-2-6, A-4, A-6	0	100	93-100	85-100	10-40	<30	NP-13

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated)

Soil name and map symbol	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group	Organic matter
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
COB--------------	0-25	2-12	1.50-1.70	2.0-6.0	0.05-0.10	6.1-7.3	<2	Low--------	0.17	5	2	<1
Comitas	25-80	6-24	1.45-1.70	2.0-6.0	0.11-0.17	6.1-8.4	<2	Low--------	0.24			
CzA--------------	0-6	7-20	1.20-1.40	0.6-2.0	0.09-0.15	6.6-7.8	<2	Low--------	0.24	5	3	1-3
Czar	6-80	18-28	1.30-1.50	0.6-2.0	0.10-0.18	7.4-8.4	<2	Low--------	0.32			
DeB--------------	0-16	4-12	1.50-1.70	2.0-6.0	0.07-0.11	6.1-7.3	<2	Low--------	0.17	5	2	<1
Delfina	16-31	25-35	1.45-1.70	0.2-0.6	0.10-0.20	6.6-8.4	<4	Moderate	0.32			
	31-80	23-35	1.45-1.70	0.6-2.0	0.10-0.17	7.4-8.4	<4	Moderate	0.32			
DfB--------------	0-12	7-20	1.50-1.70	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low--------	0.24	5	3	<1
Delfina	12-34	25-35	1.45-1.70	0.2-0.6	0.10-0.20	6.6-8.4	<4	Moderate	0.32			
	34-80	23-35	1.45-1.70	0.6-2.0	0.10-0.17	7.4-8.4	<4	Moderate	0.32			
DMB--------------	0-15	5-14	1.45-1.70	2.0-6.0	0.07-0.11	6.6-7.8	<2	Low--------	0.17	3	2	<1
Delmita	15-34	18-30	1.45-1.70	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low--------	0.28			
	34-60	---	---	---	---	---	---	-----------	----			
DtB--------------	0-14	5-18	1.40-1.70	0.6-2.0	0.10-0.14	6.6-7.8	<2	Low--------	0.24	3	3	<1
Delmita	14-38	18-30	1.45-1.70	0.6-2.0	0.12-0.15	6.6-7.8	<2	Low--------	0.28			
	38-60	---	---	---	---	---	---	-----------	----			
DU*--------------	0-80	0-9	1.45-1.65	6.0-20	0.02-0.08	5.1-6.5	<2	Low--------	0.15	5	1	<1
Dune land												
EdA--------------	0-10	40-55	1.35-1.55	<0.06	0.10-0.17	6.1-7.3	<8	High-------	0.32	5	4	1-4
Edroy	10-42	35-50	1.35-1.55	0.06-0.2	0.09-0.17	7.4-8.4	<8	High-------	0.32			
	42-56	20-35	1.35-1.65	0.06-0.2	0.08-0.16	7.9-8.4	<8	Moderate	0.37			
	56-75	20-35	1.35-1.65	0.06-2.0	0.05-0.15	7.9-9.0	<8	Moderate	0.37			
FAB--------------	0-80	0-9	1.45-1.65	6.0-20	0.02-0.08	5.1-6.5	<2	Low--------	0.15	5	1	<1
Falfurrias												
JDB--------------	0-17	7-18	1.45-1.70	0.6-2.0	0.10-0.14	6.6-8.4	<2	Low--------	0.24	1	3	1-2
Jardin	17-60	---	---	---	---	---	---	-----------	----			
NFB--------------	0-30	2-10	1.50-1.70	2.0-6.0	0.05-0.10	5.6-7.3	<2	Low--------	0.17	5	1	<1
Nueces	30-80	18-35	1.35-1.75	0.2-0.6	0.12-0.17	5.6-8.4	<2	Low--------	0.24			
NSB*:												
Nueces----------	0-33	2-10	1.50-1.70	2.0-6.0	0.05-0.10	5.6-7.3	<2	Low--------	0.17	5	1	<1
	33-80	18-35	1.35-1.75	0.2-0.6	0.12-0.17	5.6-8.4	<2	Low--------	0.24			
Sarita----------	0-42	1-10	1.50-1.70	6.0-20	0.05-0.08	6.1-7.3	<2	Low--------	0.17	5	1	<1
	42-80	12-34	1.35-1.65	2.0-6.0	0.13-0.19	6.1-8.4	<2	Moderate	0.24			
PAA--------------	0-28	0-6	1.45-1.70	2.0-6.0	0.03-0.10	5.6-7.3	<2	Low--------	0.17	5	1	<1
Padrones	28-80	8-24	1.35-1.80	0.2-0.6	0.05-0.15	6.6-9.0	<4	Low--------	0.24			
PbA--------------	0-9	4-12	1.50-1.75	2.0-6.0	0.07-0.11	5.6-7.3	<2	Low--------	0.17	5	2	<1
Palobia	9-40	20-35	1.45-1.80	0.06-0.2	0.04-0.12	6.6-9.0	2-8	Moderate	0.32			
	40-80	18-30	1.45-1.70	0.2-2.0	0.04-0.11	6.6-9.0	4-16	Moderate	0.32			
PfA--------------	0-12	7-20	1.50-1.75	2.0-6.0	0.11-0.15	5.6-7.3	<2	Low--------	0.24	5	3	<1
Palobia	12-38	20-35	1.45-1.80	0.06-0.2	0.04-0.12	6.6-9.0	2-8	Moderate	0.32			
	38-80	18-30	1.45-1.70	0.2-2.0	0.04-0.11	6.6-9.0	4-16	Moderate	0.32			

See footnote at end of table.

TABLE 14.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Soil name and map symbol	Depth	Clay	Moist bulk density	Permea- bility	Available water capacity	Soil reaction	Salinity	Shrink- swell potential	Erosion factors		Wind erodi- bility group	Organic matter
									K	T		
	In	Pct	g/cc	In/hr	In/in	pH	mmhos/cm					Pct
PpA--------------	0-12	5-18	1.40-1.60	2.0-6.0	0.11-0.15	6.1-7.3	<2	Low--------	0.28	5	3	<1
Papagua	12-41	30-50	1.40-1.60	0.06-0.2	0.14-0.18	6.1-7.3	<2	High-------	0.32			
	41-80	30-35	1.45-1.65	0.06-0.6	0.12-0.18	7.4-8.4	<2	High-------	0.37			
QTA*-------------	0-15	0-6	1.50-1.70	2.0-6.0	0.03-0.10	5.6-7.3	<2	Low--------	0.17	5	1	<1
Quiteria	15-59	8-18	1.45-1.80	0.2-0.6	0.05-0.15	6.6-9.0	2-8	Low--------	0.24			
	59-80	8-18	1.45-1.75	0.6-2.0	0.05-0.15	7.9-9.0	4-8	Low--------	0.24			
SAB--------------	0-48	1-10	1.50-1.70	6.0-20	0.05-0.08	6.1-7.3	<2	Low--------	0.17	5	1	<1
Sarita	48-80	12-34	1.35-1.65	2.0-6.0	0.13-0.19	6.1-8.4	<2	Moderate	0.24			
SSB*:												
Sarita----------	0-43	1-10	1.50-1.70	6.0-20	0.05-0.08	6.1-7.3	<2	Low--------	0.17	5	1	<1
	43-72	12-34	1.35-1.65	2.0-6.0	0.13-0.19	6.1-8.4	<2	Moderate	0.24			
Sauz------------	0-7	2-12	1.50-1.70	2.0-6.0	0.05-0.10	6.6-7.8	<2	Low--------	0.20	5	2	<1
	7-44	10-18	1.50-1.75	0.2-0.6	0.08-0.13	>7.8	2-16	Low--------	0.32			
	44-70	10-25	1.50-1.70	0.6-2.0	0.02-0.10	>7.8	>8	Low--------	0.32			
SZA--------------	0-9	2-12	1.50-1.70	2.0-6.0	0.05-0.10	6.6-7.8	<2	Low--------	0.20	5	2	<1
Sauz	9-45	10-18	1.50-1.75	0.2-0.6	0.08-0.13	>7.8	2-16	Low--------	0.32			
	45-70	10-25	1.50-1.70	0.6-2.0	0.02-0.10	>7.8	>8	Low--------	0.32			
TSA--------------	0-12	2-10	1.50-1.70	2.0-6.0	0.03-0.10	5.6-7.3	<2	Low--------	0.17	3	2	<1
Tasajal	12-34	8-18	1.45-1.75	0.6-2.0	0.05-0.15	6.6-9.0	2-16	Low--------	0.24			
	34-36	---	---	---	---	---	---	-----------	----			
TuC--------------	0-10	15-20	1.20-1.40	0.6-2.0	0.11-0.15	7.4-8.4	<2	Low--------	0.24	5	3	1-3
Turcotte	10-38	20-32	1.20-1.45	0.6-2.0	0.08-0.17	7.4-8.4	<4	Moderate	0.32			
	38-80	23-35	1.25-1.65	0.6-2.0	0.08-0.20	7.9-8.4	<4	Moderate	0.32			
VRA*:												
Vargas----------	0-10	10-20	1.45-1.65	2.0-6.0	0.11-0.15	7.4-8.4	<2	Low--------	0.24	2	3	1-2
	10-27	10-18	1.45-1.70	0.6-2.0	0.11-0.17	7.4-8.4	<2	Low--------	0.28			
	27-33	10-18	1.40-1.65	0.6-2.0	0.10-0.15	7.4-8.4	<2	Low--------	0.32			
	33-60	---	---	---	---	---	---	-----------	----			
Jardin----------	0-15	7-18	1.45-1.70	0.6-2.0	0.10-0.14	6.6-8.4	<2	Low--------	0.24	1	3	1-2
	15-60	---	---	---	---	---	---	-----------	----			
YtB--------------	0-22	5-17	1.50-1.70	2.0-6.0	0.09-0.15	6.6-7.8	<2	Low--------	0.24	5	3	1-2
Yturria	22-80	8-19	1.45-1.65	2.0-6.0	0.10-0.15	7.4-8.4	<2	Low--------	0.24			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--SOIL AND WATER FEATURES

("Flooding" and "water table" and terms such as "rare," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
COB: Comitas	A	None	---	---	>6.0	---	---	---	---	Low	Low.
CzA: Czar	B	Rare	---	---	>6.0	---	---	---	---	Moderate	Low.
DeB, DfB: Delfina	B	None	---	---	>6.0	---	---	---	---	High	Low.
DMB, DtB: Delmita	C	None	---	---	>6.0	---	---	20-40	Thin	Moderate	Low.
DU*: Dune land	A	None	---	---	>6.0	---	---	---	---	Low	Low.
EdA: Edroy	D	None	---	---	+2-4.0	Apparent	Sep-May	---	---	High	Low.
FAB: Falfurrias	A	None	---	---	>6.0	---	---	---	---	Low	Low.
JDB: Jardin	D	None	---	---	>6.0	---	---	7-20	Thin	Moderate	Low.
NFB: Nueces	C	None	---	---	>6.0	---	---	---	---	Moderate	Low.
NSB*:											
Nueces	C	None	---	---	>6.0	---	---	---	---	Moderate	Low.
Sarita	A	None	---	---	>6.0	---	---	---	---	Low	Low.
PAA: Padrones	B	None	---	---	>6.0	---	---	---	---	High	Moderate.
PbA, PfA: Palobia	B	None	---	---	2.5-5.0	Perched	Sep-May	---	---	High	Moderate.
PpA: Papagua	C	None	---	---	+1-1.5	Perched	Sep-May	---	---	High	Low.
QTA: Quiteria	B	None	---	---	>6.0	---	---	---	---	High	Moderate.
SAB: Sarita	A	None	---	---	>6.0	---	---	---	---	Low	Low.
SSB*:											
Sarita	A	None	---	---	>6.0	---	---	---	---	Low	Low.
Sauz	B	None	---	---	0-3.0	Apparent	Sep-May	---	---	High	Moderate.
SZA: Sauz	B	None	---	---	0-3.0	Apparent	Sep-May	---	---	High	Moderate.

See footnote at end of table.

TABLE 15.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydro-logic group	Flooding			High water table			Cemented pan		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hard-ness	Uncoated steel	Concrete
					Ft			In			
TSA------------- Tasajal	B	None-------	---	---	>6.0	---	---	30-50	Thin	High-----	Moderate.
TuC------------- Turcotte	B	None-------	---	---	>6.0	---	---	---	---	High-----	Low.
VRA*:											
Vargas---------	C	None-------	---	---	>6.0	---	---	20-40	Thin	Moderate	Low.
Jardin---------	D	None-------	---	---	>6.0	---	---	7-20	Thin	Moderate	Low.
YtB------------- Yturria	A	None-------	---	---	>6.0	---	---	---	---	Low------	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--PHYSICAL ANALYSIS OF SELECTED SOILS

(Data determined by the Soil Survey Laboratory Staff. Dashes indicate that data were not determined. TR means trace)

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Sand: Coarse (1-0.5 mm)	Sand: Medium (0.5-0.25 mm)	Sand: Fine (0.25-0.1 mm)	Sand: Very fine (0.1-0.05 mm)	Sand: Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Bulk density: 1/3 bar	Bulk density: Ovendry	Water content: 1/10 bar	Water content: 1/3 bar	Water content: 15 bar	Water retention difference
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	g/cc	g/cc	Pct (wt)	Pct (wt)	Pct (wt)	In/in
Falfurrias:[1]	0-3	A1	---	0.2	4.4	86.7	6.2	97.5	2.5	TR	---	---	---	---	1.1	---
S77TX-047-004	3-16	A2	---	0.1	3.5	86.9	6.5	97.0	3.0	TR	1.53	1.53	5.0	4.9	1.0	0.06
	16-38	A3	---	---	3.8	88.7	5.3	97.8	2.2	TR	1.53	1.53	9.3	6.9	0.9	---
	38-57	C1	---	0.1	2.3	89.3	6.6	98.3	1.7	TR	1.52	1.52	5.0	4.0	0.8	0.05
	57-80	C2	---	---	2.1	92.3	4.7	99.1	0.9	TR	1.57	1.57	4.9	4.8	0.7	0.06
	80-131	C3	---	---	5.3	85.6	7.6	98.5	1.5	TR	1.56	1.56	4.3	3.8	0.6	0.05
Falfurrias:[2]	0-18	A1	TR	0.1	4.8	84.0	8.2	97.1	2.9	---	1.50	1.50	1.8	2.2	1.5	---
S78TX-047-001	18-42	A2	TR	0.1	4.2	86.6	6.8	97.7	2.3	---	1.59	1.59	2.8	3.7	1.2	0.04
	42-78	C1	TR	0.1	4.7	84.6	8.5	97.9	2.1	---	1.57	1.57	3.5	3.6	1.1	0.04
	78-119	C2	TR	0.1	3.7	87.3	7.2	98.3	1.7	---	1.58	1.58	7.9	8.1	1.2	---
Falfurrias:[3]	0-3	A1	TR	0.2	2.1	79.3	14.4	96.0	2.0	2.0	---	---	---	---	1.1	---
S77TX-047-002	3-9	A2	---	0.1	1.3	80.8	13.6	95.8	0.6	3.6	1.54	1.55	4.2	3.2	0.8	0.04
	9-15	A3	---	0.1	1.8	81.0	13.3	96.2	0.6	3.6	1.47	1.50	---	5.8	0.9	0.07
	15-25	A4	---	0.1	1.5	80.0	14.4	95.2	TR	4.8	1.52	1.52	---	5.5	0.8	0.07
	25-43	C1	---	0.1	1.5	82.2	12.5	96.3	0.9	2.8	1.55	1.58	---	6.8	0.7	---
	43-60	C2	---	0.1	1.4	81.1	14.2	96.8	0.6	2.6	1.50	1.52	---	5.3	0.4	0.07
	60-85	C3	---	0.1	1.2	81.2	14.0	96.5	1.1	2.4	1.53	1.53	4.0	4.0	0.4	0.06
Nueces:[1]	0-10	A1	---	0.3	6.3	69.3	13.1	89.0	7.4	3.6	---	---	---	---	1.6	---
S76TX-047-001	23-30	E	---	0.1	6.1	69.7	11.7	87.6	7.3	5.1	---	---	---	---	2.0	---
	30-40	2Bt1	---	0.1	4.9	48.0	9.7	62.7	7.8	29.5	---	---	---	---	12.4	---
	40-48	2Bt2	---	0.1	4.7	53.9	9.9	68.6	8.1	23.3	---	---	---	---	10.7	---
Nueces:[4]	0-16	A1	---	0.1	2.4	77.1	14.5	94.1	4.3	1.6	---	---	---	---	1.4	---
S77TX-047-001	16-30	A2	---	---	2.2	77.9	15.1	95.2	2.8	2.0	---	---	---	---	0.8	---
	30-39	E	---	0.1	1.8	77.1	16.1	95.1	3.3	1.6	---	---	---	---	0.7	---
	39-41	2Btg1	---	---	1.9	55.5	12.1	69.5	3.3	27.2	1.60	1.73	---	21.0	12.3	0.14
	41-50	2Btg2	---	0.1	1.9	56.8	11.2	70.0	4.2	25.8	1.67	1.77	---	17.7	13.3	0.07
	50-56	2Btg3	---	TR	2.3	58.3	12.1	72.7	4.9	22.4	1.74	1.81	---	14.8	11.4	0.06
	56-65	2Bt1	---	---	2.5	57.5	14.5	74.5	3.8	21.7	1.69	1.80	---	17.7	10.5	0.12
	65-75	2Bt2	---	0.1	2.2	60.7	13.2	76.2	2.3	21.5	1.67	1.77	---	16.6	10.5	0.10
	75-83	2Bt3	---	0.1	2.1	61.1	11.6	74.9	1.1	24.0	1.64	1.74	---	15.5	11.7	0.06
	83-97	2Bt4	---	0.1	2.2	55.8	12.1	70.2	3.3	26.5	1.64	1.74	---	16.4	12.7	0.06
	97-111	2Bt5	---	---	2.4	55.3	16.5	74.2	7.0	18.8	1.66	1.77	---	16.2	9.0	0.10
	111-120	2Bt6	---	---	2.5	54.1	18.4	75.0	5.8	19.2	1.66	1.76	---	16.8	9.8	0.12

See footnotes at end of table.

TABLE 16.--PHYSICAL ANALYSIS OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Particle-size distribution: Sand: Very coarse (2-1 mm)	Coarse (1-0.5 mm)	Medium (0.5-0.25 mm)	Fine (0.25-0.1 mm)	Very fine (0.1-0.05 mm)	Total (2-0.05 mm)	Silt (0.05-0.002 mm)	Clay (<0.002 mm)	Bulk density: 1/3 bar	Bulk density: Ovendry	Water content: 1/10 bar	1/3 bar	15 bar	Water retention difference
	In		Pct	Pct	Pct	Pct	Pct	Pct	Pct	Pct	g/cc	g/cc	Pct (wt)			In/in
Padrones:[5]	0-3	A1	---	0.1	5.8	77.5	10.5	93.9	6.1	TR	---	---	---	---	2.0	---
S77TX-047-003	3-11	A2	---	0.1	4.9	79.3	9.4	93.7	6.3	TR	---	---	---	---	1.4	---
	11-23	A3	---	0.1	5.2	78.2	11.1	94.6	5.4	TR	1.49	1.52	---	6.1	1.0	0.08
	23-34	E1	---	0.1	4.4	79.5	10.1	94.1	5.9	TR	1.55	1.55	4.2	3.1	0.9	0.03
	34-39	E2	---	0.1	4.9	77.8	12.1	94.9	5.1	TR	1.58	1.58	3.3	2.4	0.7	0.03
	39-40	2Btn1	---	0.1	3.9	75.1	8.8	87.9	6.0	6.1	---	---	---	---	3.6	---
	40-53	2Btn2	---	0.1	4.7	70.7	10.0	85.5	6.0	8.5	1.62	1.69	19.1	15.7	5.0	---
	53-64	2Btn3	---	0.1	4.5	70.3	7.8	82.7	6.8	10.5	1.55	1.66	24.8	20.7	6.3	0.17
	64-75	2Btn4	---	0.1	4.7	68.2	8.4	81.4	4.7	13.9	1.49	1.64	27.2	22.3	7.8	0.22
	75-87	2Btknc1	0.1	0.1	4.8	63.9	7.3	76.2	4.1	19.7	1.38	1.70	36.5	29.9	12.3	0.22
	87-96	2Btknc2	---	0.1	5.1	67.2	6.8	79.2	4.4	16.4	1.45	1.66	32.6	28.0	11.0	0.24
	96-108	2Btknc3	---	---	5.7	65.8	9.9	81.4	3.9	14.7	---	---	---	---	9.0	0.25
Sauz:[6 7]	0-8	A	TR	TR	4.2	41.4	45.8	91.4	6.2	2.4	---	---	---	---	1.1	---
S79TX-047-002	8-11	Btn1	TR	0.1	5.0	40.0	36.8	81.9	5.1	13.0	---	---	---	---	5.9	---
	11-15	Btn2	TR	0.1	4.5	37.4	35.1	77.1	5.4	17.5	---	---	---	---	8.5	---
	15-27	Btnc	0.1	0.2	4.0	37.2	35.6	77.1	5.0	17.9	---	---	---	---	8.7	---
	27-40	Btknc	0.3	0.2	4.0	35.7	35.9	76.1	6.0	17.9	---	---	---	---	8.6	---
	40-60	2Ckn	1.8	1.9	5.7	32.8	28.4	70.6	9.0	20.4	---	---	---	---	9.5	---

[1] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[2] Located 14.4 miles south of Texas Highway 285 in Falfurrias on U.S. Highway 281, about 0.9 mile west, and 50 feet south in an area of rangeland.

[3] Located from U.S. Highway 281 in Falfurrias, 9.8 miles west on Texas Highway 285, about 6.3 miles south, and 0.1 mile west in an area of rangeland.

[4] Located from U.S. Highway 281 in Falfurrias, 9.8 miles west on Texas Highway 285, about 6.3 miles south, 0.3 mile west, and 100 feet north in an area of rangeland.

[5] Located from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 12 miles east-northeast along a paved ranch road.

[6] Located from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 7.3 miles east on a paved road, 2 miles north on a paved road, and 100 feet west in an area of rangeland.

[7] This pedon is outside the range of the series because the pH is slightly higher than is typical for the series and the salinity is slightly lower.

TABLE 17.--CHEMICAL ANALYSIS OF SELECTED SOILS

(Data determined by the Soil Survey Laboratory Staff. Dashes indicate that data were not determined. TR means trace; CEC, cation-exchange capacity; ESP, exchangeable sodium percentage; and SAR, sodium adsorption ratio)

Soil name and sample number	Depth	Horizon	Extractable bases: Ca	Mg	Na	K	Sum	Extractable acidity	CEC (sum of cations)	Base saturation (sum)	Organic carbon	Electrical conductivity	pH: H_2O (1:1)	$CaCl_2$ 0.01M (1:2)	ESP	SAR	Extractable iron
	In		---Milliequivalents/100 grams of soil----							Pct	Pct	mmhos/cm			Pct		Pct
Falfurrias:[1] S77TX-047-004	0-3	A1	0.9	0.2	0.1	0.1	1.3	---	1.3	100	0.20	---	6.1	5.4	---	---	0.1
	3-16	A2	0.8	0.2	0.1	0.1	1.2	0.5	1.7	71	0.12	---	5.6	5.0	---	---	0.1
	16-38	A3	0.8	0.2	---	---	1.0	0.5	1.5	67	0.08	---	5.5	4.9	---	---	0.1
	38-57	C1	0.5	0.2	0.1	TR	0.8	0.3	1.1	73	0.04	---	5.4	4.9	---	---	TR
	57-80	C2	0.3	0.1	0.1	TR	0.5	0.3	0.8	62	0.02	---	5.3	4.9	---	---	TR
	80-131	C3	0.3	0.2	0.1	TR	0.6	0.1	0.7	86	0.02	---	5.4	4.9	---	---	0.1
	131-139	2Bt1	3.5	1.6	0.2	0.3	5.6	1.0	6.6	85	0.03	---	6.1	5.4	---	---	0.1
	139-158	2Bt2	5.3	2.4	0.2	0.4	8.3	1.2	9.5	87	0.04	---	6.0	5.3	---	---	0.1
	158-170	2Bt3	4.1	1.8	0.2	0.3	6.4	0.8	7.2	89	0.05	---	6.3	5.5	---	---	0.1
Falfurrias:[2] S78TX-047-001	0-18	A1	1.1	0.4	---	TR	1.5	0.8	2.3	65	0.19	---	6.2	5.8	---	---	0.1
	18-42	A2	0.5	0.2	---	---	0.7	0.5	1.2	58	0.05	---	6.0	5.4	---	---	TR
	42-78	C1	0.2	0.1	---	---	0.3	0.1	0.4	75	0.02	---	5.6	5.0	---	---	TR
	78-119	C2	0.2	0.1	---	---	0.3	0.1	0.4	75	0.02	---	5.5	5.0	---	---	TR
	119-121	2Bt1	1.9	1.0	0.4	0.1	3.4	1.2	4.6	74	0.08	---	6.0	4.0	---	---	TR
	121-124	2Bt2	2.2	1.2	0.5	0.1	4.0	1.8	5.8	69	0.08	---	5.9	4.9	---	---	TR
	124-143	2Bt3	3.6	2.0	1.1	0.2	6.9	1.0	7.9	87	0.03	---	7.1	6.4	---	---	0.1
Falfurrias:[3] S77TX-047-002	0-3	A1	1.2	0.3	0.1	0.2	1.8	---	1.8	100	0.32	---	6.3	5.8	---	---	0.1
	3-9	A2	0.8	0.2	0.1	0.1	1.2	---	1.2	100	0.16	---	6.2	5.6	---	---	0.1
	9-15	A3	0.7	0.2	0.1	0.1	1.1	---	1.1	100	0.09	---	6.1	5.5	---	---	0.1
	15-25	A4	0.7	0.2	0.1	0.1	1.1	---	1.1	100	0.07	---	6.1	5.4	---	---	0.1
	25-43	C1	0.5	0.2	0.1	0.1	0.9	---	0.9	100	0.04	---	6.0	5.3	---	---	0.1
	43-60	C2	0.3	0.1	0.1	0.1	0.6	---	0.6	100	0.02	---	5.8	5.2	---	---	0.1
	60-85	C3	0.3	0.1	TR	0.1	0.5	---	0.5	100	0.02	---	5.5	4.9	---	---	0.1
	85-91	2Bt1	2.1	1.9	0.2	0.3	4.5	2.4	6.9	65	0.07	---	5.5	4.6	---	---	0.2
	91-101	2Bt2	6.4	5.8	0.4	0.7	13.3	4.0	17.3	77	0.07	---	5.9	4.9	---	---	0.4
	101-124	2Bt3	7.7	6.8	0.5	0.9	15.9	3.3	19.2	83	0.04	---	5.7	5.2	---	---	0.2
	124-130	2Bt4	7.4	6.7	0.5	0.8	15.4	2.2	17.6	88	0.04	---	6.2	5.4	---	---	0.2
	130-142	2Bt5	7.5	6.2	0.5	0.7	14.9	1.5	16.4	91	0.03	---	6.2	5.5	---	---	0.2
Nueces:[1] S76TX-047-001	0-10	A1	1.8	0.5	0.3	0.5	3.1	1.2	4.3	72	0.29	---	6.9	6.2	---	---	---
	23-30	E	1.6	0.5	0.3	0.3	2.7	1.2	3.9	69	0.11	---	6.2	5.4	---	---	---
	30-40	2Bt1	9.0	4.7	0.5	1.0	15.2	4.3	19.5	78	0.23	---	6.7	6.1	---	---	---
	40-48	2Bt2	8.5	4.9	0.6	0.8	14.8	2.3	17.1	87	0.15	---	6.8	6.1	---	---	---

See footnotes at end of table.

TABLE 17.--CHEMICAL ANALYSIS OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Extractable bases: Ca	Mg	Na	K	Sum	Extractable acidity	CEC (sum of cations)	Base saturation (sum)	Organic carbon	Electrical conductivity	pH H_2O (1:1)	pH $CaCl_2$ 0.01M (1:2)	ESP	SAR	Extractable iron
	In		---Milliequivalents/100 grams of soil----							Pct	Pct	mmhos/cm			Pct		Pct
Nueces:[4] S77TX-047-001	0-16	A1	1.0	0.3	TR	0.2	1.5	0.4	1.9	79	0.19	0.03	6.2	5.5	---	---	0.1
	16-30	A2	0.5	0.2	TR	0.1	0.8	0.3	1.1	73	0.08	0.01	5.7	4.8	---	---	0.1
	30-39	E	0.4	0.1	0.1	---	0.6	0.3	0.9	67	0.04	0.01	5.7	4.7	---	---	0.1
	39-41	2Btg1	5.0	3.6	1.1	0.7	10.4	4.5	14.9	70	0.33	0.07	6.2	5.3	---	---	0.1
	41-50	2Btg2	5.3	4.0	1.4	0.7	11.4	3.9	15.3	75	0.20	0.08	6.5	5.6	---	---	0.6
	50-56	2Btg3	5.1	3.9	1.5	0.6	11.1	2.5	13.6	87	0.11	0.12	7.1	5.2	---	---	0.4
	56-65	2Bt1	5.0	3.9	1.8	0.5	11.2	1.3	12.5	90	0.06	0.20	7.6	6.8	---	---	0.3
	65-75	2Bt2	5.0	3.9	2.0	0.5	11.4	0.8	12.2	93	0.05	1.14	7.9	7.2	13	13	0.2
	75-83	2Bt3	5.9	4.7	2.8	0.6	14.0	0.8	14.8	95	0.04	1.56	8.1	7.4	16	14	0.2
	83-97	2Bt4	6.8	5.4	3.3	0.7	16.2	0.7	16.9	96	0.03	1.83	8.1	7.5	17	15	0.2
	97-111	2Bt5	5.4	4.3	2.6	0.6	12.9	0.6	13.5	96	0.03	1.86	8.1	7.4	16	14	0.2
	111-120	2Bt6	5.4	4.4	2.5	0.7	13.0	0.4	13.4	97	0.02	2.12	8.0	7.4	15	13	0.2
Padrones:[5] S77TX-047-003	0-3	A1	1.6	0.5	0.1	0.3	2.5	0.3	2.8	89	0.63	---	6.4	5.8	---	---	0.1
	3-11	A2	0.9	0.3	TR	0.2	1.4	---	1.4	100	0.18	---	5.9	5.3	---	---	0.1
	11-23	A3	0.7	0.3	TR	0.2	1.2	0.2	1.4	86	0.12	---	5.8	5.2	---	---	0.1
	23-34	E1	0.6	0.3	0.1	0.1	1.1	---	1.1	100	0.07	---	5.6	5.1	---	---	0.1
	34-39	E2	0.4	0.2	0.1	TR	0.7	---	0.7	100	0.04	---	6.0	5.4	14	---	0.1
	39-40	2Btn1	1.3	1.2	0.8	0.1	3.4	0.4	3.8	89	0.14	---	7.0	5.8	21	---	0.1
	40-53	2Btn2	1.4	1.7	1.6	0.2	4.9	0.1	5.0	98	0.05	---	7.9	6.6	32	---	0.1
	53-64	2Btn3	1.5	2.2	3.1	0.3	7.1	---	7.1	100	0.02	1.07	8.3	7.3	40	30	0.1
	64-75	2Btn4	1.7	2.8	4.7	0.4	9.6	---	9.6	100	0.02	1.70	8.9	7.9	43	41	0.1
	75-87	2Btknc1	13.6	4.9	9.4	0.9	28.8	---	28.8	100	0.02	1.97	9.2	8.6	59	49	0.1
	87-96	2Btknc2	2.0	3.9	7.8	0.7	14.4	---	14.4	100	0.01	1.67	8.9	8.2	53	49	0.1
	96-108	2Btknc3	2.0	3.3	6.4	0.6	12.3	---	12.3	100	0.03	1.82	9.3	8.7	54	54	TR
Sauz:[6] [7] S79TX-047-002	0-8	A	0.6	0.2	0.3	0.2	1.3	---	---	100	0.10	0.06	7.2	6.2	---	---	---
	8-11	Btn1	---	1.1	3.4	0.6	---	---	---	---	0.21	1.20	8.6	7.4	51	30	---
	11-15	Btn2	2.3	1.6	6.4	0.9	11.2	---	---	100	0.13	1.46	9.4	8.4	70	47	---
	15-27	Btnc	5.6	1.7	7.5	0.9	15.7	---	---	100	0.05	2.17	9.9	9.3	79	61	---
	27-40	Btknc	---	2.5	9.5	1.0	---	---	---	---	0.03	2.85	10.0	9.2	94	89	---
	40-60	2Ckn	---	4.4	12.4	0.8	---	---	---	---	0.06	7.32	9.9	9.0	105	360	---

[1] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[2] Located 14.4 miles south of Texas Highway 285 in Falfurrias on U.S. Highway 281, about 0.9 mile west, and 50 feet south in an area of rangeland.

[3] Located from U.S. Highway 281 in Falfurrias, 9.8 miles west on Texas Highway 285, about 6.3 miles south, and 0.1 mile west in an area of rangeland.

[4] Located from U.S. Highway 281 in Falfurrias, 9.8 miles west on Texas Highway 285, about 6.3 miles south, 0.3 mile west, and 100 feet north in an area of rangeland.

[5] Located from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 12 miles east-northeast along a paved ranch road.

[6] Located from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 7.3 miles east on a paved road, 2 miles north on a paved road, and 100 feet west in an area of rangeland.

[7] This pedon is outside the range of the series because the pH is slightly higher than is typical for the series and the salinity is slightly lower.

TABLE 18.--MINERALOGY OF SELECTED SOILS

(Data determined by the Soil Survey Laboratory Staff. A dash indicates that the test was not run. An asterisk indicates that the test was run, but the mineral was not detected)

Soil name and sample number	Depth	Horizon	Clay fraction[1]								Sand fraction		
			Montmo- rillonite	Kaolinite	Quartz	Calcite	Dolomite	Vermiculite	Vermic- ulite mica	Mica	Grain size	Resistant minerals	Dominant weatherable minerals[2]
	In										Mm	Pct	Pct
Falfurrias:[3]													
S77TX-047-004	16-38	A3	---	---	---	---	---	---	---	---	0.25-0.05	87	FK12
	57-80	C2	---	---	---	---	---	---	---	---	0.25-0.05	89	FK10
	131-139	2Bt1	4	2	*	*	*	*	*	3	0.25-0.05	94	FK6
Falfurrias:[4]													
S78TX-047-001	18-42	A2	---	---	---	---	---	---	---	---	0.25-0.10	89	FK10
	119-121	2Bt1	*	3	*	*	*	*	3	3	0.25-0.10	89	FK10
	124-143	2Bt3	2	2	*	*	*	2	*	3	0.25-0.10	89	FK10
Falfurrias:[5 6]													
S77TX-047-002	15-25	A4	---	---	---	---	---	---	---	---	0.25-0.05	93	FK7
	43-60	C2	---	---	---	---	---	---	---	---	0.25-0.05	92	FK8
	91-101	2Bt2	2	3	1	*	*	*	*	3	0.25-0.05	93	FK6
Nueces:[7]													
S77TX-047-001	0-16	A1	---	---	---	---	---	---	---	---	0.25-0.10	92	FK8
	39-41	2Btg1	3	3	1	*	*	*	*	4	0.25-0.10	92	FK8
	50-56	2Btg3	3	3	1	*	*	*	*	4	0.25-0.10	93	FK7
	50-56	2Btg3	---	---	---	---	---	---	---	---	0.10-0.05	81	FK19
	75-83	2Bt3	4	3	1	*	*	3	*	4	0.25-0.10	93	FK7
	111-120	2Bt6	3	2	1	*	*	*	*	4	---	---	---
Nueces:[3]													
S76TX-047-001	0-10	A1	---	---	---	---	---	---	---	---	0.25-0.10	90	FK10
	30-40	2Bt1	---	---	---	---	---	---	---	---	0.25-0.10	90	FK10
Padrones:[8]													
S77TX-047-003	0-3	A1	---	---	---	---	---	---	---	---	0.25-0.10	89	FK10
	23-34	E1	---	---	---	---	---	---	---	---	0.25-0.10	88	FK10
	40-53	2Btn2	2	2	1	*	*	*	*	3	0.25-0.10	88	FK11

See footnotes at end of table.

TABLE 18.--MINERALOGY OF SELECTED SOILS--Continued

Soil name and sample number	Depth	Horizon	Clay fraction[1]								Sand fraction		
			Montmo-rillonite	Kaolinite	Quartz	Calcite	Dolomite	Vermiculite	Vermic-ulite mica	Mica	Grain size	Resistant minerals	Dominant weatherable minerals[2]
	In										Mm	Pct	Pct
Sauz:[9] [10]													
S79TX-047-002	15-27	Btnc	2	2	1	*	*	*	*	3	0.10-0.05	82	FK16
	40-60	2Ckn	2	*	*	2	2	*	*	3	0.10-0.05	80	FK15

[1] Relative amounts: 6, indeterminate; 5, dominant; 4, abundant; 3, moderate; 2, small; and 1, trace.
[2] FK indicates potassium feldspar.
[3] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."
[4] Located 14.4 miles south of Texas Highway 285 in Falfurrias on U.S. Highway 281, about 0.9 mile west, and 50 feet south.
[5] Located from U.S. Highway 281 in Falfurrias, 9.8 miles west on Texas Highway 285, about 6.3 miles south, and 0.1 mile west.
[6] This pedon is outside the range of the series because the percentage of resistant minerals is more than 90 percent.
[7] Located from U.S. Highway 281 in Falfurrias, 9.8 miles west on Texas Highway 285, about 6.3 miles south, 0.3 mile west, and 100 feet north.
[8] Located from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 12 miles east-northeast along a paved ranch road.
[9] Located from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 7.3 miles east on a paved road, 2 miles north on a paved road, and 100 feet west.
[10] This pedon is outside the range of the series because the pH is slightly higher than is typical for the series and the salinity is slightly lower.

TABLE 19.--ENGINEERING INDEX TEST DATA

(Dashes indicate that data were not available)

Soil name, report number, horizon, and depth in inches	Classification		Grain-size distribution													Liquid limit	Plasticity index	Specific gravity	Shrinkage		
			Percentage passing sieve--									Percentage smaller than--									
	AASHTO	Unified	5/8 inch	3/8 inch	No. 4	No. 10	No. 20	No. 40	No. 60	No. 100	No. 200	.05 mm	.005 mm	.002 mm	.001 mm				Limit	Linear	Ratio
																Pct		g/cc	Pct	Pct	
Sarita:[1] (S79TX-047-1-1-6)																					
A------- 0 to 22	A-3(0)	SP-SM	---	---	---	---	---	100	94	53	8	7	2	1	1	24	3	2.64	18	0.6	1.68
E------- 22 to 48	A-3(0)	SP-SM	---	---	---	---	---	100	95	55	7	2	1	0	0	23	3	2.63	18	0.6	1.65
2Bt1---- 48 to 50	A-2-4(0)	SM-SC	---	---	---	---	---	100	96	60	17	16	12	11	10	22	5	2.63	19	2.2	1.72
2Bt2---- 50 to 55	A-2-4(0)	SM-SC	---	---	---	---	---	100	95	58	19	17	15	14	13	25	7	2.64	20	2.8	1.66
2Bt3---- 55 to 68	A-2-4(0)	SC	---	---	---	---	---	100	94	55	20	18	16	15	14	26	8	2.65	18	4.2	1.72
2Bt4---- 68 to 80	A-2-4(0)	SC	---	---	---	---	---	100	94	56	22	21	19	18	17	28	10	2.65	20	4.5	1.69
Sauz fine sand:[2] (S79TX-047-2-1-6)																					
A------- 0 to 8	A-2-4(0)	SM	---	---	---	---	---	100	97	67	14	8	3	1	1	22	3	2.63	17	1.4	1.71
Btn1---- 8 to 11	A-2-4(0)	SC	---	---	---	---	---	100	97	68	24	21	16	15	14	27	9	2.64	20	3.8	1.67
Btn2---- 11 to 15	A-2-6(0)	SC	---	---	---	---	100	99	96	68	27	23	18	17	17	30	12	2.63	21	4.8	1.65
Btnc---- 15 to 27	A-2-6(0)	SC	---	---	---	---	100	99	97	69	28	22	16	15	15	30	12	2.66	21	4.7	1.65
Btknc--- 27 to 40	A-2-6(0)	SC	100	98	97	95	95	94	91	66	27	24	17	16	16	31	13	2.67	20	5.2	1.67
2Ckn---- 40 to 60	A-2-6(0)	SC	100	98	92	84	78	76	73	54	28	27	24	20	16	34	21	2.67	17	8.2	1.76
Yturria fine sandy loam:[3] (S79TX-047-3-1-4)																					
A------- 0 to 20	A-2-4(0)	SM-SC	---	---	---	---	---	100	98	78	28	19	6	5	5	22	6	2.65	17	2.8	1.74
Bw------ 20 to 30	A-2-4(0)	SM-SC	---	---	---	---	---	100	98	79	29	21	8	6	5	24	7	2.62	18	3.1	1.75
Bk------ 30 to 41	A-2-4(0)	SM-SC	---	---	100	100	100	100	98	80	32	25	11	9	6	25	7	2.65	16	4.2	1.76
BCk----- 41 to 80	A-4(0)	SC	---	---	100	99	99	99	97	80	37	28	12	6	3	25	9	2.66	16	4.8	1.78

[1] Location of the pedon sampled is the same as that of the typical pedon described in the section "Soil Series and Their Morphology."

[2] This pedon is outside the range of the series because the pH is slightly higher than is typical for the series and the salinity is slightly lower. It is located from the post office in Encino, 0.6 mile north on U.S. Highway 281 to the entrance of the Encino Division of the King Ranch, 7.3 miles east on a paved road, 2 miles north on a paved road, and 100 feet west in an area of rangeland.

[3] Located from Texas Highway 285 in Falfurrias, 3.7 miles south on U.S. Highway 281, about 1.25 miles east, 0.15 mile south, and 50 feet west of a road in an area of rangeland.

TABLE 20.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Comitas	Loamy, mixed, hyperthermic Arenic Aridic Paleustalfs
Czar	Fine-loamy, mixed, hyperthermic Pachic Argiustolls
Delfina	Fine-loamy, mixed, hyperthermic Aquic Paleustalfs
Delmita	Fine-loamy, mixed, hyperthermic Petrocalcic Paleustalfs
Edroy	Fine, mixed, hyperthermic Vertic Haplaquolls
Falfurrias	Mixed, hyperthermic Typic Ustipsamments
Jardin	Loamy, mixed, hyperthermic, shallow Petrocalcic Paleustolls
Nueces	Loamy, mixed, hyperthermic Aquic Arenic Paleustalfs
Padrones	Loamy, mixed, hyperthermic Aquic Arenic Natrustalfs
Palobia	Fine-loamy, mixed, hyperthermic Aquic Natrustalfs
Papagua	Fine, mixed, hyperthermic Typic Albaqualfs
Quiteria	Coarse-loamy, mixed, hyperthermic Aquic Natrustalfs
Sarita	Loamy, mixed, hyperthermic Grossarenic Paleustalfs
Sauz	Fine-loamy, mixed, hyperthermic Typic Natraqualfs
Tasajal	Coarse-loamy, mixed, hyperthermic Petrocalcic Natrustalfs
Turcotte	Fine-loamy, mixed, hyperthermic Typic Haplustolls
Vargas	Coarse-loamy, mixed, hyperthermic Petrocalcic Paleustolls
Yturria	Coarse-loamy, mixed, hyperthermic Pachic Haplustolls

*U.S. G.P.O.:1993-341-646:80012/SCS

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