Soil Survey Of
Wilson County, Texas

ELECTRONIC VERSION

This soil survey is an electronic version of the original printed copy, dated June 1977. It has been formatted for electronic delivery. Additional and updated information may be available from the Web Soil Survey. In Web Soil Survey, identify an Area of Interest (AOI) and navigate through the AOI Properties panel to learn what soil data is available.

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

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey

Major fieldwork for this soil survey was completed in the period 1964-71. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1972. This survey was made cooperatively by the Soil Conservation Service and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Wilson Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

This soil survey contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

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

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

Finding and Using Information

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

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

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

Game managers sportsmen, and others can find information about soils and wildlife in the section "Use of the Soils for Wildlife."

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

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and for recreation areas in the sections Engineering Uses of the Soils" and "Use of the Soils for Recreation."

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

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

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

Cover: Charolais cattle in a coastal bermudagrass pasture in an area of Venus clay loam, 0 to 1 percent slopes.

Contents

Issued June 1977

Summary of Tables

SOIL SURVEY OF WILSON COUNTY, TEXAS

By Frank B. Taylor, Soil Conservation Service
United States Department of Agriculture, Soil Conservation Service,
In Cooperation with the Texas Agricultural Experiment Station

Wilson County is in north-central Texas (fig. 1). It is nearly pentagonal in shape. The total area is 802 square miles, or 513,280 acres. The population is about 14,650, nearly 42 percent of which is urban. Floresville, the county seat, is located in the west-central part of the county at the intersection of U.S. Highway 181 and Texas Highway 97. The average annual rainfall is 28.96 inches, and the average annual temperature is about 72°F. Elevation ranges from 290 feet in the southeastern part of the county, where the San Antonio River crosses the Wilson-Karnes County line, to 790 feet in the northern part of the county west-southwest of LaVernia *(3).*

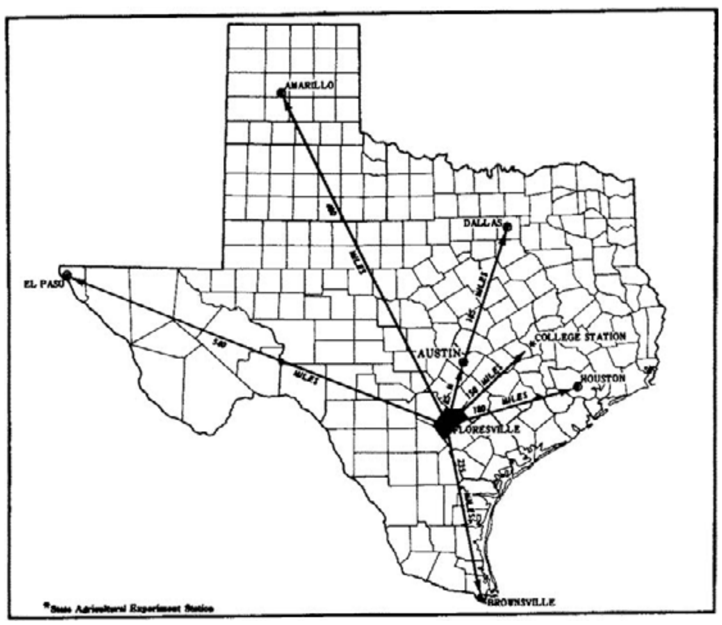

Figure 1.—Location of Wilson County in Texas.

Farming and ranching are the main enterprises in the county, and some oil, gas, and clay products are produced. About 235,000 acres is farmed. The main crops are peanuts, corn, grain sorghums, small grains, watermelons, flax, hay, and some vegetable crops. About 30,000 acres is irrigated and is mainly in peanuts, vegetable crops, hay, and improved coastal bermudagrass pastures. Irrigation water comes mainly from deep wells in the Carrizo and Queen City geologic formations or from the San Antonio River and Cibolo Creek. Dairy farming is an important enterprise in Wilson County, accounting for one-fourth of farm income. Approximately 179,585 acres is in range, and about 80,000 acres is in improved pasture. This land is devoted primarily to livestock production.

How This Survey Was Made

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

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

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

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Floresville fine sandy loam, 0 to 1 percent slopes, is one of several phases within the Floresville series.

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

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

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

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

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

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rock outcrop is a land type in this county.

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

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

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

General Soil Map

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

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

The six soil associations in Wilson County are described in the following pages. The terms for texture used in the title for several of the associations apply to texture of the surface layer. For example, in the title of association 3, the words, "loamy and clayey" refer to the texture of the surface layer.

1. Wilco-Floresville-Miguel association

Deep, nearly level to sloping, well-drained, slowly permeable and very slowly permeable sandy and loamy soils that have clayey lower layers; on uplands

This association (fig. 2) makes up about 35 percent of the county. Wilco soils make up about 30 percent of this association; Floresville soils, about 28 percent; Miguel soils, about 26 percent; and minor soils about 16 percent. Among the minor soils are Leming, Poth, Willamar, Runge, Clareville, and Zavala soils.

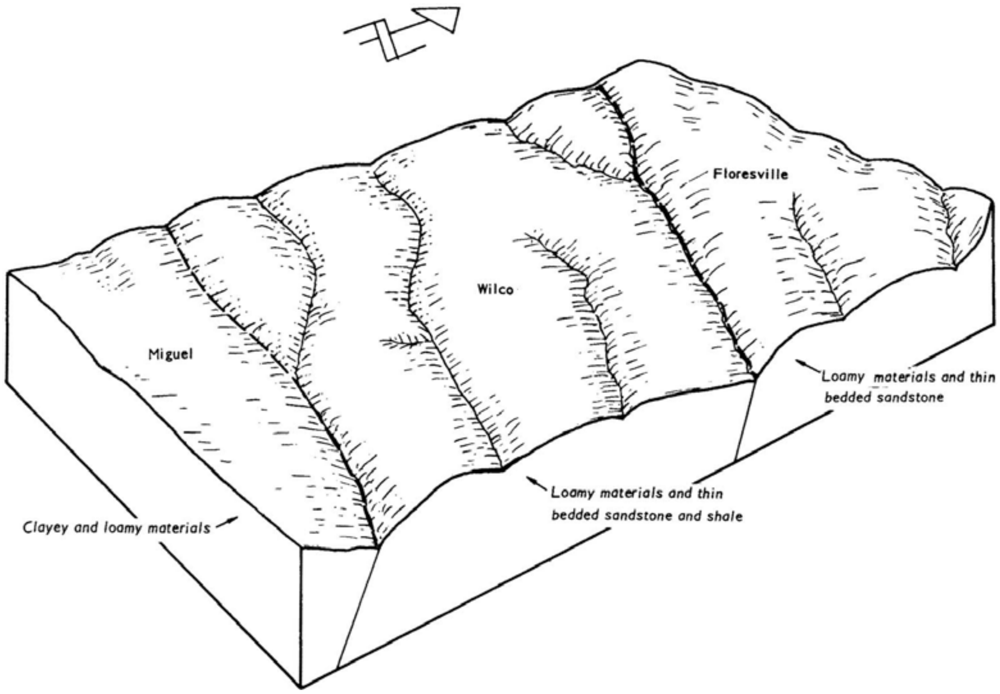

Figure 2.—Typical pattern of soils in association 1.

Wilco soils have a pale-brown loamy fine sand surface layer about 16 inches thick. Below this is about 16 inches of brown sandy clay and about 6 inches of reddish-yellow sandy clay loam. The next layer, to a depth of 60 inches, is fine sandy loam that is light yellowish brown in the upper part and very pale brown in the lower part.

Floresville soils have a reddish-brown fine sandy loam surface layer about 10 inches thick. Below this is about 20 inches of red clay and sandy clay. The next layer, to a depth of 65 inches, is sandy clay loam that is yellowish red in the upper part and reddish yellow in the lower part.

Miguel soils have a brown fine sandy loam surface layer about 11 inches thick. The next layer is about 13 inches of brown clay and sandy clay. Below this, to a depth of 60 inches, is mostly sandy clay loam that is light brown in the upper part, light yellowish brown in the middle part, and very pale brown in the lower part.

Most areas of this association are used for crops, but some are used for improved pasture and others for native range. The average size of a farm in this association is about 300 acres. Most farms emphasize livestock or an irrigated specialty crop. The soils in this association are suited to all crops grown in the county.

The development of septic-tank systems and sanitary landfills are the main concerns in urban planning. The corrosivity of steel pipe in the soils in this association is also a concern. The hazards of water erosion and soil blowing are slight to severe.

These soils have good potential for the development of habitat for quail, dove, and small game.

2. Eufaula-Patilo association

Deep, undulating somewhat excessively drained to moderately well drained, rapidly permeable to moderately slowly permeable sandy soils that have loamy lower layers; on uplands

This association (fig. 3) makes up about 20 percent of the county. Eufaula soils make up about 38 percent of this association; Patilo soils, about 20 percent; and minor soils about 42 percent. Among the minor soils are Sarita, Zavala, Tabor, Poth, Leming, Nocken, and Crockett soils.

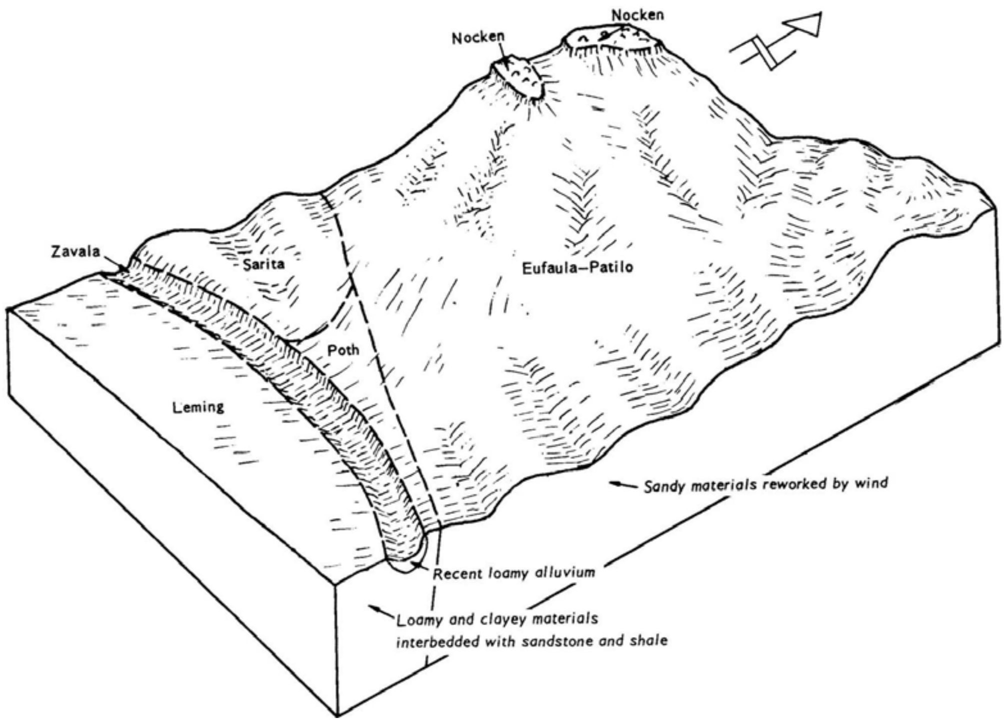

Figure 3.—Typical pattern of soils in association 2.

Eufaula soils have a fine sand layer, about 102 inches thick, that is pale brown in the upper part and very pale brown in the lower part. The next layer, to a depth of 120 inches, is red sandy clay loam.

Patilo soils have a fine sand layer, about 54 inches thick, that is pale brown in the upper part and very pale brown in the lower part. The next layer, to a depth of 85 inches, is sandy clay loam that is light gray in the upper part and white in the lower part.

Most areas of this association are used for range, but some are used for improved pasture, especially if irrigation water is available, and others are used for crops. The average size of a farm in this association is about 450 acres, and livestock is raised on most farms. The soils in this association are suited to only a few of the crops grown in the county.

The development of roads and sanitary landfills are concerns in urban planning. The hazard of soil blowing is severe, and the hazard of water erosion is slight. Establishing vegetative cover and landscaping are difficult unless the soils are irrigated.

These soils have good potential for the development of habitat for deer and small game.

3. Elmendorf-Luling-Denhawken association

Deep, nearly level to gently sloping, well-drained, very slowly permeable loamy and clayey soils that have clayey lower layers; on uplands

This association makes up about 15 percent of the county. Elmendorf soils make up 45 percent of this association; Luling soils, 22 percent; Denhawken soils, 10 percent; and minor soils, 23 percent. Among the minor soils are Kaufman, Aransas, Coy, Clareville, and Floresville soils.

Elmendorf soils have a dark grayish-brown clay loam surface layer about 11 inches thick. The next layer, about 27 inches thick, is very dark gray clay loam in the upper part and clay in the lower part. Below this is about 10 inches of dark-gray clay over yellowish-brown clay that extends to a depth of 62 inches.

Luling soils have a dark grayish-brown clay surface layer about 14 inches thick. The next layer, about 28 inches thick, is olive-gray clay. Below this, to a depth of 70 inches, is clay that is light olive gray in the upper part and light gray in the lower part.

Denhawken soils have a clay loam layer, about 14 inches thick, that is grayish brown in the upper part and brown in the lower part. Below this is about 32 inches of clay that is brown in the upper part and pale brown in the lower part. Shaly clay is at a depth of 46 inches.

Most areas of this association are used for crops, but some are used for improved pasture or native range. The average size of a farm in this association is about 350 acres. Most farms are diversified, raising crops, livestock, or dairy cattle. The soils in this association are suited to most crops generally grown in the county.

The development of septic-tank systems and sanitary landfills are concerns in urban planning. The shrink-swell potential and the corrosivity of steel pipe in this association are also concerns. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is slight.

These soils have good potential for development of habitat for dove, quail, and small game.

4. Tabor-Crockett association

Deep, nearly level to gently sloping, moderately well drained, very slowly permeable sandy and loamy soils that have clayey lower layers; on uplands

This association (fig. 4) makes up about 12 percent of the county. Tabor soils make up about 36 percent of this association; Crockett soils, about 18 percent, and minor soils, about 46 percent. Among the minor soils are Nocken, Alum, Rosanky, Zavala, and Leming soils.

Tabor soils have a loamy fine sand surface layer, about 17 inches thick, that is brown in the upper part and very pale brown in the lower part. Below this is about 15 inches of light yellowish-brown clay, 14 inches of mottled sandy clay, and 12 inches of light yellowish-brown sandy clay. The underlying material, to a depth of 62 inches, is light-gray sandy clay loam.

Crockett soils have a brown fine sandy loam surface layer about 10 inches thick. The next layer, about 25 inches thick, is clay that is brown in the upper part and reddish brown in the lower part. Below this, to a depth of 62 inches, is sandy clay loam that is pale brown in the upper part, reddish yellow in the middle part, and yellow in the lower part.

Areas of this association are used about equally for crops and native range, and some areas are in improved pasture. The average size of a farm in this association is about 250 acres. Most farms emphasize livestock or an irrigated specialty crop. The soils in this association are suited to most crops grown in the county.

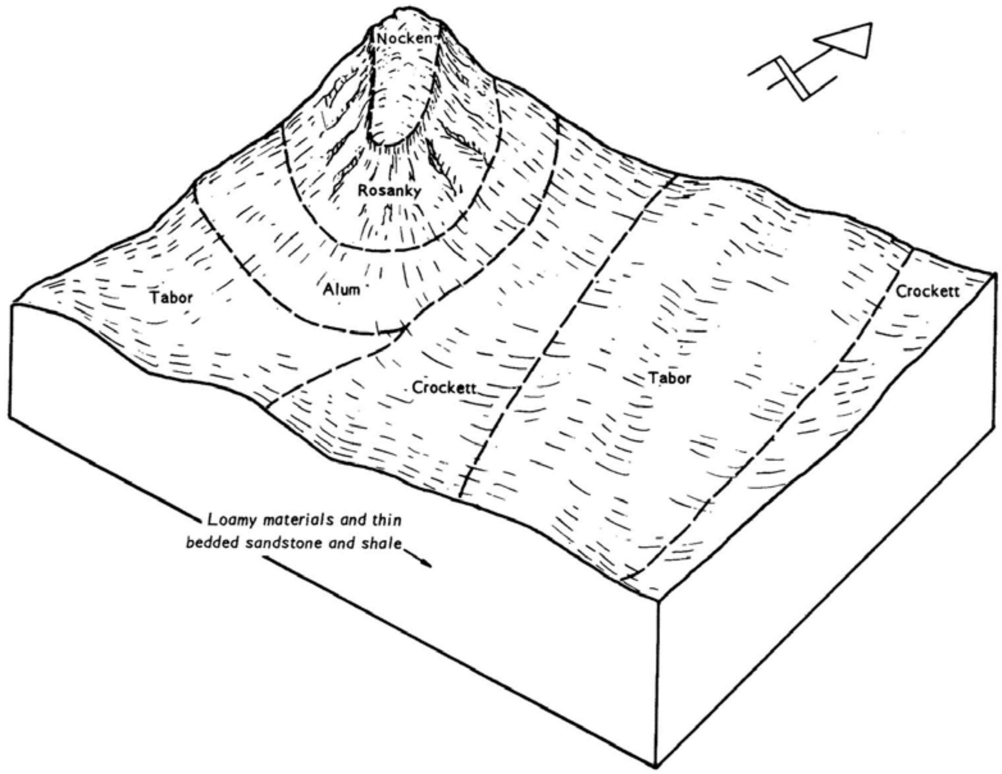

Figure 4.—Typical pattern of soils in association 4.

The development of septic-tank systems and sanitary landfills are concerns in urban planning. The corrosivity of steel pipe and of concrete pipe in acid areas of the soils in this association are also concerns. The hazard of soil blowing is slight to moderate, and the hazard of water erosion is slight to severe.

These soils have good potential for the development of habitat for dove, quail, and small game.

5. Clareville-Coy-Tordia association

Deep, nearly level to gently sloping, well-drained, moderately slowly permeable to very slowly permeable loamy and clayey soils that have loamy and clayey lower layers; on uplands

This association (fig. 5) makes up about 10 percent of the county. Clareville soils make up 38 percent of this association; Coy soils, 31 percent; Tordia soils, 16 percent; and minor soils, 15 percent. Among the minor soils are Aransas, Miguel, Floresville, Willamar, and Picosa soils.

Clareville soils have a dark-gray clay loam surface layer about 10 inches thick. Below this is about 4 inches of very dark gray clay loam, about 11 inches of very dark grayish-brown clay loam, about 13 inches of dark grayish-brown clay loam, and about 8 inches of grayish-brown clay loam. The underlying material, to a depth of 65 inches, is clay loam that is pale brown in the upper part and very pale brown in the lower part.

Coy soils have a dark-gray clay loam surface layer about 6 inches thick. The next 6 inches is also dark-gray clay loam. Below this is about 13 inches of dark-gray clay, about 15 inches of dark grayish-brown clay, about 15 inches of brown clay, and about 10 inches of mottled grayish-brown and brownish-yellow clay.

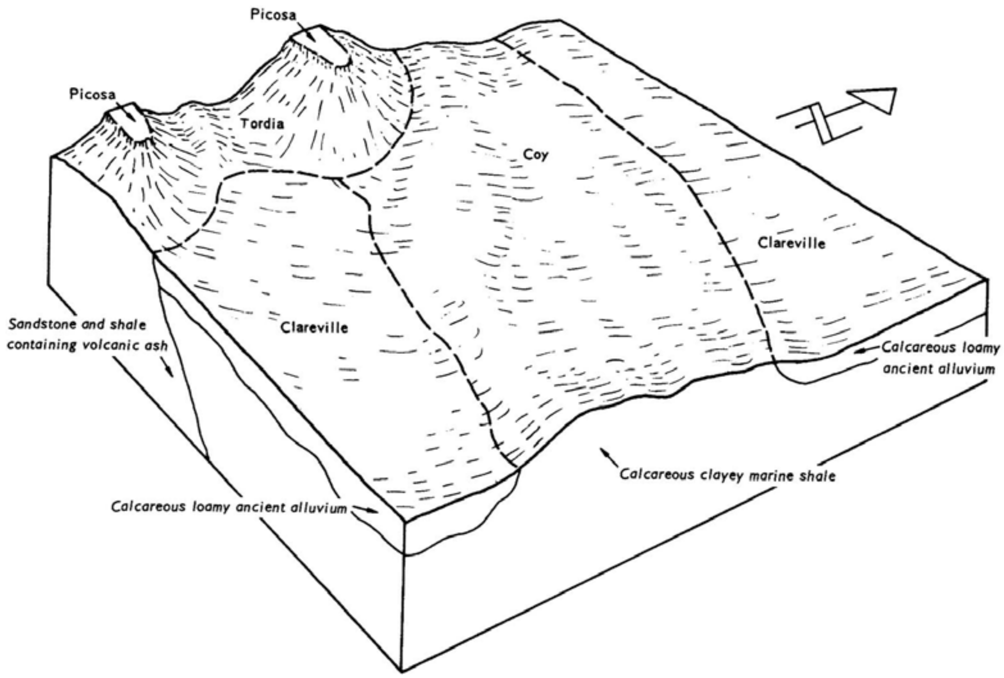

Figure 5.—Typical pattern of soils in association 5.

Tordia soils have a very dark gray and dark gray clay surface layer about 38 inches thick. The next layer, about 6 inches thick, is mottled grayish-brown and dark-gray clay. The underlying material, to a depth of 60 inches, is light brownish-gray shale.

Most areas of this association are used for crops, but some are used for native range and others for improved pasture. The average size of a farm in this association is about 300 acres. Most farms are diversified, raising crops, livestock, or dairy cattle, but the emphasis is away from cash crops and toward livestock production.

The development of septic-tank systems and sanitary landfills are the main concerns in urban planning. The shrink-swell potential and the corrosivity of steel pipe in the soils in this association are also concerns. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is slight.

These soils have good potential for the development of habitat for quail, dove, small game, and deer.

6. Venus-Aransas-Loire association

Deep, nearly level to gently sloping, well-drained to poorly drained, moderately permeable to very slowly permeable loamy and clayey soils that have loamy and clayey lower layers; on terraces and bottom lands

This association makes up about 8 percent of the county. Venus soils make up about 21 percent of this association; Aransas soils, about 21 percent; Loire soils, about 11 percent; and minor soils, about 47 percent. Among the minor soils are Karnes, Colibro, Saspamco, Yahola, Zavala, and Frio soils. Venus soils are on the higher terraces along the San Antonio River and Cibolo Creek, Loire soils are on the lower parts of flood plains, and Aransas soils are on higher parts of flood plains and on lower terraces in places.

Venus soils have a grayish-brown clay loam surface layer about 18 inches thick. Below this is about 9 inches of grayish-brown clay loam and about 21 inches of pale-brown clay loam. The underlying material, to a depth of 62 inches, is very pale brown loam.

Aransas soils have a dark-gray clay surface layer about 52 inches thick. The next layer is gray clay about 8 inches thick. The underlying material, to a depth of 75 inches, is light-gray clay.

Loire soils have a brown silty clay loam surface layer about 8 inches thick. Below this is 8 inches of grayish-brown silty clay loam and 26 inches of pale-brown loam. Light yellowish-brown fine sandy loam extends to a depth of 80 inches.

Areas of this association are used about equally for crops and native range, and some areas are in improved pasture and pecan orchards. The average farm in this association occupies about 175 acres. Most farms emphasize livestock or irrigated specialty crops and not cash crops. The soils in this association are suited to most crops grown in the county, except in frequently flooded areas.

The development of septic-tank systems, sanitary landfills, and roads are concerns in urban planning. The corrosivity of steel pipes in the soils in this association is also a concern. The frequent or occasional flooding of soils in some places increases the hazard for urban development.

These soils have good potential for the development of habitat for dove, quail, turkey, small game, deer, and some waterfowl.

Descriptions of the Soils

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

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils.

The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section “How This Survey Was Made,” not all mapping units are members of a soil series. Rock outcrop, for example, does not belong to a soil series; but it is listed in alphabetic order along with the soil series.

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

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual *(6).*

Alum Series

The Alum series consists of deep, noncalcareous, very friable, gently sloping sandy soils on uplands. These soils formed in loamy materials interbedded with weakly cemented sandstone.

In a representative profile the surface layer is loamy fine sand about 18 inches thick. It is brown in the upper part and reddish yellow in the lower part. The subsurface layer is pink, loose loamy fine sand about 10 inches thick. Below this is red sandy clay about 20 inches thick and red sandy clay loam about 7 inches thick. The underlying material, to a depth of 65 inches, is yellowish-red sandy clay loam that is about 10 percent, by volume, sandstone fragments.

These soils are well drained, and permeability is slow. Runoff is slow, and available water capacity is medium.

Alum soils are mostly cultivated, but some areas are used for native range or improved pasture. The soils are suited to crops, range, or pasture.

Representative profile of Alum loamy fine sand, 1 to 3 percent slopes, in a cultivated field, 0.2 mile northeast of Stockdale on old U.S. Highway 87 to Farm Road 1107, 0.4 mile east on Farm Road 1107 to county road, and 0.8 mile north and east on county road; then 500 feet south of road:

Ap—0 to 8 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; single grained; slightly hard, very friable; many roots; slightly acid; clear, smooth boundary.

A1—8 to 18 inches, reddish-yellow (7.5YR 6/6) loamy fine sand, strong brown (7.5YR 5/6) moist; weak, fine, granular structure; slightly hard, very friable; many roots; slightly acid clear, smooth boundary.

A2—18 to 28 inches, pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; single grained; soft, loose; common roots; few angular sandstone pebbles and stones; slightly acid; abrupt, wavy boundary.

B21t—28 to 37 inches, red (2.5YR 5/6) sandy clay; red (2.5YR 4/6) moist; common, medium, distinct, yellowish-red (5YR 5/6) and yellowish-brown (10YR 5/4) and few, fine, faint, red (10R 4/6) mottles; moderate, fine, blocky structure; very hard, firm, sticky; common fine pores; thin continuous clay films on faces of peds; few angular sandstone fragments; medium acid; gradual, wavy boundary.

B22t—37 to 48 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; common, medium distinct yellowish-brown (10YR 5/4) and yellowish-red (5YR 5/6) mottles; moderate, medium, blocky structure; very hard, firm, sticky; common fine pores; thin, continuous clay films on peds; few angular sandstone fragments; medium acid; gradual, wavy boundary.

B3—48 to 55 inches, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; few, fine and medium, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine, blocky structure; hard, firm, slightly sticky; few angular sandstone fragments; patchy clay films; medium acid; gradual, wavy boundary.

C—55 to 65 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; massive; hard, friable; estimated 10 percent, by volume, sandstone fragments and stones; strongly acid.

The solum ranges from 40 to 70 inches in thickness. Angular sandstone fragments or ironstone pebbles and stones make up 0 to 15 percent of any horizon.

The A horizon ranges from 21 to 36 inches in thickness. The Ap and A1 horizons are reddish brown, reddish yellow, light brown, and brown, and the A2 horizon is pink or reddish yellow.

The Bt horizon is red, reddish brown, or yellowish red in color and sandy clay or clay in texture. The amount of clay ranges from 35 to 45 percent. Mottles range from few to many, fine to medium, and faint to distinct in shades of red, yellow, and brown. Reaction is slightly acid or medium acid.

The B3 horizon is the same color as the Bt horizon. Texture is clay loam, sandy clay loam, or sandy clay. Reaction is medium acid or strongly acid.

The C horizon is sandy clay loam, sandy loam, or loam interbedded with discontinuous sandstone strata.

Alum loamy fine sand, 1 to 3 percent slopes (AmB).—This gently sloping soil is in slightly concave areas that average about 200 acres in size that range from 40 to 325 acres. It is lower than Nocken stony soils and Rock outcrop and slightly higher than Crockett soils. Areas of this soil are generally longer than they are wide, but a few areas are subrounded in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Alum loamy fine sand, 3 to 5 percent slopes. Also included are Nocken stony soils and Rock outcrop on small, narrow ridges. In places, Crockett soils are in areas less than 6 acres in size and on foot slopes.

This soil is used mainly for crops, but some areas are used for pasture and range. The soil is suited to cultivated crops (fig. 6). The hazard of soil blowing and water erosion are moderate. Capability unit IIIe-6 dryland, IIIe-5 irrigated; Loamy Sand range site.

Figure 6.—Watermelons growing in an area of Alum loamy fine sand, 1 to 3 percent slopes.

Alum loamy fine sand, 3 to 5 percent slopes (AmC).—This gently sloping soil is in slightly convex areas on uplands. These areas are oblong and are slightly higher than adjoining areas of less sloping Alum soils. They generally range from 20 to 200 acres in size.

This soil has a surface layer of light-brown, slightly acid loamy fine sand about 15 inches thick. The subsurface layer is reddish-yellow fine sand about 6 inches thick.

Below this is red, mottled sandy clay about 27 inches thick. At a depth of 48 inches is yellowish-red sandy clay loam that has coarse fragments of sandstone and ironstone.

Included with this soil in mapping are small areas of Alum loamy fine sand, 1 to 3 percent slopes, on foot slopes. Also included are small areas of Nocken stony soils and Rock outcrop on narrow ridges and Rosanky soils in small areas near ridgetops.

This soil is mostly cultivated. The hazards of water erosion and soil blowing are moderate. Small areas of this soil are used for pasture and native range. Capability unit IVe-4 dryland, IIIe-6 irrigated; Loamy Sand range site.

Aransas Series

The Aransas series consist of deep, calcareous, firm, nearly level clayey soils on terraces and bottom lands. These soils formed in calcareous clayey alluvium on terraces and on flood plains of rivers and creeks.

In a representative profile the surface layer is dark-gray, calcareous clay about 52 inches thick. The upper 7 inches is firm, the next 21 inches is very firm, and the lower 24 inches is extremely firm. Below this is calcareous, gray clay about 8 inches thick. The underlying material, to a depth of 75 inches, is light-gray, calcareous clay.

These soils are poorly drained, and permeability is very slow. Runoff is very slow, and available water capacity is high. Frequent flooding in flood-plain areas is a hazard.

Aransas soils are mostly cultivated, but frequently flooded areas are generally in native range or improved pasture. The soils are suited to crops, range, or pasture.

Representative profile of Aransas clay in an improved pasture, 1.8 miles north of Post Office in Sutherland Springs on Farm Road 539, and 450 feet northwest across old, abandoned rail road right-of-way:

A11—0 to 7 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine, granular structure; hard, firm, plastic and sticky; many fine roots; few wormcasts; calcareous; moderately alkaline; clear, smooth boundary.

A12—7 to 28 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium and fine, angular blocky and subangular blocky structure; very hard, very firm, plastic and sticky; common fine roots; common fine threads and fine lumps of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

A13—28 to 52 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, medium and fine, angular blocky structure; extremely hard, extremely firm, plastic and sticky; few fine concretions of calcium carbonate; few fine ferro-manganese accretions in the lower part; calcareous; moderately alkaline; gradual, wavy boundary.

AC—52 to 60 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine, angular blocky structure; extremely hard, very firm, plastic and sticky; few fine calcium carbonate concretions; few fine ferro-manganese accretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—60 to 75 inches, light-gray (10YR 6/1) clay, gray (10YR 5/1) moist; massive; extremely hard, very firm, plastic and sticky; few calcium carbonate concretions; few ferro-manganese accretions; calcareous; moderately alkaline.

The solum ranges from 36 to 66 inches in thickness. When the soils are dry, cracks at least 1 inch wide and 12 inches long or more extend to a depth of 20 inches or more.

The A horizon ranges from 36 to 66 inches in thickness. It is very dark gray or dark gray. Reaction is moderately alkaline or strongly alkaline.

The AC horizon ranges from 0 to 12 inches in thickness. It is light gray, gray, or dark gray.

The C horizon is dark gray or light gray. In some places are yellowish-brown or olive-brown mottles. The texture is clay, and the horizon contains a few calcium carbonate concretions as well as a few ferro-manganese accretions. In places, buried horizons of contrasting materials are at depths of more than 50 inches.

Some of the Aransas soils are outside the defined range for the Aransas series in that the solum is as much as 66 inches thick. The defined range for the series is 35 to 50 inches. This increased thickness does not alter use and management of these soils.

Aransas clay (Ar).—This soil is on terraces and bottom lands that flood, generally for less than 2 days, about once every 1 to 10 years. Slopes are less than 1 percent. Areas of this soil are long and narrow and range in size from 15 to 350 acres. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Frio, Karnes, and Venus soils. Frio and Karnes soils are adjacent to stream channels and are generally less than 5 acres in size. Venus soils are in the same landscape as Aransas soils and are mostly 8 acres or less in size.

This soil is used mainly for crops, but areas are used for pasture or range or as wildlife habitat. Runoff is very slow, so planting and harvesting are delayed at times because of standing water or wet soil. In places, this soil is subject to occasional overflow, but in others it is seldom, if ever, flooded because it is on high terraces. The hazard of water erosion is slight. Capability unit IIIw-1 dryland, IIs-1 irrigated; Clayey Bottomland range site.

Aransas clay, frequently flooded (As).—This nearly level soil is on bottom lands that flood at least once each year. The flooding is of brief duration, generally less than 2 days. Slopes are less than 1 percent. Areas of this soil are long and narrow and range from 15 to 150 acres in size.

The surface layer is dark-gray, calcareous, firm clay about 44 inches thick. Beneath this, and extending to a depth of 60 inches, is gray, calcareous clay.

Included with this soil in mapping are areas of Loire and Frio soils, frequently flooded. These included soils, mainly adjacent to stream channels, are mostly less than 3 acres in size.

Most areas of this soil are in native vegetation used as pasture, but some areas are cultivated. Runoff is very slow, and the hazard of water erosion is slight. Most areas of this soil are frequently flooded, causing crop damage or crop loss in places. Capability unit Vw-3 dryland; Clayey Bottomland range site.

Clareville Series

The Clareville series consists of deep, noncalcareous, friable, nearly level to gently sloping loamy soils on uplands. These soils formed in calcareous loamy ancient alluvium or outwash.

In a representative profile the surface layer is noncalcareous, dark-gray clay loam about 10 inches thick. The next layer is noncalcareous, very dark-gray clay loam about 4 inches thick. Below this is clay loam, about 24 inches thick, that is noncalcareous and very dark grayish brown in the upper part and calcareous and dark grayish brown in the lower part. Below this is 8 inches of calcareous, grayish-brown clay loam and 8 inches of pale-brown, calcareous clay loam. The underlying material, to a depth of 65 inches, is very pale brown, calcareous sandy clay loam.

These soils are well drained, and permeability is moderately slow. Runoff is slow to medium, and available water capacity is high.

Clareville soils are mostly cultivated, but a few small areas are in improved pasture or native range. The soils are suited to crops, range, or pasture.

Representative profile of Clareville clay loam, 1 to 3 percent slopes, in a cultivated field, 7.5 miles west of Poth on Farm Road 541 to unpaved county road, 2.5 miles south on unpaved county road, and 350 feet west of county road:

Ap—0 to 5 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak, fine, granular structure; hard, friable; many fine roots; neutral; clear, smooth boundary.

A1—5 to 10 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak, fine, granular and subangular blocky structure; hard, friable; many fine roots; common fine pores; common wormcasts; neutral; clear, wavy boundary.

B1—10 to 14 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate, fine, subangular blocky structure; hard, firm; common roots; common fine pores; common wormcasts; mildly alkaline; clear, wavy boundary.

B21t—14 to 25 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; moderate, medium, prismatic structure parting to moderate, medium and fine, blocky; very hard, firm; common fine pores; thin clay films on ped surfaces; mildly alkaline; gradual, wavy boundary.

B22t—25 to 38 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, blocky structure; very hard, firm; common fine pores; thin clay films on ped surfaces; calcareous; moderately alkaline; gradual wavy boundary.

B3—38 to 46 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak, medium, blocky structure; very hard, firm; fine soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—46 to 54 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; massive; hard, firm; estimated 10 to 15 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

C—54 to 65 inches, very pale brown (10YR 8/3) sandy clay loam; pale brown (10YR 6/3) moist; massive; hard, friable; few soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 36 to 46 inches thick. The A horizon ranges from 7 to 16 inches in thickness. It is very dark gray, dark gray, dark grayish brown, or dark brown in color. Reaction is neutral or mildly alkaline.

The B1 horizon ranges in thickness from 0 to 8 inches and in color from very dark gray to dark brown. Texture ranges from sandy clay loam to clay loam. Reaction is neural or mildly alkaline.

The Bt horizon is 10 to 24 inches thick. It is very dark grayish brown, dark brown, dark grayish brown, or brown. The Bt horizon is clay loam to clay in the upper part and clay loam or sandy clay loam in the lower part. The upper 20 inches of the Bt horizon is 35 to 45 percent clay. Reaction is mildly alkaline or moderately alkaline.

The B3 horizon ranges in color from brown to grayish brown and in texture from clay loam or sandy clay loam to loam. Reaction is mildly alkaline or moderately alkaline.

The Cca and C horizons consist of variable materials that range from loam to sandy clay loam. Soft masses and weakly cemented concretions in the Ca horizon make up 3 to 25 percent, by volume, of the horizon.

Clareville clay loam, 0 to 1 percent slopes (CaA).—This nearly level soil is on uplands. Areas of this soil are mostly irregularly oval in shape and are slightly higher than adjoining areas of more sloping Clareville soils. They are mostly 20 to 350 acres in size.

The surface layer of this soil is very dark gray, noncalcareous clay loam about 15 inches thick. Below this is very dark gray, noncalcareous clay loam about 7 inches thick, dark grayish-brown, noncalcareous clay about 16 inches thick, and brown, calcareous clay loam about 8 inches thick. The underlying material, to a depth of 62 inches, is very pale brown, calcareous sandy clay loam that has soft masses and weakly cemented concretions of calcium carbonate.

Included with this soil in mapping are small areas of Clareville clay loam, 1 to 3 percent slopes, mostly on breaks to field drainageways, and small areas of Willamar and Miguel soils in depressions. Also included are small areas of a soil that is similar to this Clareville soil except that it has a thinner dark-colored surface layer and yellowish-red and olive mottles in places. These inclusions, less than 5 acres in size, are mostly at the heads of field drainageways.

This soil is mostly cultivated, but small areas are used for pasture and native ranges. The hazard of water erosion is slight. Capability unit IIc-1 dryland, I-1 irrigated; Clay Loam range site.

Clareville clay loam, 1 to 3 percent slopes (CaB).—This gently sloping soil is on uplands. Areas of this soil average about 200 acres in size, ranging from 25 to 300 acres. They are subrounded to irregular in shape. This soil is slightly lower than Clareville clay loam, 0 to 1 percent slopes. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Clareville clay loam, 0 to 1 percent slopes, on ridgetops or upland flats. Also included are small areas of Floresville soils on slopes to field drainageways and Miguel and Willmar soils in depressions. Also included are small areas of a soil that is similar except for the dark-colored surface layer that is less than 20 inches thick. This included soil is mainly at the heads of field drainageways.

This soil is mostly cultivated, but small areas are used for pasture and native range. The hazard of water erosion is moderate. Capability unit IIe-5 dryland, IIe-3 irrigated; Clay Loam range site.

Colibro Series

The Colibro series consists of deep, calcareous, friable, gently sloping loamy soils on uplands. These soils formed in calcareous loamy material on ancient alluvial terraces.

In a representative profile the surface layer is grayish-brown, calcareous sandy clay loam about 16 inches thick. Below this is pale-brown, calcareous loam about 16 inches thick and very pale brown, calcareous fine sandy loam about 16 inches thick. The underlying material, to a depth of 60 inches, is very pale brown, calcareous loamy fine sand.

Colibro soils are well drained, and permeability is moderately rapid. Runoff is medium, and available water capacity is medium. In places, this soil is subject to short-duration flooding about once each 10 to 20 years.

Most of this soil is used for range or improved pasture, but a few areas are used for crops. The soils are better suited to range or pasture than to other uses.

Representative profile of Colibro sandy clay loam, 1 to 3 percent slopes, in native pasture, 4.25 miles west of Poth on Farm Road 541 to unpaved county road, 0.3 mile south on unpaved county road, and 200 feet east of unpaved county road:

A11—0 to 6 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure and very fine, subangular blocky; hard, friable; many fine roots; few fragments of snail shells; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

A12—6 to 16 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; hard, friable; many fine roots; few fragments of snail shells; few films, threads, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

R21—16 to 32 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; moderate, fine, subangular blocky structure; hard, friable; few fragments of snail shells; few films, threads, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

R22—32 to 48 inches, very pale brown (10YR 8/4) fine sandy loam, very pale brown (10YR 7/4) moist; weak, fine, subangular blocky structure; slightly hard, very friable; few faint films and threads of calcium carbonate in upper part; calcareous; moderately alkaline; gradual, smooth boundary.

C—48 to 60 inches, very pale brown (10YR 8/3) loamy fine sand, very pale brown (10YR 7/3) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The solum is 24 to 50 inches thick. The A horizon ranges from 10 to 22 inches in thickness and is grayish brown, dark grayish brown, or brown in color.

The B2 horizon is grayish-brown, brown, light brownish-gray, pale brown, or very pale brown loam, sandy clay loam, or fine sandy loam. The 10- to 40-inch layer is 18 to 30 percent silicate clay and 1 to 10 percent carbonate clay.

The C horizon is pale brown or very pale brown loam, sandy loam, loamy fine sand, or loamy sand. In places, it is gravelly. Visible concretions or soft lumps of calcium carbonate range from 0 to 10 percent, by volume. A line of rounded pebbles as much as 2 inches in diameter are in some profiles between the B and C horizons.

Colibro sandy day loam, 1 to 3 percent slopes (CbB).—This gently sloping, slightly convex soil is in areas that range from 10 to 180 acres in size. These areas are mostly on uplands that parallel the flood plains of the San Antonio River and Cibolo Creek. This soil has the profile described as representative for the series (fig. 7).

Included with this soil in mapping are areas, 8 acres or less in size, of a soil similar in color, texture, and reaction to this Colibro soil except that the percentage of calcium carbonate at a 10- to 40-inch depth is estimated to be greater than 40 percent, by volume. Also included, in areas of 3 to 5 acres or less, are Runge and Clareville soils.

This soil is used mostly for range or improved pasture, and only a small acreage is farmed. The hazard of water erosion is moderate. Chlorosis (yellowing) of plants occurs in areas of high lime. Capability unit IIe-4 dryland, IIe-4 irrigated; Gray Sandy Loam range site.

Colibro sandy clay loans, 3 to 5 percent slopes (CbC).—This gently sloping soil is on uplands. It is in areas of 30 to 200 acres that parallel the San Antonio River and Cibolo Creek.

Figure 7.—Profile of a Colibro sandy clay loam showing the weak line of rounded pebbles at a depth of about 30 inches.

This soil has a surface layer of grayish-brown, calcareous sandy clay loam about 10 inches thick. The next layer is brown, calcareous sandy clay loam about 27 inches thick. A layer of very pale brown, calcareous loam that is an estimated 4 to 6 percent, by volume, soft, visible accumulations of calcium carbonate begins at a depth of about 37 inches.

Included with this soil in mapping are areas, less than 6 acres in size, of a soil similar to this Colibro soil except that the percentage of calcium carbonate at a 10- to 40-inch depth is estimated to be greater than 10 percent, by volume. Also included are areas, 3 acres or less in size, of Runge and Clareville soils.

This soil is used mostly for range or improved pasture, and only a small acreage is farmed. The hazard of water erosion is moderate. Chlorosis (yellowing) of plants occurs in areas of high lime in places. Capability unit IIIe-7 dryland, IIIe-7 irrigated; Gray Sandy Loam range site.

Coy Series

The Coy series consists of deep, calcareous, firm, nearly level to gently sloping clayey soils on uplands. These soils formed in calcareous clayey marine shales.

In a representative profile the surface layer is dark-gray, calcareous clay loam about 6 inches thick. The layer below is dark-gray, calcareous clay loam about 6 inches thick. Below this is calcareous clay, about 28 inches thick, that is dark gray in the upper part and dark grayish brown in the lower part. The next layer is brown, calcareous clay about 15 inches thick. The underlying material, to a depth of 65 inches, is calcareous clay that is mottled in shades of gray, brown, and yellow and that has gypsum crystals and shale fragments.

These soils are well drained, and permeability is very slow. When these soils are dry, cracks $^{1}/_{4}$-inch to 2 inches wide or more extend to a depth of more than 40 inches. Water intake is slow in moist soil and rapid in dry, cracked soil. Available water capacity is high.

Coy soils are mostly cultivated, but some areas are used for native range or improved pasture. These soils are suited to crops, range, or pasture.

Representative profile of Coy clay loam, 1 to 4 percent slopes, in a cultivated field, 4.5 miles south of Floresville on U.S. Highway 181, 300 feet north and 150 feet east of a petroleum service station:

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; weak, fine granular and subangular blocky structure; hard, firm; many fine roots; common wormcasts and insect tunnels; $^{1}/_{8}$-inch gray (10YR 6/1) surface crust; calcareous; moderately alkaline; clear smooth boundary.

B1t—6 to 12 inches dark-gray (10YR 4/1) clay loam, very (dark gray (10YR 3/1) moist; weak, coarse, prismatic structure parting to moderate, fine, subangular blocky; hard, firm; many fine roots; many wormcasts and insect tunnels; few clay films; calcareous; moderately alkaline; gradual, wavy boundary

R21t—12 to 25 inches dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak, medium, prismatic structure parting to moderate, fine, blocky; very hard, firm; common fine roots; common wormcasts and insect tunnels; common pressure faces; few clay films; calcareous; moderately alkaline; gradual wavy boundary.

R22t—25 to 40 inches, dark grayish brown (10YR 4/2) clay very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, blocky structure; very hard, firm; common pressure faces; few clay films; few fine and very fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B3tca—40 to 55 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, medium, blocky structure; very hard, firm; few dark grayish-brown (10YR 4/2) vertical streaks as much as $^{1}/_{4}$-inch wide that are apparently filled cracks; common pressure faces; common soft masses and fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B&C—55 to 65 inches, mottled grayish-brown (10YR 5/2) and brownish-yellow (10YR 6/6) clay, dark grayish brown (10YR 4/2) and yellowish brown (10YR 5/6) moist; weak medium, blocky structure; very hard, firm; few dark grayish-brown (10YR 4/2) vertical streaks; few fine calcium carbonate concretions; few to common gypsum crystals; few shale fragments; calcareous; moderately alkaline.

The solum is 45 to 75 inches thick. When the soil is dry, cracks as wide as 2 inches at the surface extend to a depth of more than 40 inches. The dark-colored soil layers range from 12 to 45 inches in thickness.

The A horizon ranges from 4 to 10 inches in thickness. It is dark gray, very dark gray, or dark grayish brown. The A horizon is 24 to 35 percent clay and 25 to 35 percent silt.

The B1t and B2t horizons range from 22 to 46 inches in thickness. They are dark gray, very dark gray, gray, grayish-brown, or dark grayish-brown clay to clay loam. The B1t and B2t horizons are 35 to 50 percent clay.

The B3tca horizon is brown or light-gray clay or clay loam. It is 10 to 20 inches thick. Soft masses, or cemented calcium carbonate concretions range from 2 to 12 percent, by volume, of the horizon.

The C horizon ranges in color from light gray to light olive brown and is mottled in shades of gray, brown, or yellow. It is shaly clay or clayey shale that has common gypsum crystals and small amounts of carbonates in the form of soft masses or cemented concretions.

Coy clay loam, 0 to 1 percent slopes (CoA).—This nearly level soil is on plane or in slightly convex areas on uplands. These areas range from 20 to 175 acres in size, and they are mostly irregularly rounded in shape. Slopes are less than 1 percent.

This soil has a surface layer of very dark gray, calcareous clay loam about 8 inches thick. The next layer is dark-gray clay that extends to a depth of about 44 inches. Below this is brown, calcareous clay that ex-tends to a depth of about 54 inches. The underlying material, to a depth of 65 inches, is mottled, calcareous shaly clay or shale.

Included with this soil in mapping are areas, generally less than 5 acres in size, of Denhawken, Elmendorf, Luling, and Tordia soils. The Elmendorf and Denhawken soils are in the same landscape, the Luling soil is slightly lower, mostly on breaks to field drainageways, and the Tordia soil is slightly lower in depressions.

This soil is mostly cultivated, but some areas are used for range or improved pasture. The soil is well suited to cultivation. The hazard of water erosion is slight. Capability unit IIs-1 dryland, IIs-1 irrigated; Rolling Blacklands range site.

Coy clay loam, 1 to 4 percent slopes (CoB).—This gently sloping soil is in irregularly shaped areas that range from 50 to 450 acres in size. It has the profile described as representative for the series.

Included with this soil in mapping are areas of Coy clay loam, 0 to 1 percent slopes, and Clareville, Denhawken, Elmendorf, Luling, and Tordia soils. These inclusions are mostly less than 8 acres in size. Coy clay loam, 0 to 1 percent slopes, is on narrow ridgetops or small upland flats, Luling soils are slightly lower and on breaks to field drainageways, the Clareville soil is slightly lower and near footslopes, and Tordia soils are slightly lower in depressions. Elmendorf and Denhawken soils are in the same landscape or are at slightly higher positions.

This soil is used mostly for crops, but some areas are used for native range or improved pasture. The soil is well suited to cultivated crops. The hazard of water erosion is moderate. Capability unit IIIe-3 dry-land, IIIe-3 irrigated; Rolling Blacklands range site.

Crockett Series

The Crockett series consists of deep, noncalcareous, friable, nearly level to gently sloping loamy soils on broad uplands. These soils formed in sandy clay loam or shale interbedded with more sandy material.

In a representative profile the surface layer is noncalcareous, brown fine sandy loam about 10 inches thick. The next layer is mottled, slightly acid clay, about 25 inches thick, that is brown in the upper part and reddish brown in the lower part. The layer below is mildly alkaline, pale-brown sandy clay loam about 7 inches thick. The underlying layer, to a depth of 62 inches, is calcareous sandy clay loam that is reddish yellow in the upper part and yellow in the lower part. It contains calcium carbonate concretions and shale fragments.

These soils are moderately well drained, and permeability is very slow. Runoff is slow to rapid, and available water capacity is high.

Crockett soils are used mostly for crops, but some areas are used for improved pasture or native range. The soils are suited to crops, pasture, or range.

Representative profile of Crockett fine sandy loam, 1 to 3 percent slopes, in an unimproved pasture, 3 miles north of Stockdale on Texas Highway 123, 0.4 mile east on unpaved county road; then 125 feet north of road:

A11—0 to 4 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, friable; many fine roots; few fine and medium pores; medium acid; clear, smooth boundary.

A12—4 to 10 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, coarse, prismatic structure breaking to weak, fine, granular; hard, friable; many fine roots; few medium pores; medium acid; abrupt, wavy boundary.

B21t—10 to 17 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; common, medium, distinct, red (2.5YR 5/6) and few, fine, faint, yellowish-red (5YR 5/6) and reddish-brown (5YR 5/4) mottles; moderate, medium, blocky structure; extremely hard, very firm, plastic and sticky; common fine roots; distinct clay films and organic stains on ped surfaces; slightly acid; gradual, wavy boundary.

B22t—17 to 35 inches; reddish-brown (2.5YR 5/4) clay, reddish brown (2.5YR 4/4) moist; many, coarse, prominent, red (2.5YR 5/6) and few, fine, distinct, brownish-yellow (10YR 6/6) mottles; moderate, medium, blocky structure; extremely hard, very firm, plastic and sticky; few fine pores; distinct clay films and organic stains on ped surfaces; few ferro-manganese concretions; slightly acid; gradual, wavy boundary.

B3t—35 to 42 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; many, coarse, distinct, yellowish-red (5YR 5/6) and few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, blocky structure; very hard; very firm; sticky; few thin clay films; few ferro-manganese concretions; mildly alkaline; gradual, wavy boundary.

C1—42 to 50 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; few, medium, distinct, yellowish-red (5YR 5/6) mottles; massive; extremely hard, firm; few fine, soft calcium carbonate concretions; few ferro-manganese concretions; common shale fragments; calcareous; moderately alkaline; gradual, wavy boundary.

C2—50 to 62 inches, yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) moist; massive; few fine, hard calcium carbonate concretions; common medium shale fragments; calcareous; moderately alkaline.

The solum is 40 to 56 inches thick. Secondary carbonates are at a depth of 40 to 60 inches. Most of the clay in the profile is montmorillonite.

The A horizon ranges from 6 to 15 inches in thickness. It is dark brown, brown, light brown, very dark grayish brown, or dark grayish brown. Reaction is medium acid to neutral.

The B2t horizon ranges from 20 to 45 inches in thickness. It is reddish brown, brown, dark brown, strong brown, and yellowish brown in color and has few to many, fine to course, and distinct to prominent mottles in shades of red, yellow, brown, and olive. The B2t horizon ranges from clay loam to clay in texture and is 35 to 50 percent clay in the upper 20 inches. Reaction ranges from medium acid to mildly alkaline.

The B3t horizon has variable color and degree of mottling within short distances. It is similar in color and degree of mottling to the B2t horizon, but the B3t horizon has fewer red mottles and more yellow, brown, and olive mottles. The B3t horizon ranges from clay to sandy clay loam in texture. Reaction is neutral or mildly alkaline.

The C horizon is reddish yellow, strong brown, or yellow and has mottles mainly of brown and olive, but some profiles have mottles of reddish yellow and grayish brown. It ranges from fine sandy loam to clay in texture and has few to common shale fragments. The zone of visible lime accumulations ranges from none to prominent.

Crockett fine sandy loam, 0 to 1 percent slopes (CrA).—This nearly level soil is on uplands. It is in broad, plane, irregularly shaped areas that range from 20 to 280 acres in size.

This soil has a surface layer of brown, noncalcareous fine sandy loam about 12 inches thick. The next layer is mottled reddish-brown, slightly acid clay about 35 inches thick. The underlying material, to a depth of about 60 inches, is reddish-yellow, calcareous loam mottled with gray, brown, and yellow, calcareous loam few shale fragments and a few weakly cemented calcium carbonate concretions.

Included with this soil in mapping are Tabor soils on low mounds and Alum soils on low ridges in slightly elevated areas. Crockett fine sandy loam, 1 to 3 percent slopes, is included on the sides of long field drainageways. Most of these inclusions are less than 5 acres in size.

This soil is mostly cultivated, but some areas are used for pasture and range. The soil is suited to cultivated crops. The hazards of soil blowing and water erosion are slight. Capability unit IIIs-1 dryland, IIs-2 irrigated; Tight Sandy Loam range site.

Crockett fine sandy loam, 1 to 3 percent slopes (CrB).—This gently sloping soil is on plane or in convex areas on uplands. These areas range from 25 to 400 acres in size. This soil is lower than Tabor soils and slightly higher than Leming soils. This soil has the profile described as representative for the series.

Included with this soil in mapping are Tabor soils on low mounds and Rosanky soils on upland flats. Most inclusions are less than 5 acres in size.

This soil is mostly cultivated, but a few areas are used for range and improved pasture. The soil is suited to cultivated crops. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. Capability unit IIIe-1 dryland, IIIe-1 irrigated; Tight Sandy Loam range site.

Crockett fine sandy loam, 2 to 5 percent slopes, eroded (CrC2).—This gently sloping, eroded soil is on uplands in areas that average 20 acres in size but that range from 10 to 125 acres. This soil is on the sides and at the heads of small draws in cultivated fields. Water drains from these small draws to larger draws. The surface is convex, and in places it is gullied.

This soil has a surface layer of noncalcareous, brown fine sandy loam about 6 inches thick. The next layer is reddish-brown, slightly acid clay that is mottled in shades of red, yellow, and brown. It is about 37 inches thick. The underlying layer, to a depth of 60 inches, is reddish-yellow, noncalcareous loam that has a few calcium carbonate concretions.

About 50 to 60 percent of the surface layer has been removed, mainly by sheet erosion. In places, tillage has made the surface layer more clayey and redder by mixing it with material from the upper part of the clayey subsoil. Shallow, crossable gullies are common, and in places gullies have cut deeply into the underlying material.

Included with this soil in mapping are small areas of uneroded Crockett soils between gullies or on foot slopes and some Crockett soils that have slopes of as much as 6 percent. Also included are small areas of Tabor soils that are slightly higher in the landscape.

Areas of this soil that are in larger fields of other cultivated Crockett soils are still cultivated. Most areas are idle cropland or cropland converted to pasture. The soil is better suited to improved pasture than to other uses. The hazard of water erosion is severe. Capability unit IVe-1 dryland, IVe-1 irrigated; Tight Sandy Loam range site.

Denhawken Series

The Denhawken series consists of deep, calcareous, friable, nearly level to gently sloping loamy soils on uplands. These soils formed in calcareous clayey marine shale that has selenite (gypsum) crystals.

In a representative profile the surface layer is grayish-brown, calcareous clay loam about 6 inches thick. The next layer is firm, brown clay loam about 8 inches thick. Below this is calcareous clay, about 32 inches thick, that is brown in the upper part and pale brown in the lower part. The underlying material, to a depth of 75 inches, is mottled, calcareous shaly clay that has lenses of selenite (gypsum) crystals. It is light yellowish brown in the upper part and light brownish gray in the lower part.

These soils are well drained, and they are very slowly permeable. Runoff is slow to medium, and available water capacity is high.

Denhawken soils are mostly cultivated. In Wilson County, Denhawken soils are mapped only in complex with Elmendorf soils.

Representative profile of Denhawken clay loam in an area of Elmendorf-Denhawken complex, 1 to 4 percent slopes, in a cultivated field, 0.25 mile north of Poth on U.S. Highway 181 to Farm Road 427, 3 miles east on Farm Road 427 to county road, and 0.8 mile northwest on county road; then 0.12 mile southwest in a microhigh:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; hard, friable; common fine roots; calcareous; moderately alkaline; clear, smooth boundary.

B1—6 to 14 inches, brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; moderate, fine, subangular blocky structure; hard, firm; common fine roots; shiny surfaces on peds; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B2—14 to 25 inches, brown (10YR 5/3) clay, dark brown (10YR 4/3) moist; moderate, medium and fine, angular blocky structure; very hard, very firm; common roots; few darker streaks from root channels and cracks filled with darker materials from above; evident pressure faces; 3 percent fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary

B2ca—25 to 46 inches, pale-brown (10YR 6/3) clay, brown (10YR 5/3) moist; moderate, medium and fine, angular blocky structure; very hard, very firm; few roots; dark streaks in old root channels and cracks filled with darker materials from above; evident pressure faces; about 8 percent soft lumps and calcium carbonate concretions; calcareous; moderately alkaline; gradual wavy boundary.

Cca—46 to 68 inches, light yellowish-brown (10YR 6/4) shaly clay: yellowish brown (10YR 5/4) moist; few, medium, distinct, olive-brown (2.5Y 4/4) mottles; massive, crushes to block-like fragments; very hard, very firm; few dark streaks of darker materials from above; about 15 percent, by volume, soft masses and indurated concretions of calcium carbonate few fine selenite (gypsum) crystals; few shale fragments; calcareous; moderately alkaline; gradual, smooth boundary.

C—68 to 75 inches, light brownish-gray (2.5Y 6/2) shaly clay; grayish brown (2.5Y 5/2) moist; common, coarse, distinct, olive-brown (2.5Y 4/4) and brownish-yellow (10YR 6/6) mottles; massive; very hard, very firm; estimated 10 percent, by volume, lenses and fragments of selenite (gypsum) crystals; few fine calcium carbonate concretions; calcareous; moderately alkaline.

When the soil is dry, cracks as much as 2 inches wide are at the surface and extend to a depth of 25 to 50 inches. The A and B1 horizons range from 8 to 24 inches in combined thickness. They range from loam to clay loam in texture and are brown, grayish brown, or pale brown in color. Reaction of the combined A and B1 horizons is mildly alkaline or moderately alkaline.

The B2 horizons range from 18 to 40 inches in thickness. They range from clay to clay loam in texture and are 35 to 55 percent clay. The B2 horizons are brown, grayish brown, or pale brown. The calcium carbonate equivalent ranges from 2 to 12 percent, by weight.

The C horizons are mottled and streaked grayish, brownish, and yellowish shaly clay or clayey shale. Selenite (gypsum) crystals comprise 3 to 15 percent, by volume, of the C horizons.

Elmendorf Series

The Elmendorf series consists of deep, noncalcareous, friable, nearly level to gently sloping clayey soils on uplands. These soils formed in calcareous clayey marine shales.

In a representative profile the surface layer is noncalcareous, dark grayish-brown clay loam about 11 inches thick. The next layer is noncalcareous, very dark gray clay loam about 5 inches thick. The layer below is clay, about 32 inches thick, that is very dark gray and noncalcareous in the upper part and dark gray and calcareous in the lower part. Below this is 42 inches of calcareous clay that is yellowish brown in the upper part, yellow in the middle part, and brownish yellow in the lower part. The underlying material, to a depth of 96 inches, is calcareous, olive-yellow clayey marine shale that has lenses or fragments of selenite (gypsum) crystals.

These soils are well drained, and permeability is very slow. Runoff is slow to medium, and available water capacity is high.

Elmendorf soils are mostly cultivated, but some areas are used for native range or improved pasture. The soils are suited to crops, range, or pasture.

Representative profile of Elmendorf clay loam in an area of Elmendorf-Denhawken complex, 1 to 4 percent slopes, in a cultivated field, 0.25 mile north of Poth on U.S. Highway 181 to Farm Road 427, 3 miles east on Farm Road 427 to unpaved county road, and 0.8 mile northwest on unpaved county road; then 0.12 mile southwest of county road in a microdepression:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; hard, friable; common roots; mildly alkaline; abrupt, smooth boundary.

A1—6 to 11 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak moderate, subangular blocky structure; hard, friable, sticky; common roots; mildly alkaline; clear, wavy boundary.

B1t—11 to 16 inches, very dark gray (10YR 3/1) clay loam, black (10YR 2/1) moist; moderate, medium and fine, angular blocky structure; hard, firm, sticky; common roots; few clay films; mildly alkaline; diffuse, wavy boundary.

B2t—16 to 38 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, medium and fine, angular blocky structure; very hard, very firm, sticky; few roots; common clay films; evident pressure faces; 1 percent fine calcium carbonate concretions in lower part of horizon; mildly alkaline; gradual, wavy boundary.

B2tca—38 to 48 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; common, coarse, distinct, grayish-brown (10YR 5/2) and yellowish-brown (10YR 5/4) mottles; moderate, medium and fine, angular blocky structure; very hard, very firm, sticky; common clay films; evident pressure faces; estimated 6 percent calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

B31—48 to 62 inches, yellowish-brown (10YR 5/4) clay that has streaks and pockets of very dark gray (10YR 3/1); dark yellowish brown (10YR 4/4) moist; weak, medium and fine, angular blocky structure; extremely hard, very firm, sticky; few clay films; few pressure faces; estimated 3 percent calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B32—62 to 72 inches, yellow (10YR 7/6) clay, brownish yellow (10YR 6/6) moist; weak, medium, blocky structure; very hard, very firm, sticky; estimated 10 percent gray (10YR 5/1) clayey marine shale fragments that have faint, yellowish-brown (10YR 5/6) mottles and few, fine, prominent, yellowish-red (5YR 5/6) mottles; estimated 4 percent selenite (gypsum) crystals; calcareous; moderately alkaline; gradual, wavy boundary.

B33—72 to 90 inches, brownish-yellow (10YR 6/6) clay, brownish yellow (10YR 6/6) moist; moderate, fine blocky structure; very hard, very firm; estimated 30 percent light olive-gray (5Y 6/2) clayey marine shale fragments; estimated 15 percent selenite (gypsum) crystals; calcareous; moderately alkaline; diffuse, wavy boundary.

C—90 to 96 inches, olive-yellow (2.5Y 6/6) clayey marine shale; massive; extremely hard, extremely firm; few, prominent, brownish-yellow (10YR 6/6) mottles; estimated 15 percent selenite (gypsum) crystals; calcareous; moderately alkaline.

When these soils are dry, cracks 2 inches wide or more are at the surface and extend to a depth of more than 50 inches. Depth to secondary carbonates ranges from 28 to 54 inches.

The A horizon ranges from 8 to 22 inches in thickness and from loam to clay loam in texture. Color is dark gray, very dark grayish brown, very dark gray, or dark grayish brown. Reaction is neutral to moderately alkaline.

The B1t horizon ranges from 0 to 8 inches in thickness. It is very dark gray, dark gray, black, or dark grayish brown in color and clay or clay loam in texture. Reaction ranges from neutral to moderately alkaline.

The B2t horizons range in thickness from 16 to 38 inches. The upper part of the B2t horizon is dark gray, very dark gray, black, or dark grayish brown in color and clay or clay loam in texture. The upper 20 inches is 35 to 50 percent clay. The lower part of the B2t horizon is dark gray, pale brown, pale yellow, yellowish brown, light reddish brown, light yellowish brown, brown, or olive yellow in color and clay to clay loam in texture. Clay content ranges from 30 to 40 percent. Visible calcium carbonate, in the form of films, threads, soft masses, or cemented concretions, ranges from 2 to 10 percent:

The B3 horizon is yellowish brown, yellow, or brownish yellow in color and clay or clay loam in texture. It is 1 to 15 percent selenite (gypsum) crystals and 5 to 30 percent shale fragments.

The C horizon is grayish, pinkish, brownish, or yellowish clayey marine shale and 1 to 25 percent selenite (gypsum) crystals.

Elmendorf-Denhawken complex, 0 to 1 percent slopes (EdA).—This nearly level complex occupies upland areas that range from 20 to 325 acres in size. The soils are in a repeating pattern of circular areas so intermingled that is not practical to separate them at the scale mapped. Elmendorf soils are in areas of slight depressions that appear on the map as dark-colored soils.

Elmendorf clay loam makes up 75 percent of the complex, Denhawken clay loam 20 percent, and other soils, mostly Coy and Luling, the rest. Included in mapping are Elmendorf and Denhawken soils that have slopes of as much as 2 percent.

The Elmendorf soil has a dark grayish-brown, noncalcareous clay loam surface layer about 18 inches thick. The next layer, about 32 inches thick, is very dark gray, noncalcareous clay. The layer below, about 24 inches thick, is yellowish-brown, calcareous clay. The underlying material is light olive-gray, calcareous marine shale.

The Denhawken soil has a grayish-brown calcareous clay loam surface layer about 15 inches thick. The next layer, about 33 inches thick, is pale-brown, calcareous clay. The underlying material, to a depth of 65 inches, is mottled, yellowish, calcareous shaly clay.

Most areas of this complex are cultivated, but a few small areas are used for native range and improved pasture. The hazard of water erosion is slight. Capability unit IIs-1 dryland, IIs-1 irrigated; Rolling Blacklands range site.

Elmendorf-Denhawken complex, 1 to 4 percent slopes (EdB).—This gently sloping complex occupies upland areas that range from 50 to 750 acres in size. They are irregular or subrounded in shape. Slopes average about 2 percent.

The two soils in this complex appear as stripes of light-colored and dark-colored soils (fig. 8). The alternating stripes appear to be almost cyclic, but the width across soil areas varies and ranges from 12 to 85 feet. Areas of darker Elmendorf soils are generally wider and are in slight depressions. The Denhawken soils are lighter in color, and they occupy microridges.

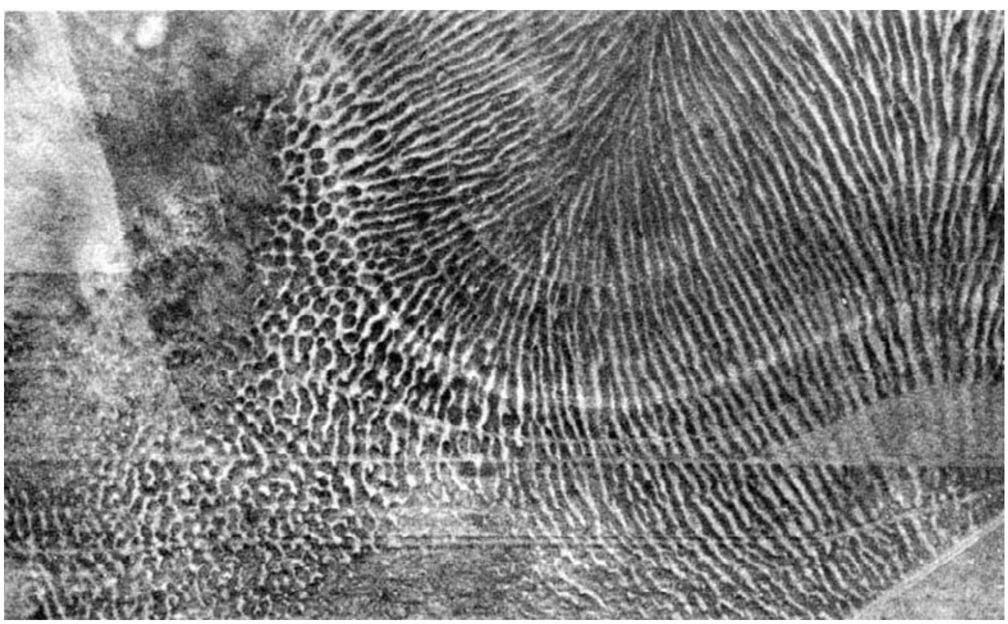

Figure 8.—The striped and spotted soil pattern in a landscape of the Elmendorf-Denhawken complex, 1 to 4 percent slopes. The darker Elmendorf soils are in areas of slight depressions, and the lighter Denhawken soils are on microridges.

Elmendorf clay loam makes up about 80 percent of the complex; Denhawken clay loam, about 18 percent; and other soils, mostly Luling, Coy, and Marcelinas, the rest. Included in mapping are Elmendorf and Denhawken soils that have slopes of as much as 6 percent.

The Elmendorf and Denhawken soils have the profiles described as representative for their respective series.

The soils in this complex are used mainly for crops, but some areas are used for pasture and range. The soils are suitable for cultivation. The hazard of water erosion is moderate. Capability unit IIIe-3 dryland, IIIe-3 irrigated; Rolling Blacklands range site.

Eufaula Series

The Eufaula series consists of deep, noncalcareous, loose, undulating sandy soils on uplands. These soils formed in thick sandy material or in eolian material.

In a representative profile (fig. 9) the surface layer is noncalcareous, pale-brown fine sand about 4 inches thick. The next layer is noncalcareous, very pale brown fine sand about 42 inches thick. The layer below, about 56 inches thick, is noncalcareous, very pale brown fine sand that has nearly continuous, alternate horizontal bands of strong-brown loamy fine sand. The bands are $^1/_8$-inch to $^1/_2$-inch thick and 2 to 5 inches apart. Below this, to a depth of 120 inches, is noncalcareous, red sandy clay loam.

These soils are somewhat excessively drained, and permeability is rapid. Runoff is very slow, and available water capacity is low.

Most areas of these soils are used for range, but a few are used for improved pasture or crops. The soils are better suited to range than to other uses.

Representative profile of Eufaula fine sand in an area of Eufaula and Patilo soils, undulating, 8 miles southwest of LaVernia, 2 miles east on Old Sulfur Springs Road from Bexar-Wilson County line to Kicaster Cemetery, and 1.9 miles south on paved county road into Woodvalley Homesite area; then 30 feet southeast of intersection of Liveoak and Bluebonnet lanes:

A1—0 to 4 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; common fine roots; medium acid; clear, smooth boundary.

A21—4 to 46 inches, very pale brown (10YR 7/3) fine sand, pale brown (10YR 6/3) moist; single grained; loose; common fine roots in upper 20 inches; medium acid; clear, wavy boundary.

A22&B21t—46 to 102 inches, very pale brown (10YR 7/3) fine sand (A22), pale brown (10YR 6/3) moist; single grained; loose; lamellae of strong-brown (7.5YR 5/6) loamy fine sand (B21t); massive; slightly hard, friable; wavy and discontinuous bands $^1/_8$-inch to $^1/_2$-inch thick and 2 to 5 inches apart; clay bridges between sand grains; medium acid; abrupt lower boundary.

B22t—102 to 120 inches, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) moist; common, medium, distinct, pale-brown (10YR 6/3) mottles; massive; hard, friable; thin, discontinuous clay films on ped surfaces; strongly acid.

The A horizon ranges from 42 to 105 inches in thickness. The Al horizon is pale brown, dark brown, or very pale brown in color and fine sand or loamy fine sand in texture. Reaction ranges from medium acid to neutral. The A2 horizon is pink, pinkish gray, light brownish gray, or very pale brown in color.

The B21t horizon is red, light red, yellowish red, or reddish yellow in color and fine sandy loam to loamy fine sand in texture. A B21t horizon that is continuous vertically and horizontally is less common than one that has a B2t horizon with a lamellae. Such a horizon ranges from loamy fine sand to fine sandy loam to sandy clay loam. It is less than 20 percent clay. Profiles that have both a vertical and a horizontal B2t horizon have an A horizon that is 90 inches thick or more. In the B2t and A22 horizons, reaction ranges from strongly acid to slightly acid.

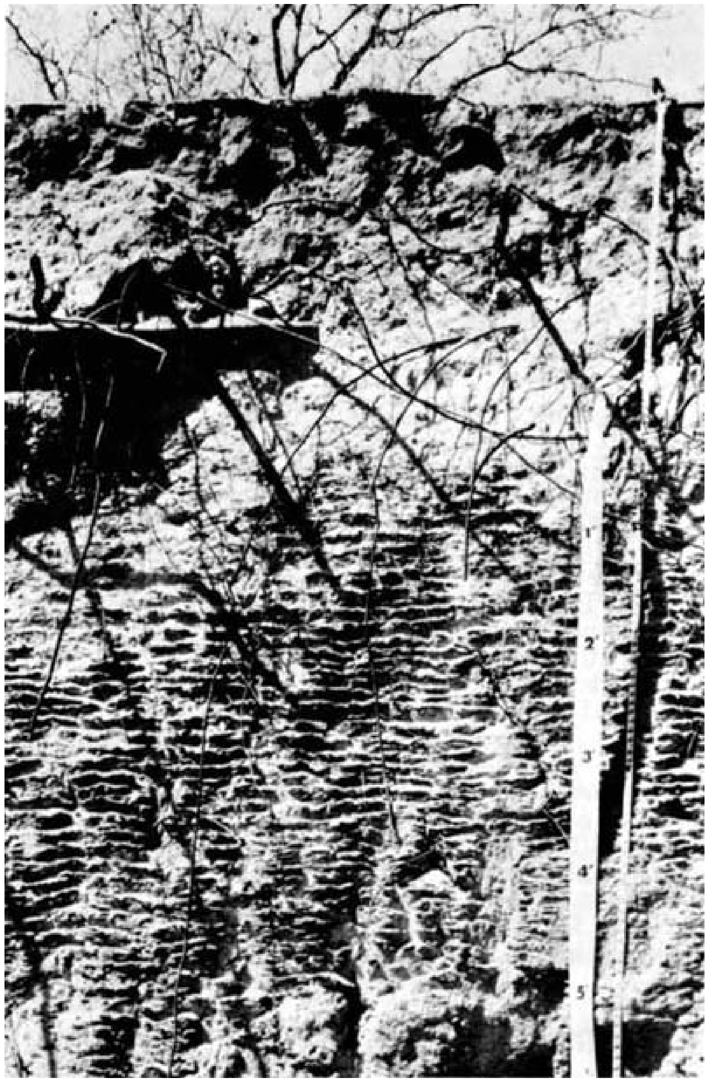

Figure 9.—Profile of Eufaula fine sand in an area of Eufaula and Patilo soils, undulating. The lamellae, or horizontal bands, are ¼-inch to ½-inch thick and are almost continuous. Between the bands is fine sand.

Eufaula and Patilo soils, undulating (EPB).—These soils are in broad, undulating areas that are generally several thousand acres in size, but smaller areas were mapped. Slopes range from 1 to 8 percent but are mostly 2 to 4 percent. The landscape is heavily dissected by drainageways.

The percentage of different soils in areas of this mapping unit vary more than those of other mapping units in the county, but the interpretations presented can be applied to all expected uses. Eufaula soils are dominant, making up 30 to 70 percent of the mapped areas. Where Patilo soils are mapped, they make up 15 to 45 percent of the area, but they are not present in all mapped areas. An average area of this unit is 47 percent Eufaula soils, 26 percent Patilo soils, and 27 percent other soils. Eufaula soils are generally steeper than Patilo soils.

Included with these soils in mapping is a deep fine sand that is similar to the Eufaula soil, but it does not have alternating bands or any continuous horizons that have accumulations of clay. It is in the same landscape as Eufaula soils. Poth and Tabor soils are gently sloping and mostly on the outer extremities of the largest areas of this mapping unit. Leming soils are on low terraces that border creeks or larger field drains.

These soils are used mainly for range, but some areas are used for improved pasture or crops. The hazard of soil blowing is severe. Capability unit IVs-2 dryland, IIIs-3 irrigated; Deep Sand Savannah range site.

Floresville Series

The Floresville series consists of deep, noncalcareous, friable, nearly level to gently sloping loamy soils on uplands. These soils formed in loamy material that has thin strata of sandstone.

In a representative profile (fig. 10) the surface layer is noncalcareous, reddish-brown fine sandy loam about 10 inches thick. The next layer is noncalcareous, red clay about 11 inches thick and noncalcareous, red sandy clay about 9 inches thick. Below it is noncalcareous, yellowish-red sandy clay loam about 7 inches thick and calcareous, reddish-yellow sandy clay loam about 7 inches thick. The underlying material, to a depth of 65 inches, is reddish-yellow, mottled sandy clay loam.

Figure 10.—Profile of a Floresville fine sandy loam showing the abrupt boundary between the surface layer and the subsoil.

These soils are well drained, and permeability is slow. Available water capacity is medium, and runoff is slow to medium.

Areas of Floresville soils are mostly cultivated, but in places they are used for improved pasture or native range.

Representative profile of Floresville fine sandy loam, 1 to 3 percent slopes, in native range 7 miles west of intersection of U.S. Highway 181 and Farm Road 541 in Poth; Farm Road 541 to Dewees community, 1 mile north of Farm Road 1344 and 3.1 miles west on county road; then 255 feet north of the road:

A1—0 to 10 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, subangular blocky structure; hard, friable; many fine roots; few flat ironstone fragments less than 1 inch long; slightly acid; abrupt, smooth boundary.

B21t—10 to 21 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; weak; coarse, prismatic structure that parts to moderate, medium and fine, blocky; very hard, firm; common fine roots; few fine and very fine pores; distinct, continuous clay films on peds; patchy dark stains on vertical ped faces; few flat ironstone fragments less than 1 inch long; slightly acid gradual, wavy boundary.

B22t—21 to 30 inches, red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; moderate, medium and fine, blocky structure; very hard, firm; few roots; distinct, continuous clay films on peds; few dark streaks or stains on peds; few flat ironstone fragments less than 1 inch long; neutral; gradual, wavy boundary.

B3—30 to 37 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, medium, blocky structure; very hard firm; few fine pores; common clay films on peds; few flat ironstone fragments less than 1 inch long; mildly alkaline; gradual, wavy boundary

B3ca—37 to 44 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; weak, medium, blocky structure; hard, friable; estimated 3 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

C—44 to 65 inches, reddish-yellow (5YR 6/6), sandy clay loam, yellowish red (5YR 5/6) moist; common, faint, yellowish-red (5YR 5/8) and brownish-yellow (10YR 6/8) mottles; massive; hard, friable; few fine calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 40 to 85 inches in thickness. Depth to secondary carbonates ranges from 28 to 40 inches. Ironstone fragments are in most profiles, making up 1 to 5 percent, by volume, of any horizon.

Thickness of the A horizon ranges from 6 to 15 inches. The color is reddish brown or brown. Reaction is slightly acid or neutral.

The Bt horizon ranges from 11 to 32 inches in thickness. The B2t horizon is red, reddish brown, or yellowish red in color and clay or sandy clay in texture. It is 35 to 50 percent clay. Reaction ranges from slightly acid to mildly alkaline.

The B3 horizon is 10 to 36 inches thick. It is yellowish red, red, or reddish yellow in color. Texture ranges from sandy clay loam to sandy clay. Reaction is mildly alkaline or moderately alkaline.

The C horizon is reddish yellow, yellowish red, brownish yellow, yellow, or light yellowish brown in color and sandy clay loam, fine sandy loam, or clay loam in texture. This horizon contains thin strata of weakly consolidated sandstone in places.

Floresville fine sandy loam, 0 to 1 percent slopes (FoA).—This nearly level soil is on upland flats or broad ridgetops, mostly within larger areas of more sloping Floresville soils. Areas of this soil are subrounded or irregular in shape, and they range from 10 to 125 acres in size.

This soil has a surface layer of noncalcareous, reddish-brown fine sandy loam about 13 inches thick. The next layer is noncalcareous, red clay about 24 inches thick. The next layer below is calcareous, yellowish-red sandy clay loam about 24 inches thick. The underlying material, to a depth of 70 inches, is fine sandy loam that contains a few cemented concretions of calcium carbonate.

Included with this soil in mapping are areas of Miguel and Wilco soils. Miguel soils are in slight depressions or near the heads of field drainageways. Wilco soils are on low ridges in slightly elevated areas. Also included are areas of Floresville fine sandy loam, 1 to 3 percent slopes, on sides of long field drainageways. Most inclusions are less than 5 acres in size.

This soil is used mainly for crops, but some areas are used for pasture and range. The soil is well suited to cultivated crops (fig. 11). The hazard of water erosion is slight. Capability unit IIs-2 dryland, IIs-4 irrigated; Tight Sandy Loam range site.

Figure 11.—Irrigated peanuts in an area of Floresville fine sandy loam, 0 to 1 percent slopes.

Floresville fine sandy loam, 1 to 3 percent slopes (FoB).—This gently sloping soil is on uplands on plane or in convex areas that range from 30 to 300 acres in size and are mostly irregular or subrounded in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Miguel and Wilco soils. Miguel soils are at the heads of field drainageways or in slightly concave areas. Wilco soils are on crests of higher hills in places. Also included, in places, are small areas of Floresville fine sandy loam, 0 to 1 percent slopes, that cap areas of gently sloping soils, and areas of Floresville fine sandy loam, 3 to 5 percent slopes, on the sides of field drainageways. These inclusions are mostly 10 acres or less.

This soil is used mainly for crops, but in places areas are used for range and improved pasture. This soil is well suited to cultivated crops. The hazard of water erosion is moderate. Capability unit IIe-1 dryland, IIe-1 irrigated; Tight Sandy Loam range site.

Floresville fine sandy loam, 3 to 5 percent slopes (FoC).—This gently sloping soil is on uplands on the sides of the major field drainageways and creeks that dissect the area. Areas of this soil range from 20 to 200 acres in size, and they are long and narrow or irregularly oblong in shape.

This soil has a surface layer of noncalcareous, reddish-brown fine sandy loam about 8 inches thick. The next layer is noncalcareous, red sandy clay about 22 inches thick. The layer below is calcareous, yellowish-red sandy clay loam about 14 inches thick. Below it, to a depth of 60 inches, is reddish-yellow, calcareous sandy clay loam that has a few cemented concretions of calcium carbonate and a few fragments of sandstone.

Small areas of Miguel soil are included with this soil in mapping. They are generally in slightly concave areas mostly on foot slopes. Also, small areas of Floresville fine sandy loam, 2 to 5 percent slopes, eroded, are included in places. Most inclusions are 3 acres or less in size.

Most areas of this soil are cultivated, but in places areas are used for improved pasture or native range. The soil is suitable for crops, pasture grasses, and range. The hazard of water erosion is moderate. Capability unit IIIe-4 dryland, IIIe-4 irrigated; Tight Sandy Loam range site.

Floresville fine sandy loam, 2 to 5 percent elopes, eroded (FoC2).—This gently sloping, eroded soil is on uplands. Most areas are about 25 acres in size, but they range from 5 to 100 acres. This soil is in cultivated fields on the sides and at the heads of small draws from which water drains to larger draws. Relief is convex, and the surface is gullied in places.

The surface layer of this soil is noncalcareous, reddish-brown fine sandy loam about 6 inches thick. The next layer is noncalcareous, reddish-brown sandy clay about 27 inches thick. The layer below is calcareous, reddish-yellow sandy clay loam about 13 inches thick. About 5 percent of this layer is soft masses of cemented concretions of calcium carbonate. The underlying material, to a depth of 60 inches, is calcareous, reddish-yellow clay loam.

About 55 to 65 percent of the surface layer of this soil has been removed by sheet erosion. In places tillage has made the surface layer more clayey by mixing into it some of the upper part of the clayey subsoil. Shallow, crossable gullies less than 2 $^{1}/_{2}$ feet deep and 50 to 200 feet apart are common, and in some areas gullies have cut into the underlying material.

Included with this soil in mapping are small areas of uneroded Floresville soils on foot slopes and Floresville soils that slope as much as 6 percent. Also included are a few areas of soils similar to, but thinner than, Floresville soils; a soil that has iron rock and cherty gravel on the surface, especially in severely eroded areas; and a few areas of Miguel soils at the heads of small field drainageways.

In places areas of this soil are still cultivated, because they are within larger areas of Floresville soils, but most areas are idle cropland or cropland converted to improved pasture. The soil is better suited to improved pasture than to other uses. The hazard of water erosion is severe. Capability unit IVe-2 dryland, IVe-1 irrigated; Tight Sandy Loam range site.

Frio Series

The Frio series consists of deep, calcareous, friable, nearly level loamy soils on flood plains. These soils formed in loamy to clayey alluvium.

In a representative profile (fig. 12) the surface layer is calcareous, dark grayish-brown and grayish-brown silty clay loam about 35 inches thick. The underlying material, to a depth of 60 inches, is calcareous, pale-brown silty clay loam in the upper part and calcareous, light yellowish-brown silty clay in the lower part.

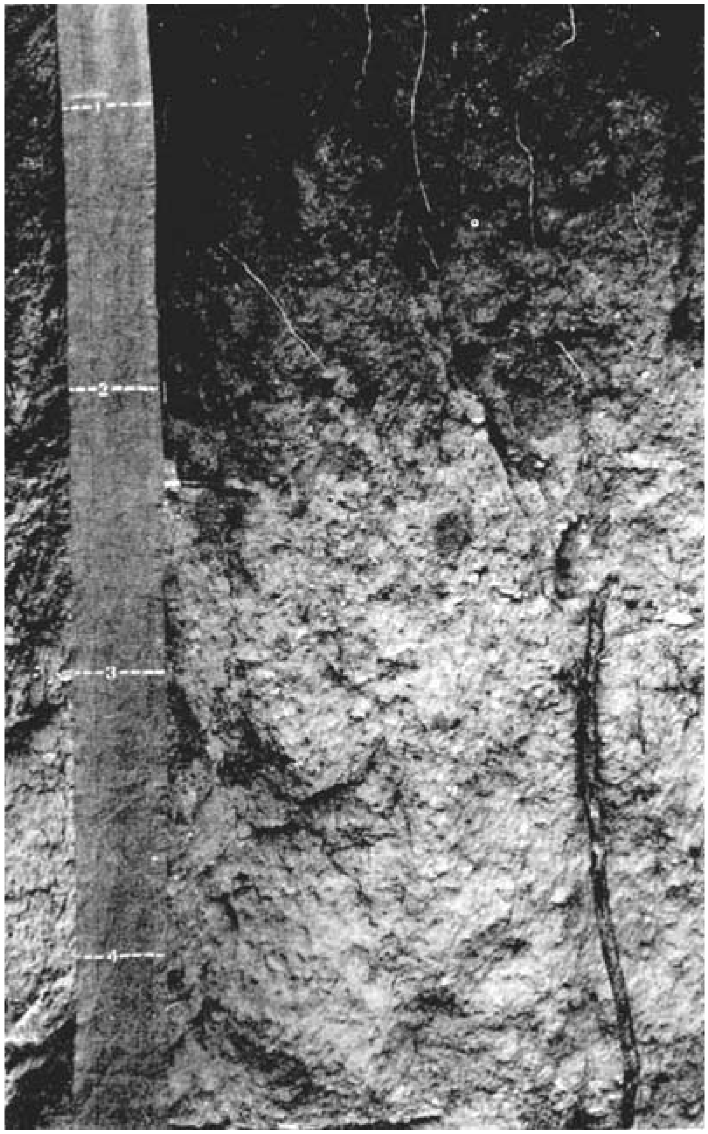

Figure 12.—Profile of Frio silty clay loam showing the dark-colored surface layer.

These soils are well drained, and permeability is moderately slow. Runoff is slow, and available water capacity is high. These soils flood once or twice a year.

Frio soils are mostly in native range, but some areas are used for improved pasture or pecan orchards. The soils are suited to pecan orchards, improved pasture, or range. In Wilson County, Frio soils are mapped only in an undifferentiated unit with Loire soils.

Representative profile of Frio silty clay loam in an area of Loire and Frio soils, frequently flooded, in a pecan orchard, 3.5 miles north of Floresville on Business Loop of U.S. Highway 181 to intersection with paved county road, 0.7 miles west on county road; then 250 feet south of county road and 200 feet east of the San Antonio River:

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, fine, granular and subangular blocky structure; hard, friable; many fine roots; few films and threads of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; diffuse, smooth boundary.

A12—5 to 22 inches, dark grayish-brown (10YR 4/2) silty clay loam; very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, subangular blocky structure; hard, firm; common roots; few films and threads of calcium carbonate; few snail shell fragments;

A13—22 to 35 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; hard, firm; common roots; few films, threads, and soft masses of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; gradual, smooth boundary.

C1—35 to 42 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 5/3) moist; massive; hard, firm; few strata or lenses of silty clay and silty loam; calcareous; moderately alkaline; gradual, smooth boundary.

C2—42 to 60 inches, light yellowish-brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) moist; massive; hard firm; few bedding planes; few strong-brown mottles or strains of decaying plants; calcareous; moderately alkaline.

The A horizon is 22 to 58 inches thick. It is very dark grayish-brown, dark grayish-brown, grayish-brown, dark-brown, or brown silty clay loam, silty clay, or clay loam. Clay makes up 30 to 48 percent of the A horizon at a depth of 10 to 40 inches. Between depths of 30 to 58 inches some profiles have strata of more loamy or more clayey sediment.

The C horizons are light brownish-gray, pale brown, light yellowish-brown, or very pale brown silty clay loam, silty clay, or clay loam. Bedding planes are mostly below a depth of 50 inches. Thin lenses or strata of loamy or more clayey sediment are in some profiles. A few fine, faint to distinct, strong-brown to yellowish-brown mottles or organic stains are in the C horizon.

Gowen Series

The Gowen series consists of deep, noncalcareous, firm, nearly level loamy soils on low terraces or flood plains. These soils formed in loamy, noncalcareous material.

In a representative profile the upper 7 inches of the surface layer is firm, noncalcareous, dark grayish-brown clay loam. Below this is 33 inches of noncalcareous clay loam that is very dark grayish brown in the upper part and brown in the lower part. The underlying material, to a depth of 60 inches, is brown, noncalcareous, stratified clay loam.

These soils are well drained, and permeability is moderate. Available water capacity is high, and runoff is slow to medium.

Gowen soils are mostly in native range or improved pasture, but a few areas are cultivated. The soils are better suited to pasture and range than to other uses.

Representative profile of Gowen clay loam in a cultivated field, 11 miles northwest of Floresville on U.S. Highway 181 and 0.75 mile west on unpaved county road; then 75 feet northwest of unpaved county road:

Ap—0 to 7 inches, dark grayish-brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, granular structure; hard, firm, sticky; many fine roots; common pores; neutral; clear, smooth boundary.

A11—7 to 32 inches, very dark grayish-brown (10YR 3/2) clay loam, very dark brown (10YR 2/2) moist; weak, fine, subangular blocky structure; hard, firm, sticky; common fine roots; common fine pores; mildly alkaline; gradual, smooth boundary.

A12—32 to 40 inches, brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak, fine, subangular blocky structure; hard, firm sticky; few fine roots; common fine pores; mildly alkaline; gradual, smooth boundary.

C—40 to 60 inches, brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; thin strata of pale-brown (10YR 6/3) fine sandy loam and thin strata or lenses of grayish-brown (10YR 5/2) clay; hard, firm; common fine pores; mildly alkaline.

These soils are noncalcareous to a depth of 60 inches. The A horizon ranges from 28 to 50 inches in thickness. It is very dark grayish-brown, dark grayish-brown, dark-brown, brown, or grayish-brown clay loam to sandy clay loam. Clay makes up 20 to 35 percent of the A horizon at a depth of 10 to 40 inches. Reaction of the A horizon is slightly acid to mildly alkaline.

The C horizon is very dark brown or brown sandy clay to stratified sandy loam that has thin lenses of very dark gray to pale-brown material in places. The C horizon is mottled in places. Reaction ranges from neutral to moderately alkaline.

Gowen clay loam (Go).—This nearly level, and in places slightly undulating, soil is on low terraces or flood plains. Areas of this soil are long and narrow, ranging in size from 30 to 175 acres, but they are dominantly about 70 acres. Slopes are 0 to 1 percent, but they average about 0.5 percent. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Kaufman soils in depressions in places and Zavala soils near the main channels of creeks or field drains. These inclusions are mostly less than 5 acres in size.

This soil is mostly in native range or improved pasture, but some areas are cultivated. Occasional flooding harms some crops, but generally the extra water received from occasional floods helps the crops. The hazard of water erosion is slight. Capability unit IIw-1 dryland, IIw-1 irrigated; Loamy Bottomland range site.

Gowen and Zavala soils, frequently flooded (Gz).—These nearly level soils are on frequently flooded creek bottoms and along intermittent field drains. Areas of these soils are adjacent to stream channels and are long and narrow, ranging from 10 to 200 acres in size (fig. 13). Slopes are 0 to 1 percent. Some areas of this mapping unit consist entirely of either Gowen clay loam or Zavala fine sandy loam, and others are made up of both soils.

Gowen clay loam has a surface layer of noncalcareous, dark grayish-brown clay loam about 47 inches thick. The next layer, to a depth of 62 inches, is non-calcareous, brown clay loam or loam stratified with lenses of sandy loams or sandy clays. Zavala fine sandy loam, to a depth of 60 inches, is noncalcareous, friable, brown fine sandy loam.

Included with these soils in mapping are a few areas of the slightly higher Leming loamy fine sand, bordering uplands.

These soils are mostly in range, but a few small areas are in improved pasture. The soils are not suited to cultivated crops because of the hazard of flooding. Overflow occurs about twice each year, enough to damage crops. Capability unit Vw-1 dryland; Loamy Bottomland range site.

Karnes Series

The Karnes series consists of deep, calcareous, friable, nearly level to moderately steep soils on high terraces. These soils formed in loamy material derived from soils formed in soft limestone, chalk, or marl.

Figure 13.—Landscape of Gowen and Zavala soils, frequently flooded, showing the scoured drainage pattern.

In a representative profile the surface layer is light brownish-gray, calcareous loam about 20 inches thick. Below this is pale-brown, calcareous loam, about 40 inches thick, that has films and threads of calcium carbonate. The underlying material extends to a depth of 72 inches and is very pale brown, calcareous fine sandy loam weakly stratified with loam or silty clay loam.

These soils are well drained, and permeability is moderately rapid. Available water capacity is medium, and runoff is slow to medium.

Karnes soils are used mostly for crops, but a few areas are used for improved pasture or range. The soils are suited to crops, range, or pasture.

Representative profile of Karnes loam, 0 to 3 percent slopes, in a pasture, 3.5 miles north of Floresville on Business Loop of U.S. Highway 181 from intersection with Farm Road 536 and 0.8 mile west on paved county road; then 200 feet north of county road:

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure to weak, fine, subangular blocky; hard, friable; many fine roots; common wormcasts and insect tunnels; $^{1}/_{4}$-inch platy crust on surface; calcareous; moderately alkaline; clear, smooth boundary.

A1—6 to 20 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular and subangular blocky structure; hard, friable; common fine roots; few line pores; common wormcasts and insect tunnels; calcareous; moderately alkaline; gradual, smooth boundary.

B2—20 to 38 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak, medium and fine, subangular blocky structure; hard, friable; few roots; few fine pores; common wormcasts and insect tunnels; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C1—38 to 60 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; hard, friable; few roots; few fine pores; few wormcasts and insect tunnels; few thin stratified layers of silty clay loam in the lower part; calcareous; moderately alkaline; gradual, smooth boundary.

C2—60 to 72 inches, very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; hard, friable; weakly stratified loam or silty clay loam; calcareous; moderately alkaline.

The solum is 34 to 50 inches thick. The A horizon ranges from 5 to 22 inches in thickness and from loam to fine sandy loam in texture. It is grayish brown, brown, light brownish gray, or pale brown in color.

The B horizons range in thickness from 15 to 30 inches. They are grayish brown, brown, pale brown, or very pale brown in color and loam or fine sandy loam in texture. At a depth of 10 to 40 inches, these horizons are 15 to 25 percent clay. From the surface to a depth below 40 inches, these horizons are 40 to 80 percent or more calcium carbonate.

The C horizons are at a depth of 25 to 50 inches. They are pale brown or very pale brown in color. Textures range from loam to fine sandy loam, and stratification is weakly expressed. The strata range from $^1/_4$-inch to 1 inch thick and are mostly silty clay loam.

Karnes loam, 0 to 3 percent slopes (KaB).—This nearly level to gently sloping soil is on broad, high terraces. Areas of this soil are roughly parallel to the river and creek channels. They are irregularly oblong in shape and range from 25 to 225 acres in size.

Included with this soil in mapping are areas of Venus soils in slightly lower areas and Aransas soils in old waterways that once drained the high terraces.

This soil is mostly cultivated, and a small acreage is irrigated, but some areas are used for pasture or range. The soils are suited to cultivated crops, but the high calcium carbonate content causes chlorosis in some plants. Capability unit IIIs-2 dryland, IIs-3 irrigated; Gray Sandy Loam range site.

Kaufman Series

The Kaufman series consists of deep, noncalcareous, very firm, nearly level clayey soils on low terraces or bottom lands. These soils formed in recent, alkaline clayey material.

The surface layer is dark-gray, noncalcareous clay, about 28 inches thick, that has a few yellowish-brown and strong-brown mottles in the lower part. The next layer is dark grayish-brown, noncalcareous clay, about 18 inches thick, that is mottled with yellowish brown and strong brown. The underlying material, to a depth of 60 inches, is olive-gray, noncalcareous clay that has a few gray and yellowish-brown mottles and a few ferro-manganese concretions.

These soils are somewhat poorly drained, and permeability is slow. Available water capacity is high, and runoff is slow.

Kaufman soils are mostly in native range or improved pasture, but a few areas are used for cultivated crops. The soils are suited to pasture, range, and some crops.

Representative profile of Kaufman clay, frequently flooded, 5.25 miles south of Stockdale on Texas Highway 123 to Farm Road 1347, 5.5 miles east on Farm Road

1347 to unpaved county road, and 0.8 mile south on unpaved county road; then west of unpaved county road in flood plain of a small creek:

A1—0 to 14 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; sand coatings on ped surfaces give soil brown (10YR 4/3) color; moderate, medium, subangular blocky structure; extremely hard, very firm, sticky and plastic; many fine roots; neutral; gradual, smooth boundary.

A1g—14 to 28 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; few, fine, faint, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; sand grains on ped surfaces give soil brown (10YR 4/3) color; moderate, medium and coarse, blocky structure; extremely hard, very firm, sticky and plastic; common fine roots; pressure faces on peds; mildly alkaline; diffuse, wavy boundary.

B2g—28 to 46 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; few fine, faint, yellowish-brown (10YR 5/6) and strong-brown (7.5YR 5/6) mottles; sand coatings on ped surfaces give soil brown (10YR 4/3) color; moderate, medium and coarse, blocky structure; extremely hard, very firm, sticky and plastic; few fine ferro-manganese concretions; few slickensides that do not intersect; mildly alkaline; diffuse, wavy boundary.

Cg—46 to 60 inches, olive-gray (5Y 4/2) clay, dark olive gray (5Y 3/2) moist; few, fine, faint, dark-gray (10YR 4/1) and yellowish-brown (10YR 5/4) mottles; weak, medium, blocky structure; very hard, very firm; few fine ferro-manganese concretions; mildly alkaline.

The A horizon ranges from 22 to 60 inches in thickness. It is dark gray or very dark grayish brown. In places, the A horizon is free of mottles; in other places, part of the A horizon has common, fine, yellowish-brown and strong brown mottles. Cracks that form after drying range from $^{1}/_{2}$-inch to 2 inches in width at the surface and from 2 to 4 feet in depth. Reaction is neutral to mildly alkaline.

The Bg and Cg horizons are dark grayish brown to olive gray in color and are mostly clay in texture. Mottles are yellowish brown or dark gray.

Some profiles have B2g or Cg horizons that have thin strata of coarse material. A few weakly defined slickensides are in some profiles.

Kaufman clay, frequently flooded (Kf).—This nearly level soil is on food plains of bottom lands. Areas of this soil are roughly parallel to stream channels and are 10 to 100 acres in size. In places they are on low terraces slightly higher than the flood plains and adjacent to soils on uplands. Slopes are 0 to 1 percent.

Included with this soil in mapping are areas of slightly higher Luling soils away from stream channels and very small areas of Aransas and Gowen soils.

Most areas of Kaufman soils are in range or improved pasture. The soil is suited to pasture grasses or range. The hazard of water erosion is slight although this soil is frequently flooded for periods of short duration. Capability unit Vw-3 dryland; Clayey Bottomland range site.

Leming Series

The Leming series consists of deep, noncalcareous, loose, nearly level to gently sloping sandy soils in valleys or on low terraces. These soils formed in inter-bedded shale and weakly consolidated sandstone.

In a representative profile (fig. 14) the surface layer is noncalcareous, pale-brown loamy fine sand about 18 inches thick. The subsurface layer is very pale brown loamy fine sand about 4 inches thick. The next layer is noncalcareous, grayish-brown sandy clay, about 20 inches thick, that is mottled with gray, yellow, and red. The layer below is about 14 inches thick. The upper part is light brownish-gray, noncalcareous sandy clay, and the lower part is pale-brown, calcareous sandy clay loam. This layer is mottled with red, brown, gray, and yellow, and the lower part of this horizon is about 5 percent soft masses and concretions of calcium carbonate. The underlying material, to a depth of 62 inches, is light-gray, noncalcareous sandy clay loam that has mottles of brown, yellow, red, and gray.

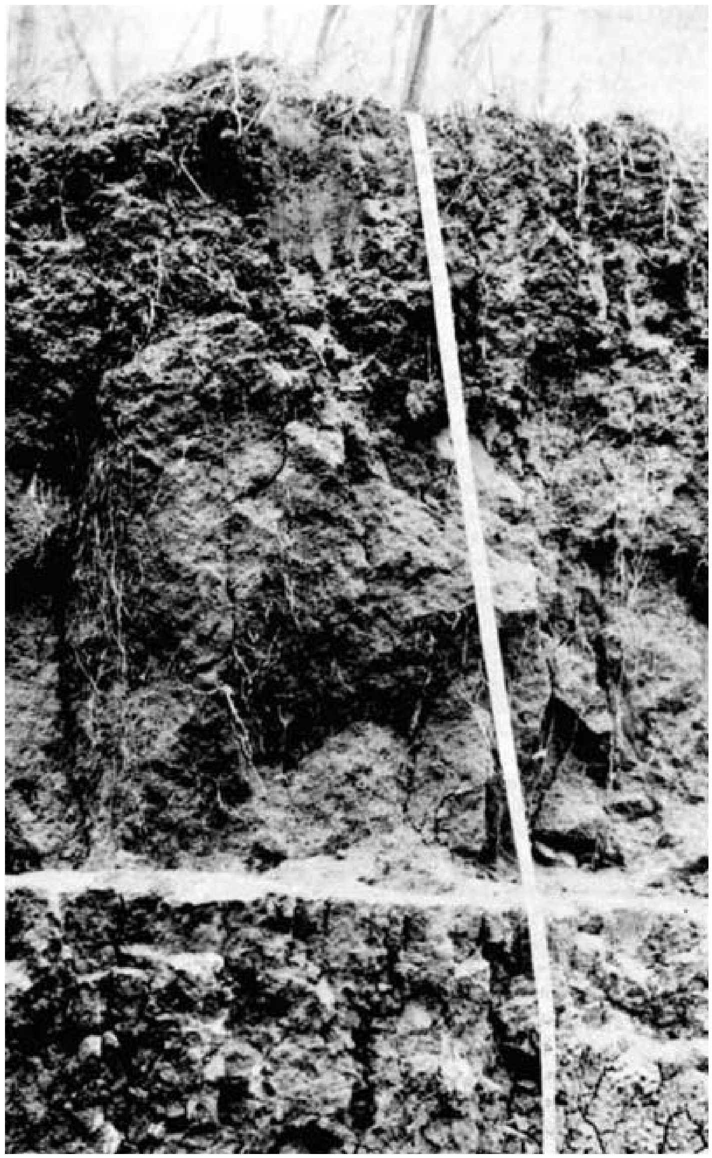

Figure 14.—Profile of Leming loamy fine sand. The surface layer in this profile is about 34 inches thick. Note the abrupt boundary between the surface layer and the subsoil. The subsoil is mottled, slowly permeable, blocky sandy clay.

These soils are moderately well drained to somewhat poorly drained, and permeability is slow. Runoff is slow to medium, and available water capacity is medium.

Leming soils are mostly cultivated, but some areas are used for native range or improved pasture. The soils are suited to crops, range, or pasture.

Representative profile of Leming loamy fine sand, 0 to 3 percent slopes, in a pasture, 7 miles east of Floresville on Texas Highway 97 to Farm Road 1922, 3 miles south on Farm Road 1922 to unpaved county road, and 0.5 mile west on unpaved county road; then 75 feet south of unpaved county road:

A1—0 to 18 inches, pale-brown (10YR 6/3) loamy fine sand, dark brown (10YR 4/3) moist; single grained; loose; many fine roots; few wormcasts; slightly acid; clear, wavy boundary.

A2—18 to 22 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; common fine roots; few wormcasts; slightly acid; abrupt, wavy boundary.

B21t—22 to 28 inches, grayish-brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; common, fine and medium, distinct, gray (10YR 5/1), brownish-yellow (10YR 6/6), and red (2.5YR 5/8) mottles; moderate fine and medium, blocky structure; extremely hard, very firm; common fine roots; few fine pores; thin, discontinuous clay films on peds; neutral; gradual, wavy boundary.

B22t—28 to 42 inches, grayish-brown (10YR 5/2) sandy clay, dark grayish brown (10YR 4/2) moist; common, medium, distinct, brownish-yellow (10YR 6/6) and prominent, red (2.5YR 5/8) mottles; moderate medium, fine, blocky structure; extremely hard, very firm; few fine pores; thin, discontinuous clay films on ped surfaces; mildly alkaline; gradual, wavy; boundary.

B3t—42 to 48 inches, light brownish-gray (10YR 6/2) sandy clay, grayish brown (10YR 5/2) moist; common, medium and course distinct, yellowish-brown (10YR 5/4) and yellowish-red (5YR 5/6), and few, faint, gray (10YR 5/1) mottles; weak medium, blocky structure; extremely hard, very firm; mildly alkaline; gradual, wavy boundary.

B3tca—48 to 56 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; common medium to coarse, distinct yellowish-brown (10YR 5/6), yellowish-red (5YR 5/6), and grayish-brown (10YR 5/2) mottles; weak medium, blocky structure; hard, firm; estimated 5 percent, by volume, indurated calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—56 to 62 inches, light-gray (10YR 7/2) sandy clay loam, light, brownish gray (10YR 6/2) moist; common, medium and coarse, distinct, brownish-yellow (10YR 6/6), yellowish-red (5YR 5/6), and grayish-brown (10YR 5/2) mottles; massive; few soft masses and indurated concretions of calcium carbonate; matrix noncalcareous; moderately alkaline.

The solum is 50 to 72 inches thick. The A horizon ranges from 20 to 38 inches in thickness and is grayish brown, light brownish gray, very pale brown, pale brown, or brown in color. Reaction is slightly acid or neutral.

The B2t horizons range from 12 to 30 inches in thickness. They are grayish brown, light brownish gray, light gray, very pale brown, pale brown, brown, or yellowish brown and are mottled in shades of gray, yellow, red, and brown. Texture is clay, clay loam, or sandy clay. Reaction ranges from slightly acid to moderately alkaline.

The B3t and C horizons are the same color as the B2t horizons. They are sandy clay, sandy clay loam, or clay loam in texture. Reaction ranges from neutral to moderately alkaline. The B3tca or Cca, when present is about 5 to 8 percent calcium carbonate in the form of films, threads, masses, or hard concretions. The C horizon in some profiles is interbedded with sandstone or shale.

Leming loamy fine sand, 0 to 3 percent slopes (LeB).—This nearly level to gently sloping soil is in valleys. Areas of this soil are mostly long and narrow and range in size from 10 to 200 acres (fig. 15).

Figure 15.—Landscape of Leming loamy fine sand, 0 to 3 percent slopes, that had been cultivated but is now planted to Coastal bermudagrass pasture.

Included with this soil in mapping are areas of Miguel soils in depressions and small areas of Poth soils in narrow bands near uplands. Also included are small areas of a soil similar to Leming soils except that it has a surface layer less than 20 inches thick.

Leming soils are mostly cultivated, but some areas are used for improved pasture or range. The soil is well suited to most of the locally grown crops. The hazards of water erosion and soil blowing are moderate. Capability unit IIIe-6 dryland, IIIe-5 irrigated; Loamy Sand range site.

Loire Series

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

In a representative profile (fig. 16) the surface layer is brown, calcareous silty clay loam about 8 inches thick. Below this is about 8 inches of calcareous, grayish-brown silty clay loam that is stratified with loamy sediment over about 26 inches of calcareous, pale-brown loam that is stratified with lenses of silty clay loam. The next layer, to a depth of 80 inches, is light yellowish-brown, calcareous fine sandy loam that is stratified with silty clay loam, very fine sandy loam, and loam.

These soils are well drained, and permeability is moderate. Runoff is slow, and available water capacity is high. These soils flood as often as one or two times a year.

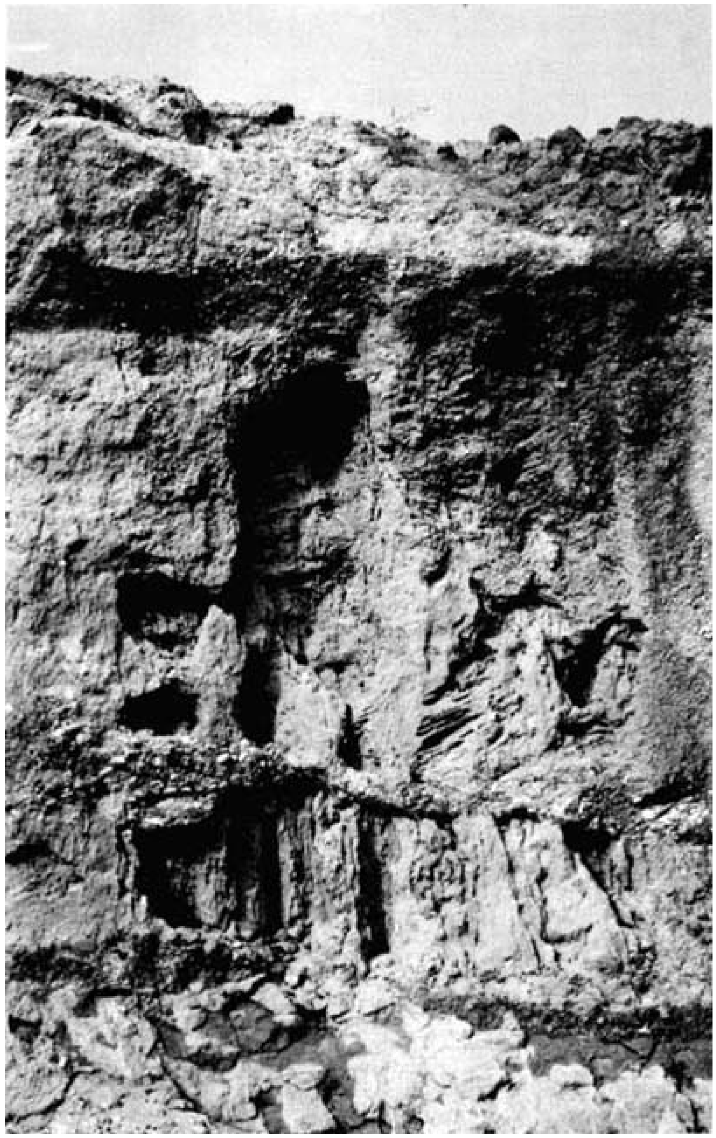

Figure 16.—Profile of a Loire silty clay loam showing thin strata of clay to fine sandy loam.

Loire soils are mainly in native range, but some areas are used for improved pasture or pecan orchards. The soils are better suited to range, improved pasture, or pecan orchards than to other uses.

Representative profile of Loire silty clay loam in an area of Loire and Frio soils, frequently flooded, 3.5 miles north of Floresville on Business Loop of U.S. Highway 181 to intersection with paved county road and 0.7 mile west on paved county road; then 60 feet south of paved county road and 100 feet west of the San Antonio River.

A1—0 to 8 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 4/3) moist; weak, fine, granular structure and very fine subangular blocky; hard, friable; common fine roots; common insect tunnels; $^{1}/_{4}$-inch fine and platy surface crust; calcareous; moderately alkaline; clear, smooth boundary.

C1—8 to 16 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) moist; weak, thin to thick, platy structure related to bedding planes; hard, friable; common fine roots; common insect tunnels; few fragments of snail shells; few thin, light brownish-gray (10YR 6/2) loamy strata; calcareous; moderately alkaline; clear, smooth boundary.

C2—16 to 42 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; weak, thin, platy structure related to bedding planes; about 30 percent thin lenses of silty clay loam; evident bedding planes; hard friable; common fine pores; few fine snail shell fragments; few mica flakes; calcareous; moderately alkaline; clear, smooth boundary

C3—42 to 80 inches, light yellowish-brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; thin evident strata of silty clay loam, very fine sandy loam, and loam; massive; slightly hard, very friable; few mica flakes; few snail shell fragments; calcareous; moderately alkaline.

The soil material to a depth of 40 inches is silty clay loam, loam, or sandy clay loam. At a depth of 10 to 40 inches the soil material is 18 to 35 percent clay. In most places, the soil contains thin strata of clay to fine sandy loam.

The A and C horizons, to a depth of 60 inches, are grayish brown, light brownish gray, brown, pale brown, very pale brown, or light yellowish brown. Thin layers below a depth of 20 inches in places are darker than the surface layer. Below a depth of 40 inches the texture is fine sandy loam or loam. Some soil material contains as much as 15 percent gravel and has dark staining below a depth of 50 inches.

Loire and Frio soils, frequently flooded (Lf).—These nearly level soils are on frequently flooded river and creek bottoms or flood plains and along some intermittent drainageways. Areas of these soils are adjacent to stream channels and are long, narrow, and irregularly shaped. They range in size from 85 to several hundred acres. Slopes are 0 to 1 percent.

Composition of this mapping unit is not uniform, and soil patterns are irregular. The Loire soil is dominant and makes up 50 to 75 percent of the mapped areas. Frio soils make up 25 to 50 percent. An average mapped area is 55 percent Loire soil, 35 percent Frio soil, and 10 percent other soils. All of these soils are on flood plains, and Loire soils are also on the walls of high terraces.

Included with these soils in mapping are Aransas soils mostly in depressions or drainageways that cut through the broader flood plains and Yahola soils in long, narrow bands near stream channels.

These soils are used mainly for range, but some areas are used for improved pasture or pecan orchards. The soils are not well suited to cultivated crops because of the frequent damaging floods and the resulting scouring or sedimentation. They are suited to pecan orchards, improved pasture, or range. Capability unit Vw-2 dryland; Loamy Bottomland range site.

Luling Series

The Luling series consists of deep, noncalcareous, extremely firm, nearly level to gently sloping clayey soils on uplands. These soils formed in moderately alkaline shaly clays.

In a representative profile the upper 14 inches of the surface layer is dark grayish-brown, noncalcareous clay. Below this is 16 inches of olive-gray, noncalcareous clay and about 24 inches of olive-gray and light olive-gray, noncalcareous clay that has streaks or mottles of brownish yellow and olive. The underlying material, to a depth of 70 inches, is light-gray shaly clay that has many gypsum crystals and brown and reddish-yellow mottles.

These soils are well drained, and permeability is very slow. Available water capacity is high, and runoff is medium.

Luling soils are used mostly for crops, but a few areas are used for native range or improved pasture. The soils are suited to crops, range, or pasture.

Representative profile of Luling clay, 0 to 4 percent slopes, in a cultivated field, 5.25 miles south of Stockdale on Texas Highway 123 to Farm Road 1347 and 4.6 miles east on Farm Road 1347; then 150 feet south:

Ap—0 to 6 inches dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; weak fine granular structure; when dry, the upper 2 inches forms a mulch of very fine granules; extremely hard, extremely firm, very sticky and very plastic; many fine roots; many wormcasts; mildly alkaline; clear, smooth boundary.

A11—6 to 14 inches, dark grayish-brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate, fine and medium, blocky structure; parallelepipeds or wedge-shaped peds that have their long axis tilted 10° to 30° above horizontal; extremely hard, very firm, very sticky and very plastic; many fine roots; many wormcasts; mildly alkaline; gradual, wavy boundary.

A12—14 to 30 inches olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; strong, medium and fine, angular blocky structure; extremely hard, very firm, very sticky and very plastic; peds are tilted above horizontal, and a few slickensides intersect; common fine roots; few very fine, indurated calcium carbonate concretions; noncalcareous in matrix; moderately alkaline; gradual wavy boundary.

AC1—30 to 42 inches, olive-gray (5Y 5/2) clay, dark olive gray (5Y 3/2) moist; common, medium mottles and splotches of brownish yellow (10YR 6/6) and olive (5Y 5/4); moderate, medium, angular blocky structure; extremely hard, very firm, very sticky and very plastic; peds are tilted above horizontal, and distinct slickensides intersect; few fine segregations of calcium carbonate; noncalcareous in matrix; moderately alkaline; gradual, wavy boundary.

AC2—42 to 54 inches, light olive-gray (5Y 6/2) clay, olive gray (5Y 5/2) moist; common, medium, distinct, brownish-yellow (10YR 6/6) mottles and streaks of darker material that has filled old cracks; weak, medium, blocky structure; extremely hard, very firm; distinct slickensides intersect; many gypsum crystals; noncalcareous; moderately alkaline; gradual, wavy boundary.

C—54 to 70 inches, light-gray (10YR 7/1) shaly clay, gray (10YR 6/1) moist; common, medium prominent, brown (7.5YR 5/4) and reddish-yellow (7.5YR 6/8) mottles; weak, blocky structure; extremely hard, very firm; many gypsum crystals; noncalcareous; moderately alkaline.

The solum is 30 to 60 inches thick. Cracks form when the soil dries. They range from 1 to 3 inches in width at the surface and extend to a depth of 3 to 5 feet.

The A horizon ranges from 15 to 36 inches in thickness. It is very dark grayish brown, dark grayish-brown, grayish-brown, brown, dark-brown, or olive-gray clay or clay loam. Reaction ranges from neutral to moderately alkaline.

The AC horizon is dark grayish brown, grayish brown, brown, light olive brown, olive, light brownish gray, light yellowish brown, pale olive, olive brown, olive gray, or light olive gray. The AC horizon frequently has mottles or streaks of brown, yellow, or olive. The AC horizon ranges from 12 to 36 inches in thickness. It is mostly clay in texture. Reaction ranges from neutral to moderately alkaline.

The AC and C horizons are 0 to 25 percent, by volume, gypsum crystals and 0 to 3 percent ferro-manganese concretions. Below a depth of 40 inches, reaction is neutral to moderately alkaline.

Luling clay, 0 to 4 percent slopes (LuB).—This nearly level to gently sloping soil is on uplands. Areas of this soil are subrounded to irregular in shape, ranging in size from 30 to 700 acres. In undisturbed areas, gilgai microrelief is evident. A few shallow gullies, more than 300 feet apart and crossable by farm machinery, are in unprotected cultivated areas in places.

Included with this soil in mapping are Marcelinas soils in slightly elevated areas. Also included are small areas, less than 10 acres in size, of Elmendorf and Denhawken soils in the same landscape. Inclusions make up less than 15 percent of any one mapped area.

This soil is mostly cultivated, but a few areas are used for native range or improved pasture. This soil is well suited to most of the locally grown crops. The hazard of water erosion is moderate. Capability unit IIIe-3 dryland, IIIe-3 irrigated; Rolling Blacklands range site.

Marcelinas Series

The Marcelinas series consists of deep, noncalcareous, firm, nearly level to gently sloping loamy soils on uplands. These soils formed in calcareous clayey and loamy material interbedded with sandstone and marine shale.

In a representative profile the surface layer is firm, noncalcareous, dark-brown clay loam about 12 inches thick. The next layer, about 16 inches thick, is noncalcareous, brown clay. The layer below is reddish-yellow, calcareous clay loam and sandy clay loam about 32 inches thick. Below this, to a depth of 72 inches, is calcareous, yellow sandy clay loam that has masses and concretions of calcium carbonate and fragments of sandstone.

These soils are well drained, and permeability is very slow. Available water capacity is high. Runoff is slow to medium.

Marcelinas soils are used mostly for crops, but a few areas are used for improved pasture or range. The soils are suited to crops, range, or pasture.

Representative profile of Marcelinas clay loam, 0 to 3 percent slopes, in a cultivated field, 1.25 miles northwest of U.S. Highway 87 in Pandora on Farm Road 1107; then 125 feet south of Farm Road 1107:

Ap—0 to 6 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, fine, granular structure; hard, firm; many fine roots; many wormcasts; mildly alkaline; clear, smooth boundary.

A1—6 to 12 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, fine, subangular blocky and granular structure; very hard, firm, sticky and plastic; many fine roots; common wormcasts; mildly alkaline; gradual, wavy boundary.

B21t—12 to 17 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate, fine and medium, blocky structure; very hard, very firm, sticky and plastic; distinct clay films on surfaces of peds; shiny surfaces on vertical faces of peds; noncalcareous; moderately alkaline; gradual, wavy boundary.

B22t—17 to 28 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; moderate, medium, blocky structure; very hard, very firm, sticky and plastic; distinct clay films on surfaces of peds; shiny surfaces on vertical faces of peds; few fine cemented calcium carbonate concretions; noncalcareous; moderately alkaline; gradual, wavy boundary.

B23t—28 to 48 inches, reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate, fine, subangular blocky structure and weak, fine, blocky; very hard, very firm, sticky and plastic; thin clay films on surfaces of peds; few fragments of sandstone as much as 1 inch in diameter; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B24t—48 to 60 inches, reddish-yellow (7.5YR 7/6) sandy clay loam, reddish yellow (7.5YR 6/6) moist; moderate, medium, subangular blocky structure and weak, fine, blocky hard, firm; few clay films on surfaces of peds; few fragments of sandstone as much as 1 inch in diameter; few fine calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

B31—60 to 68 inches, yellow (10YR 7/6) sandy clay loam, brownish yellow (10YR 6/6) moist; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, fine, blocky structure; hard, firm; few clay films on surfaces of peds; estimated 5 percent, by volume, calcium carbonate in the form of soft lumps and concretions; few sandstone fragments; 2 to 5 percent gypsum crystals; calcareous; moderately alkaline; gradual, wavy boundary.

B32—68 to 72 inches, yellow (10YR 7/6) sandy clay loam, brownish yellow (10 6/6) moist; strong-brown (7.5YR 5/6) mottles; weak, line, blocky structure; hard, firm; estimated 15 percent, by volume, light olive-gray (5Y 6/2) clayey marine shale fragments; estimated 15 percent, by volume, soft lumps and concretions of calcium carbonate; 2 to 5 percent gypsum crystals; calcareous; moderately alkaline.

The solum ranges from 60 to 90 inches in thickness. Cracks form when the soil dries. They range from 1 to 2 inches in width at the surface and extend to a depth of 2 to 6 feet.

The A horizon ranges from 8 to 18 inches in thickness. It is dark brown, brown, or dark grayish brown. Reaction is neutral to moderately alkaline.

The B21t and B22t horizons are brown or dark-brown clay or clay loam. The B23t and B24t horizons are brown, reddish brown, reddish yellow, light brown, yellowish brown, yellowish red, strong brown, or dark yellowish brown in color and clay, clay loam, or sandy clay loam in texture. Reaction of the upper Bt horizon is mildly alkaline or moderately alkaline, and in the lower B2t horizon, reaction is moderately alkaline. Coarse fragments are few and scattered in places, but sandstone fragments as much as 3 inches in diameter make up as much as 20 percent of the lower B2t and B3 horizons.

The B3 horizons are strong brown, reddish yellow, pale brown, yellowish brown, brownish yellow, or yellow in color and clay loam or sandy clay loam in texture. Secondary carbonates range from 5 to 15 percent, by volume, of the B3 horizons, and a few to common gypsum crystals are in the lower part. Clayey marine shale fragments make up 5 to 30 percent, by volume, of the lower B3 horizons.

Marcelinas clay loam, 0 to 3 percent slopes (MaB).—This nearly level to gently sloping soil is on uplands in irregular or subrounded areas 50 to 250 acres in size.

Included with this soil in mapping are Luling soils in slightly lower areas and Elmendorf and Denhawken soils in small, slightly higher areas. Also included are small areas of a soil similar to this Marcelinas soil, except that it has a more loamy surface layer and redder lower layers. This soil is slightly lower and mostly has slopes of more than 2.5 percent.

This soil is mostly cultivated, but a few areas are used for improved pasture and range. This soil is well suited to most locally grown crops. The hazard of water erosion is moderate. Capability unit IIIe-3 dryland, IIIe-3 irrigated; Rolling Blacklands range site.

Miguel Series

The Miguel series consists of deep, noncalcareous, friable, nearly level to gently sloping loamy soils on uplands. These soils formed in loamy and clayey material.

In a representative profile the surface layer is brown, noncalcareous fine sandy loam about 11 inches thick. Below this is about 4 inches of brown, noncalcareous clay that is mottled in shades of red, yellow, and olive. The layer below is about 18 inches of brown and light-brown, noncalcareous sandy clay that is mottled with red, yellow, or brown. The next layer is light yellowish-brown, calcareous sandy clay loam, about 10 inches thick, that is mottled in shades of red, yellow, and brown. The underlying material, to a depth of 60 inches, is very pale brown, calcareous sandy clay loam that is mottled in shades of brown and yellow.

These soils are well drained, and permeability is very slow. Runoff is slow to rapid, and available water capacity is medium.

Miguel soils are mostly cultivated, but some areas are used for improved pasture or native range. The soils are suited to crops, range, and pasture.

Representative profile of Miguel fine sandy loam, 1 to 3 percent slopes, in a cultivated field, 1 mile south of Poth on U.S. Highway 181 to intersection with county road and 0.6 mile southeast on county road ; then 200 feet northeast of county road:

Ap—0 to 6 inches, brown (10YR 5/3) fine sandy loam, dark brown (10 YR 4/3) moist; weak, fine, granular structure; slightly hard, friable; many fine roots; few insect tunnels; slightly acid; clear, smooth boundary.

A1—6 to 11 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, subangular blocky structure and weak, fine, granular; slightly hard friable; many fine roots; few insect tunnels; slightly acid; abrupt, smooth boundary.

B21t—11 to 15 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 4/4) moist; few, fine and medium, distinct, red (2.5YR 5/6), yellowish-red (5YR 5/6), and olive (5Y 5/3) mottles; moderate, coarse, prismatic structure parting to weak, fine, blocky; very hard, very firm, plastic and sticky; common fine roots; few medium pores; clay films on peds; organic stains and dark coatings on faces of prisms; neutral; clear, smooth boundary.

B22t—15 to 24 inches, brown (10YR 5/3) sandy clay, dark brown (10YR 4/3) moist; many, medium, distinct, red (2.5YR 5/6) and few, fine, faint, yellowish-red (5YR 4/6) mottles; moderate, coarse, prismatic structure parting to moderate, medium, blocky; very hard, very firm, plastic and sticky; few fine roots; few fine pores; clay films on peds; patchy organic stains on vertical faces of prisms; neutral; gradual, wavy boundary.

B3t—24 to 33 inches, light-brown (7.5YR 6/4) sandy clay, brown (7.5YR 5/4) moist; few, fine and medium, distinct, reddish-brown (5YR 5/4) mottles; moderate, medium, prismatic structure parting moderate medium blocky; very hard, very firm, plastic and sticky; few patchy clay films on peds; noncalcareous; moderately alkaline; gradual, wavy boundary.

B3ca—33 to 43 inches, light yellowish-brown (10YR 6/4) sandy clay loam yellowish brown (10YR 5/6 moist; few, fine, faint reddish-brown (5YR 5/4) and yellowish-red (5YR 5/6) mottles; weak, blocky structure; very hard, friable, sticky; about 10 percent, by volume, weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—43 to 60 inches, very pale brown (10YR 7/4) sandy clay loam, light yellowish-brown (10YR 6/4) moist; few, fine, faint, brownish-yellow (10YR 6/6) and yellow (10YR 7/6) mottles; massive; hard, friable; calcareous; moderately alkaline.

The solum is 40 to 60 inches thick. Secondary carbonates are at a depth of 28 to 40 inches.

The A horizon is 6 to 12 inches thick, and is reddish brown, brown, dark grayish brown, grayish brown, or dark yellowish brown. Reaction is slightly acid or neutral.

The B2t horizons range in thickness from 15 to 25 inches. They are dark grayish brown, dark brown, brown, yellowish brown, brownish yellow, light brown, or yellowish red, mottled with shades of brown, red, olive, or yellow. They are clay or sandy clay, and clay makes up 35 to 50 percent of the upper 20 inches. Reaction is neutral or mildly alkaline.

The B3t horizon is light brown reddish yellow, brown, light yellowish brown, or yellowish red, and it has about the same kind and degree of mottling as the B2t horizon. It is sandy clay or sandy clay loam. Reaction is mildly alkaline or moderately alkaline. The B3ca horizon is 3 to 12 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate.

The C horizon is light brownish gray, light gray, light brown, very pale brown, yellowish red, reddish yellow, or brownish yellow in color and sandy clay loam or sandy clay in texture. Thin strata of weakly consolidated sandstone are present in places.

Miguel fine sandy loam, 0 to 1 percent slopes (MgA).—This nearly level soil is on uplands in broad, plane, irregularly shaped areas that range from 20 to 225 acres in size. This soil has a surface layer of dark grayish-brown, noncalcareous fine sandy loam about 12 inches thick. Below this is 20 inches of noncalcareous, dark-brown clay that is mottled in shades of brown, yellow, and red. The layer below is about 6 inches of noncalcareous, light-brown sandy clay. The next layer is about 14 inches of calcareous, light yellowish-brown sandy clay loam that is about 7 percent soft masses and cemented concretions of calcium carbonate. The underlying material, to a depth of 60 inches, is calcareous, very pale brown sandy clay loam.

Included with this soil in mapping are Wilco soils on low mounds and Willamar soils in depressions. Also included are small areas of Miguel fine sandy loam, 1 to 3 percent slopes, on the sides of long field drainageways. Most inclusions are less than 5 acres in size.

This soil is used mostly for cultivated crops, but some areas are used for range or improved pasture. The soil is suited to cultivated crops. The hazards of soil blowing and water erosion are slight. Capability unit IIIc-1 dryland, IIs-2 irrigated; Tight Sandy Loam range site.

Miguel fine sandy loam, 1 to 3 percent slopes (MgB).—This gently sloping soil is on uplands on plane or in convex, irregularly shaped areas that range from 30 to 550 acres in size. This soil is lower than Wilco soils and slightly higher than Willamar soils. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Miguel fine sandy loam, 0 to 1 percent slopes, on caps of low ridges and Miguel fine sandy loam, 3 to 5 percent slopes, on the sides of field drainageways in places. Also included are small areas of Wilco soils on low ridges in the more sloping areas. Most inclusions are 10 acres or less in size.

This soil is used mostly for cultivated crops, but some areas are used for native range or improved pasture. The soil is suited to cultivated crops. The hazard of soil blowing is slight, and the hazard of water erosion is moderate. Capability unit IIIe-1 dryland; IIIe-1 irrigated; Tight Sandy Loam range site.

Miguel fine sandy loam, 3 to 5 percent slopes (MgC).—This gently sloping soil is on uplands on the sides of major field drainageways or creeks. Areas of this soil range from 20 to 300 acres in size, and they are long and narrow or irregularly oblong in shape.

This soil has a surface layer of noncalcareous, brown fine sandy loam about 9 inches thick. Below this is 8 inches of light-brown, noncalcareous clay and about 8 inches of brown, noncalcareous sandy clay that is mottled in shades of red, yellow, and olive. The next layer is noncalcareous, mottled, light-brown sandy clay about 12 inches thick. Below this is calcareous, mottled, light yellowish-brown sandy clay loam about 9 inches thick. The underlying material, to a depth of 58 inches, is calcareous, very pale brown sandy clay loam.

Included with this soil in mapping are small areas of Wilco soil in slightly higher areas. Also included are Leming soils on low terraces or on the benches of more deeply entrenched field drainageways or creeks. Most inclusions are 8 acres or less in size.

This soil is used mostly for cultivated crops, but some areas are used for improved pasture or native range. The soils are suited to crops, pasture, or range. The hazard of water erosion is severe. Capability unit IVe-1 dryland; IVe-1 irrigated; Tight Sandy Loam range site.

Miguel fine sandy loam, 2 to 5 percent slopes, eroded (MgC2).—This gently sloping, eroded soil is on uplands. Most areas are about 25 acres in size, but they range from 5 to 75 acres. This soil is on the sides and at the heads of small draws in cultivated fields. Water drains from these small draws to larger draws. The surface is convex and is gullied in places.

This soil has a surface layer of noncalcareous, brown fine sandy loam about 6 inches thick. Below this is about 25 inches of noncalcareous, brown sandy clay mottled with shades of red, yellow, brown, and olive, and about 10 inches of calcareous, light-brown sandy clay loam mottled with yellowish brown. It has many soft masses and concretions of calcium carbonate. The underlying material, to a depth of 55 inches, is calcareous, very pale brown sandy clay loam.

About 50 to 75 percent of the surface layer of this soil has been removed by sheet erosion. In places tillage has made the surface layer redder and more clayey by mixing it with material from the upper part of the clayey subsoil. Gullies, 6 inches to 5 feet deep and 1 to 12 feet wide, are 30 to 175 feet apart.

Included with this soil in mapping are small areas of Miguel fine sandy loam, 1 to 3 percent slopes, and Miguel fine sandy loam, 3 to 5 percent slopes, between gullies or on footslopes. Also included are small areas of Floresville soils on the sides of more deeply entrenched creeks and field drainageways.

Areas of this soil that are in larger fields of cultivated Miguel soils are still cultivated. Most areas are idle cropland or cropland converted to improved pasture. The soil is better suited to pasture grasses than to other uses. The hazard of water erosion is severe. Capability unit IVe-1 dryland, IVe-1 irrigated; Tight Sandy Loam range site.

Nocken Series

The Nocken series consists of moderately deep, non-calcareous, friable, gently sloping to sloping stony loams on uplands. These soils formed in weakly consolidated to cemented sandstone interbedded with ironstone.

In a representative profile (fig. 17) the surface layer is noncalcareous, reddish-brown, stony fine sandy loam about 8 inches thick. Below this is about 22 inches of noncalcareous, red sandy clay that is about 30 to 35 percent cobbles and stone-sized sandstone fragments and about 7 inches of noncalcareous, yellowish-red sandy clay loam that is about 45 percent cobbles and stone-sized sandstone fragments. The underlying material, to a depth of 40 inches, is noncalcareous, platy and weakly cemented sandstone that has seams of ironstone and cracks and crevices filled with loamy material.

These soils are well drained, and permeability is moderately slow. Runoff is medium to rapid, and available water capacity is low.

Nocken soils are used mostly for range, but some small, isolated areas are pastured. The soils are better suited to range than to other uses.

Figure 17.—Profile of Nocken stony fine sandy loam showing weakly cemented sandstone. The percentage of coarse fragments ranges from 35 to 75 percent.

Representative profile of Nocken stony soils in an area of Nocken stony soils and Rock outcrop, 1 to 8 percent slopes, in native range, 1.5 miles east of Stockdale on Farm Road 1107; then 90 feet north of Farm Road 1107:

A11—0 to 4 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure; hard, friable; many fine roots; about 25 percent, by volume, cobbles and stone-sized sandstone fragments and 10 percent pebble-sized sandstone and ironstone fragments; medium acid; clear, wavy boundary.

A12—4 to 8 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular or subangular blocky structure; hard, friable; many fine roots; about 25 percent, by volume cobbles and stone-sized sandstone fragments and 10 percent pebble-sized sandstone and ironstone fragments; medium acid; clear, wavy boundary.

B21t—8 to 15 inches, red (2.5YR 4/6) sandy clay, dark red (2.5YR 3/6) moist; moderate, fine, blocky structure; very hard, firm; clay films on surfaces of peds; about 30 percent cobbles and stone-sized sandstone fragments and 12 percent pebble-sized sandstone and ironstone fragments; medium acid; gradual, wavy boundary.

B22t—15 to 30 inches, red (2.5YR 5/6) sandy clay, red (2.5YR 4/6) moist; moderate, fine and medium, blocky structure; very hard, firm; clay films on surfaces of peds; about 35 percent cobbles and stone-sized sandstone fragments and 12 percent pebble-sized sandstone and ironstone fragments; strongly acid; gradual, wavy boundary.

B3t—30 to 37 inches yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, medium, blocky structure; hard, firm; patchy clay films on surfaces of peds; few ferro-manganese concretions; about 45 percent cobbles and stone-sized sandstone fragments and 15 percent pebble-sized sandstone and ironstone fragments; strongly acid; abrupt, wavy boundary.

C—37 to 40 inches, reddish-yellow (7.5YR 6/6) platy and weakly cemented sandstone that has thin seams of ironstone and a few cracks and crevices filled with reddish-yellow, loamy earth; very strongly acid.

Sandstone is at a depth of 22 to 40 inches. Sandstone and ironstone fragments on the surface and in the solum make up 35 to 75 percent by volume, of the soil material. These fragments range from $^{1}/_{4}$-inch to 4 feet or more in diameter, and about 3 to 20 percent of these fragments are more than 10 inches in diameter.

The A1 horizon ranges from 4 to 11 inches in thickness. It is reddish-brown, brown, or yellowish-brown fine sandy loam or loamy fine sand. It is gravelly, cobbly, or stony in places. Reaction ranges from neutral to medium acid.

The B2t horizon ranges from 14 to 34 inches in thickness. It is red, yellowish red, reddish yellow, or reddish brown. The B2t horizon has a few fine, faint mottles of reddish yellow or yellowish red in places. It is clay, sandy clay, or clay loam and is gravelly, cobbly, or stony in places. Of the soil fraction smaller than gravel, 35 to 50 percent is clay. Reaction ranges from slightly acid to strongly acid.

The B3t horizon ranges in thickness from 0 to 10 inches. It is yellowish-red, light-red, or reddish-yellow sandy clay loam or loam. It is gravelly, cobbly, or stony in places. Reaction ranges from slightly acid to very strongly acid.

The C horizon is weakly consolidated or cemented sand-stone interbedded with ironstone. It is reddish, brownish, or yellowish in color and has few to common pockets of sandy clay loam, loam, or fine sandy loam. Reaction ranges from slightly acid to very strongly acid.

Nocken stony soils and Rock outcrop, 1 to 8 percent slopes (NKC). —These gently sloping to sloping soils are on uplands. Areas of these soils range in size from 10 to 150 acres. They are mostly long and narrow, following the ridgetops of low hills, but some areas are irregularly shaped. Slopes range from 1 to 8 percent, but they are dominantly 5 to 8 percent.

The percentages of different soils in areas of this mapping unit vary more than those of other mapping units in the county, but the interpretations presented can be applied to all expected uses. Nocken stony fine sandy loam makes up 30 to 90 percent of the mapped areas. Where Rock outcrop is mapped, it makes up 5 to 20 percent of the area, but it is not present in all mapped areas. An average area of this unit is 76 percent Nocken stony soils, 8 percent Rock outcrop, and 16 percent other soils. Nocken soils are on all hillsides in areas mapped as this undifferentiated unit. Rock outcrop is mostly on narrow ridgetops or near the tops of low hills.

Included with these soils in mapping are soils similar to the Nocken soils, except that they have a solum less than 20 inches thick. Also included are small areas of the slightly lower Alum, Crockett, and Rosanky soils, and areas of Nocken stony soils and Rock outcrop where slopes are greater than 8 percent. These inclusions are generally less than 5 acres in size.

These soils are used mostly for range. They are so stony that cultivation is not practical. The unit is better suited to range than to other uses. The hazard of water erosion is severe.

Nocken part in capability unit VIs-1 dryland, Rock outcrop part in capability unit VIIIs-1 dryland; both parts in Sandstone Hills range site.

Orthents

Orthents consist of severely eroded and deeply gullied soil material on uplands. Their diagnostic subsurface horizons have been destroyed. Texture, reaction, and content of calcium carbonate are variable. Slopes range from 5 to 16 percent.

These soils support some vegetation, but they are too variable to be classified at the series level. They are correlated at the subgroup level rather than as a miscellaneous land type. Onsite investigations are needed for all interpretations because of the variability of soil material.

Orthents, rolling, severely eroded (OgD3).—These soils are on uplands or on breaks from high terraces to flood plains. Slopes are 5 to 16 percent. Areas of this soil range from 5 to 125 acres in size, but they are mostly less than 50 acres.

The hazards of sheet and gully erosion are very severe. Seventy to 80 percent of the area of this soil has been destroyed by closely spaced, deep gullies or by an intricate network of shallow and deep gullies. These gullies are 5 to 150 feet wide, 1 to 25 feet deep, and 5 to 50 feet apart. The original surface layer has been eroded from most of the area, and the present surface material is mainly subsoil material, subsurface material, or underlying material. Small areas between gullies have near-normal profiles, but most gullies are actively eroding into areas of gently sloping upland soil.

Included with this soil in mapping are Floresville, Miguel, and Wilco soils on uplands and Colibro, Karnes, Saspamco, and Venus soils on breaks from terraces to flood plains. Also included are soils that have slopes of as much as 20 percent.

This soil has little value for farming. Major reclamation is needed if it is used for farming or building purposes. Sediment eroded from areas of this soil is a major concern on local streams. The present vegetative cover is not adequate to protect against further erosion. The soil is better suited to wildlife habitat than to other uses. The hazard of water erosion is severe. Capability unit VIIe-1 dryland; included in associated range sites.

Patilo Series

The Patilo series consists of deep, noncalcareous, loose, undulating sandy soils on uplands. These soils formed in thick beds of sandy material.

In a representative profile the surface layer is noncalcareous, pale-brown fine sand about 7 inches thick. The subsurface layer is very pale brown, noncalcareous fine sand about 47 inches thick. The next layer is light-gray, noncalcareous sandy clay loam, about 16 inches thick, mottled in shades of brown and red. The underlying material, to a depth of 85 inches, is white sandy clay loam mottled in shades of red, yellow, and brown.

These soils are moderately well drained, and permeability is moderately slow. Runoff is slow, and available water capacity is low.

Patilo soils are mostly in range, but a few small areas are used for improved pasture or crops. The soils are better suited to range or improved pasture than to other uses. In Wilson County these soils are mapped only in an undifferentiated unit with Eufaula soils.

Representative profile of Patilo fine sand in an area of Eufaula and Patilo soils, undulating in range, 3.25 miles north of Floresville on U.S. Highway 181 from intersection with Texas Highway 97; and 1.4 miles east of Flores Lane; then 45 feet north of Flores Lane:

A1—0 to 7 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose; many fine roots; slightly acid; clear, smooth boundary.

A2—7 to 54 inches, very pale brown (10YR 8/3) fine sand, very pale brown (10YR 7/3) moist; single grained; loose; many fine roots in upper part, few in lower part; slightly acid; abrupt, wavy boundary.

B2t—54 to 70 inches, light-gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common, medium prominent, strong-brown (7.5YR 5/8) and red (2.5YR 4/8) mottles; weak, medium, blocky structure; very hard, very firm; thin, patchy clay films on ped surfaces; medium acid; gradual, wavy boundary.

B3t—70 to 85 inches, white (10YR 8/2) sandy clay loam, light gray (10YR 7/2) moist; common, medium, distinct, red (2.5YR 4/8) and yellowish-brown (10YR 5/6) mottles; weak, blocky structure; hard, firm; medium acid.

The solum ranges from 65 to 96 inches in thickness. The combined A horizons are 40 to 72 inches thick. The A horizon is light gray, light brownish gray, pale brown, very pale brown, or light yellowish brown. It is mostly fine sand, but is loamy fine sand in places. Reaction ranges from neutral to medium acid.

The B2t horizon is white, light gray, very pale brown, pale brown, or light yellowish brown mottled in shades of red, yellow, or gray. The upper 20 inches of the B2t horizon is estimated to range from 20 to 34 percent clay. Structure is weak to moderate blocky. Reaction is medium acid or strongly acid.

The B3t or C horizons are pale brown, white, or very pale brown mottled with red, yellow, or brown. They are sandy clay loam to sandy loam in texture. Reaction is medium acid or strongly acid.

Picosa Series

The Picosa series consists of very shallow to shallow, noncalcareous, firm, gently sloping to sloping loamy soils on uplands. These soils formed in tuffaceous sandstone and shale.

In a representative profile (fig. 18) the surface layer is about 6 inches of noncalcareous, dark grayish-brown loam that has many sandstone fragments. The next layer, about 4 inches thick, is white, noncalcareous tuffaceous sandstone and shale that has pockets and seams of loamy material similar to that of the surface horizon. The underlying material, to a depth of 15 inches, consists of white beds of weakly consolidated, noncalcareous sandstone and shale.

These soils are well drained, and permeability is moderate. Runoff is excessive, and available water capacity is very low.

Picosa soils are used almost exclusively for range. The soils are better suited to range or wildlife habitat than to other uses.

Representative profile of Picosa loam, 1 to 8 percent slopes; 7 miles west of Poth on Farm Road 541 to Dewees, 5.5 miles southwest on Farm Road 1344 from intersection with Farm Road 541, then 75 feet west of junction of unpaved county road and Farm Road 1344:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; moderate, fine subangular blocky and granular structure; hard, firm; common fine roots; estimated 12 percent, by volume, fragmented tuffaceous sandstone from $^{1}/_{4}$-inch to 1 inch in diameter; mildly alkaline; diffuse, wavy boundary.

Figure 18.—Profile of Picosa loam, 1 to 8 percent slopes, showing tuffaceous sandstone and shale material below a depth of 5 to 14 inches.

C&A1—6 to 10 inches, white (10YR 8/2) weakly consolidated, partially weathered tuffaceous sandstone and shale, light gray (10YR 7/2) moist; very hard, firm; many fine roots; estimated 35 percent pockets and seams of soil material similar to that of A1 horizon; mildly alkaline; abrupt, wavy boundary.

C—10 to 15 inches, white (10YR 8/2) beds of weakly consolidated and noncalcareous sandstone and shale.

Weakly consolidated sandstone and shale are at a depth of 5 to 14 inches. Weakly consolidated sandstone fragments cover 0 to 30 percent of the surface and make up 0 to 20 percent, by volume, of the A horizon. The A1 horizon is dark gray, dark grayish brown, or brown. Reaction is mildly alkaline or moderately alkaline.

The C horizon is white or light gray, and it contains yellowish-brown staining on unweathered fragments in places. Reaction of this tuffaceous material is neutral to moderately alkaline.

Picosa loam, 1 to 8 percent slopes (PcC).—This gently sloping to sloping, mostly convex soil is in areas about 20 acres in size but that range from 5 to 75 acres. This soil is on upland ridges and knolls that are mostly irregularly oblong in shape.

Included with this soil in mapping are small areas of a soil similar to this Picosa soil, but coarse fragments that makeup more than 35 percent of the soil are on the surface and in the surface layer. Also included are small areas of slightly lower Tordia and Coy soils.

This soil is used mostly for range. It is too shallow and too stony for cultivated crops. The hazard of water erosion is severe. Capability unit VIIs-1 dryland; Shallow Ridge range site.

Poth Series

The Poth series consists of deep, noncalcareous, very friable, nearly level to gently sloping sandy soils on uplands. These soils formed in thick beds of loamy material interbedded with thin strata of sandstone and shale.

In a representative profile the surface layer is about 18 inches of noncalcareous loamy fine sand that is pale brown in the upper part and light yellowish brown in the lower part. The subsurface layer is very pale brown, noncalcareous loamy fine sand about 12 inches thick. Below this is about 14 inches of noncalcareous, pale-brown sandy clay mottled in shades of red and yellow, and about 16 inches of noncalcareous, brownish-yellow sandy clay loam mottled in shades of red, brown, and yellow. The underlying material, to a depth of 74 inches, is noncalcareous, reddish-yellow loam.

These soils are well drained, and permeability is slow. Runoff is slow, and available water capacity is medium.

Poth soils are mostly cultivated, but some areas are used for improved pasture or native range. The soils are suited to crops, pasture, or range.

Representative profile of Poth loamy fine sand, 0 to 3 percent slopes, in an idle cropland field, 9.75 miles west of intersection of Texas Highway 97 and U.S. Highway 181 in Floresville; then about 120 yards north of Texas Highway 97:

Ap—0 to 8 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose, very friable; many fine roots; neutral; clear, smooth boundary.

A1—8 to 18 inches, light yellowish-brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grained; loose, very friable; common fine roots; neutral; clear, wavy boundary.

A2—18 to 30 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose, very friable; common roots; neutral; abrupt, wavy boundary.

B21t—30 to 36 inches, pale-brown (10YR 6/3) sandy clay brown (10YR 5/3) moist; common, medium and coarse, distinct, reddish-yellow (7.5YR 6/6) and red (2.5YR 5/6) mottles; moderate, medium, blocky structure; very hard, very firm; thin clay films on surface of peds; few ferro-manganese concretions; mildly alkaline; gradual, wavy boundary.

B22t—36 to 44 inches, pale-brown (10YR 6/3) sandy clay, brown (10YR 5/3) moist; common medium, distinct, reddish-yellow (5YR 6/6) and few, medium, distinct, red (2.5YR 5/6) mottles; moderate, medium and coarse blocky structure; very hard, very firm, thin clay films on surfaces of peds; few ferro-manganese concretions; mildly alkaline; gradual, wavy boundary.

B23t—44 to 54 inches, brownish-yellow (10YR 6/6) sandy clay loam, yellowish brown (10YR 5/6) moist; few, fine, faint, yellowish-red (5YR 5/6) and yellow (10YR 7/6) mottles; moderate, fine, blocky structure; very hard, very firm; patchy clay films on surfaces of peds; common ferro-manganese concretions; mildly alkaline; diffuse wavy boundary.

B24t—54 to 60 inches, brownish-yellow (10YR 6/8) sandy clay loam, yellowish brown (10YR 5/8) moist; few, faint, yellowish and brownish mottles; weak, fine, blocky structure; very hard, firm; patchy clay films on surfaces of peds; common ferro-manganese concretions; noncalcareous; moderately alkaline; gradual, wavy boundary.

B3t—60 to 74 inches, reddish-yellow (7.5YR 6/6) loam, strong brown (7.5YR 5/6) moist; weak, fine, blocky structure; hard, friable; few ferro-manganese concretions; noncalcareous; moderately alkaline.

The solum is 50 to 80 inches thick. A few cemented concretions of calcium carbonate are present in places, and in other places fragments of sandstone or fragments of clayey shale are below a depth of 50 inches.

The A horizon ranges from 20 to 40 inches in thickness. The A1 horizon is brown, light brown, pale brown or light yellowish brown, and the A2 horizon is very pale brown or pink. Reaction in the A1 and A2 horizons is slightly acid to mildly alkaline. The boundary between the A and B2t horizons is clear to abrupt.

The B2t horizon is pale brown, light brown, strong brown, brownish yellow, or yellowish brown. Mottles range from few to many, fine to coarse, and faint to distinct in shades of red, yellow, and brown. The upper 20 inches of the B2t horizon is clay, sandy clay, or clay loam, ranging from 35 to 52 percent clay. The lower B2t horizon is sandy clay loam, clay loam, or sandy clay. Reaction ranges from slightly acid to moderately alkaline.

The B3t horizon is reddish yellow, light brown, light yellowish brown, very pale brown, or yellow. The degree of mottling and textures are the same as those of the lower B2t horizon. Reaction ranges from slightly acid to moderately alkaline.

Poth loamy fine sand, 0 to 3 percent slopes (PtB).—This nearly level to gently sloping, slightly convex soil is in areas that average about 225 acres but that range from 30 to 400 acres. This soil is slightly lower than Sarita soils and slightly higher than Floresville, Miguel, and Wilco soils. Areas of this soil are irregular to subrounded in shape.

Included with this soil in mapping are small areas of Poth loamy fine sand that have slopes of 3 to 5 percent. These soils are in slightly higher areas or on breaks to field drainageways. Also included are small areas of slightly higher Sarita soils and slightly lower Wilco soils.

This soil is used mostly for crops, but some areas are used for pasture and range. It is suited to cultivated crops. The hazards of soil blowing and water erosion are moderate. Capability unit IIIe-6 dryland, IIIe-5 irrigated; Loamy Sand range site.

Rock Outcrop

This land type consists of gently sloping to sloping outcrops of bare sandstone rock or of soil material, only a few inches thick, over the sandstone bedrock. Areas of this land type are on uplands. The sandstone outcrops are brown, reddish brown, or red. The soil material has accumulated between stones and rocks and is generally 1 to 6 inches thick.

Areas of this land type are sparsely covered with grasses, trees, and shrubs. Rock outcrop is mapped in Wilson County only in an undifferentiated unit with Nocken soils.

Rosanky Series

The Rosanky series consists of deep, noncalcareous, friable, gently sloping sandy loams on uplands. These soils formed in weakly consolidated sandy material interbedded with strata of weakly cemented sandstone.

In a representative profile the surface layer is noncalcareous, reddish-brown fine sandy loam about 14 inches thick. Below this is about 23 inches of noncalcareous, red clay and about 8 inches of noncalcareous, yellowish-red sandy clay loam that has a few fragments of ironstone. The underlying material, to a depth of 55 inches, is noncalcareous, reddish-yellow sandy clay loam that has fragments of platy sandstone and ironstone.

These soils are well drained, and permeability is moderately slow. Runoff is medium to rapid, and available water capacity is medium.

Rosanky soils are mostly cultivated, but some areas are used for improved pasture or native range. The soils are suited to crops, pasture, or range.

Representative profile of Rosanky fine sandy loam, 1 to 3 percent slopes, in idle cropland, 5 miles northwest of Nixon on Farm Road 1681 to unpaved county road and 0.8 mile southwest on unpaved county road; then 50 feet south of unpaved county road:

Ap—0 to 7 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; slightly hard, friable; many fine roots; few ironstone fragments as much as ½-inch in diameter; medium acid; clear, smooth boundary.

A1—7 to 14 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, fine, granular; slightly hard, friable; many fine roots; few ironstone fragments as much as ½-inch in diameter; medium acid; abrupt, wavy boundary.

B21t—14 to 22 inches, red (2.5YR 4/6) clay, dark red (2.5YR 3/6) moist; moderate, fine, blocky structure; very hard, very firm; clay films on ped surfaces; organic stains on vertical faces of peds; few ironstone fragments as much as ½-inch in diameter; strongly acid; gradual, wavy boundary.

B22t—22 to 37 inches, red (2.5YR 5/6) clay, red (2.5YR 4/6) moist; moderate, fine and medium, blocky structure; very hard, very firm; clay films on ped surfaces; organic stains on vertical faces of peds, few ironstone rock fragments as much as ½-inch in diameter; strongly acid; gradual, wavy boundary.

B3—37 to 45 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, medium, blocky structure; hard, firm; patchy clay films on ped surfaces; few ferro-manganese concretions; few ironstone rock fragments as much as ½-inch in diameter; very strongly acid; gradual, wavy boundary.

C—45 to 55 inches, reddish-yellow (7.5YR 7/6) sandy clay loam that has thin strata of weakly cemented, platy sandstone, reddish yellow (7.5YR 6/6) moist; massive; hard, friable; few ferro-manganese concretions; common sandstone fragments as much as 2 inches in diameter; very strongly acid.

The solum is 40 to 60 inches thick, and it extends in most places to weakly consolidated sandstone. Coarse fragments make up 0 to 15 percent of the soil.

The A horizon is 7 to 16 inches thick. It is reddish brown, dark brown, brown, light brown, or yellowish brown. Reaction is slightly acid or medium acid.

The B2t horizon is red, yellowish red, or reddish yellow. In places are mottles in shades of yellow, brown, and red. The upper 20 inches of the B2t horizon averages 35 to 50 percent clay or sandy clay. Reaction is medium acid or strongly acid.

The B3 horizon is red, light-red, light reddish-brown, reddish-brown, reddish-yellow, or yellowish-red sandy clay, sandy clay loam, or clay loam. Reaction is medium acid or strongly acid.

The C horizon is weakly consolidated sandstone or iron-stone that crushes into fine sandy loam that has pockets of sandy clay loam, or fine sandy loam. Reaction is medium acid or strongly acid.

Rosanky fine sandy loam, 1 to 3 percent slopes (RsB).—This gently sloping soil is in upland areas that range in size from 25 to 200 acres. It is slightly lower than Nocken soils and Rock outcrop and slightly higher than Marcelinas soils. Areas of this soil are irregular to subrounded in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Nocken soils and Rock outcrop on narrow ridges or microknolls on long slopes. Also included are small areas of Alum soils on foot slopes or valley walls and Marcelinas soils in low areas in places.

This soil is used mostly for crops, but some areas are used for pasture and range. The soil is suited to cultivated crops. The hazard of water erosion is moderate. Capability unit IIe-1 dryland, IIe-1 irrigated; Sandy Loam range site.

Rosanky fine sandy loam, 3 to 5 percent slopes (RsC).—This gently sloping soil is on uplands on the sides of streams or field drainageways. Areas of this soil range from 20 to 150 acres in size. They are mostly irregularly oblong in shape.

This soil has a surface layer of noncalcareous, reddish-brown fine sandy loam about 9 inches thick. The next layer is about 25 inches thick. The upper 16 inches is noncalcareous, red sandy clay and the lower 9 inches is noncalcareous, red clay loam that has few angular sandstone pebbles. The layer below is about 6 inches of noncalcareous, yellowish-red sandy clay loam that has common angular sandstone pebbles. The underlying material, to a depth of 50 inches, is strongly weathered, platy, noncalcareous, reddish-yellow sand-stone that has pockets of fine sandy loam material.

Included with this soil in mapping are small areas of Rosanky fine sandy loam, 1 to 3 percent slopes, on foot slopes. Also included are small areas of Nocken soils and Rock outcrop on small, narrow ridges or microknolls on long slopes and slightly lower Alum soils.

This soil is mostly cultivated, but small areas are used for pasture and native range. The hazard of water erosion is severe. Capability unit IIIe-4 dryland, III-4 irrigated; Sandy Loam range site.

Runge Series

The Runge series consists of deep, noncalcareous, friable, nearly level to gently sloping sandy loams on uplands. These soils formed in calcareous, loamy material derived from sandstone or alluvium.

In a representative profile the surface layer is non-calcareous, brown fine sandy loam about 12 inches thick. The next layer is about 26 inches of noncalcareous, reddish-brown sandy clay loam that has a few calcium carbonate concretions in the lower part. Below this is about 9 inches of calcareous, yellowish-red sandy clay loam that has many calcium carbonate concretions. The underlying material, to a depth of 60 inches, is calcareous, very pale brown loam that has many soft masses and concretions of calcium carbonate.

These soils are well drained, and permeability is moderate. Runoff is medium, and available water capacity is high.

Runge soils are mostly cultivated, but some areas are used for improved pasture or range. The soils are well suited to crops, pasture, or range.

Representative profile of Runge fine sandy loam, 1 to 3 percent slopes, in a cultivated field, 2 miles southeast of Floresville on U.S. Highway 181 to unpaved road and 2.2 miles on unpaved county road (taking left fork after crossing railroad tracks); then 150 feet north of unpaved county road:

Ap—0 to 6 inches, brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; many fine roots; common wormcasts; neutral; clear, smooth boundary.

A1—6 to 12 inches, brown (7.5YR 4/2) fine sandy loam, dark brown (7.5YR 3/2) moist; weak, fine, granular and subangular blocky structure; slightly hard, friable; many fine roots; common wormcasts; neutral; clear, smooth boundary.

B21t—12 to 22 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; weak, coarse, prismatic structure parting to moderate fine, subangular blocky; hard, firm; many fine pores; thin, discontinuous clay films on ped surfaces and in pores; many insect tunnels; neutral; gradual, wavy boundary.

B22t—22 to 38 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate fine, subangular blocky; hard, firm; many fine pores; thin, discontinuous clay films on ped surfaces and in pores; few, fine, calcium carbonate concretions; mildly alkaline; gradual, wavy boundary.

B3ca—38 to 47 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, fine, subangular blocky structure; hard, firm; 4 to 5 percent, by volume, films, threads, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—47 to 60 inches, very pale brown (10YR 7/4) loam, light yellowish brown (10YR 6/4) moist; massive; hard, friable; common fine pores; 10 to 12 percent, by volume, soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 42 to 55 inches thick. Secondary carbonates are at a depth of 20 to 36 inches.

The A horizon ranges from 10 to 16 inches in thickness. It is dark brown, brown, or dark grayish brown. Reaction is slightly acid to mildly alkaline.

The Bt horizon is reddish-brown, yellowish-red, or reddish yellow sandy clay loam or clay loam. The upper 20 inches ranges from 25 to 35 percent clay. Reaction is neutral to moderately alkaline.

The B3ca horizon is reddish-brown, light-brown, reddish-yellow or yellowish-red loam, sandy clay loam, or clay loam. Visible secondary carbonates range from few to 8 percent, by volume, of the horizon. Reaction is mildly alkaline or moderately alkaline.

The C or Cca horizon is very pale brown, light yellowish-brown, or reddish-yellow sandy clay loam, clay loam, or loam. Visible secondary carbonates make up 4 to 15 percent of these horizons.

Runge fine sandy loam, 0 to 1 percent slopes (RuA).—This nearly level soil is on upland flats. Areas of this soil are mostly irregularly oblong in shape and range in size from 20 to 375 acres.

This soil has a surface layer of noncalcareous fine sandy loam about 15 inches thick. The upper part is dark grayish brown and the lower part is brown. Below this is about 19 inches of noncalcareous, reddish-brown sandy clay loam and about 12 inches of calcareous, reddish-brown sandy clay loam that has a few concretions of calcium carbonate. The underlying material, to a depth of 60 inches, is calcareous, reddish-yellow sandy clay loam that has many concretions and soft masses of calcium carbonate.

Included with this soil in mapping are small areas of Miguel soils at the heads of small field drainageways or in depressions. Also included are small areas of slightly higher Clareville soils and Floresville and Karnes soils on breaks between uplands and terraces.

Most areas of this soil are cultivated, but small areas are used for pasture and native range. The hazard of water erosion is slight. Capability unit IIc-2 dryland, I-2 irrigated; Sandy Loam range site.

Runge fine sandy loam, 1 to 3 percent slopes (RuB).—This gently sloping, slightly convex soil is mostly on breaks between uplands and high terraces. Areas of this soil average about 175 acres in size but range from 25 to 350 acres. They are mostly irregularly oblong in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of a soil similar to the Runge soil, except that it has a surface layer of fine sandy loam about 18 inches thick, and has less than 1 percent organic matter. This inclusion is scattered and occurs as low mounds. Also included are small areas of Floresville soils in slightly higher areas and on breaks to field drainageways and Miguel soils in slightly lower areas and depressions.

This soil is used mostly for crops, but some areas are used for pasture and range. It is well suited to cultivated crops. The hazard of water erosion is moderate. Capability unit IIe-2 dryland, IIe-2 irrigated; Sandy Loam range site.

Runge fine sandy loam, 3 to 5 percent slopes (RuC).—This gently sloping soil is on uplands on breaks to creeks and field drainageways or on breaks between uplands and high terraces. Areas of this soil range from 15 to 75 acres in size, and they are irregularly oblong in shape.

This soil has a surface layer of noncalcareous fine sandy loam about 10 inches thick. The upper part is dark grayish brown and the lower part is brown. Below this is about 26 inches of reddish-brown, noncalcareous sandy clay loam and about 8 inches of reddish-yellow, calcareous sandy clay loam that has many soft masses and concretions of calcium carbonate. The underlying material, to a depth of 62 inches, is calcareous, very pale brown loam that has many soft masses and concretions of calcium carbonate.

Included with this soil in mapping are small areas of Runge fine sandy loam, 1 to 3 percent slopes, on foot slopes. Also included are small areas of soils in slightly higher areas on breaks to field drainageways in places and Karnes soils on breaks between terraces and uplands in places.

This soil is used mostly for cultivated crops or improved pasture, but small areas of this soil are used for native range. The hazard of water erosion is severe. Capability unit IIIe-5 dryland, IIIe-4 irrigated; Sandy Loam range site.

Sarita Series

The Sarita series consists of deep, noncalcareous, very friable, nearly level to gently sloping sandy soils on uplands. These soils formed in eolian and water-deposited sandy and loamy material.

In a representative profile the surface layer is light-brown, noncalcareous fine sand about 22 inches thick. The subsurface layer is very pale brown, noncalcareous fine sand about 32 inches thick. The next layer is about 21 inches of pale-brown sandy clay loam mottled red and yellowish red. The underlying material, to a depth of 90 inches, is noncalcareous, very pale brown loam mottled strong brown.

These soils are well drained, and permeability is moderately rapid. Runoff is slow or very slow, and available water capacity is low.

Sarita soils are used mostly for range, but small areas are used for improved pasture or cultivated crops. The soils are better suited to range or pasture than to other uses.

Representative profile of Sarita fine sand, 0 to 5 percent slopes, in range, 10.4 miles west of Floresville on Texas Highway 97; then 25 yards north of Texas Highway 97:

A1—0 to 22 inches light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose, very friable; many roots; slightly acid; clear, wavy boundary.

A2—22 to 54 inches, very pale brown (10YR 7/4) fine sand, pale brown (10YR 6/3) moist; single grained; loose very friable; few roots; slightly acid; abrupt, wavy boundary.

B21t—54 to 62 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; many, medium and coarse, prominent, yellowish-red (5YR 5/8) mottles; moderate coarse, prismatic structure parting to weak, blocky; hard, friable; few fine roots; few fine pores; few patchy clay films on surfaces of peds; slightly acid; gradual, wavy boundary.

B22t—62 to 75 inches, pale-brown (10YR 6/3) sandy clay loam, brown (10YR 5/3) moist; many, medium prominent, red (10R 4/6) and yellowish-red (5YR 5/8) mottles; moderate, coarse, prismatic structure parting to weak, blocky; hard, friable; few fine roots; few fine pores; few patchy clay films on ped surfaces; slightly acid; gradual wavy boundary.

C—75 to 90 inches, very pale brown (10YR 8/3) loam, very pale brown (10YR 7/3) moist; many, medium and coarse, prominent, strong-brown (7.5YR 5/8) mottles; massive; hard, friable; noncalcareous; moderately alkaline.

The solum is 60 to 100 inches thick. The A horizon ranges from 40 to 80 inches thick. The A1 horizon is grayish brown, pale brown, or light brown and the A2 horizon is light gray, very pale brown, or light brown. Reaction is slightly acid or neutral.

The Bt horizon is light brownish gray, pale brown, very pale brown, or light yellowish brown, mottled red, yellow, and brown. It is sandy clay loam, clay loam, or fine sandy loam. Reaction is slightly acid or neutral.

The B3 and C horizons are very pale brown, light yellowish brown, brownish yellow, or reddish yellow, mottled yellow and brown. It ranges from sandy clay loam to sandy loam in texture. Reaction ranges from neutral to moderately alkaline.

Sarita fine sand, 0 to 5 percent slopes (SaC).—This nearly level to gently sloping soil is on uplands. It is slightly higher than Floresville, Poth, and Wilco soils. Areas of this soil are 35 to several hundred acres in size.

Included with this soil in mapping are small areas of Leming and Miguel soils on row terraces near field drainageways or on foot slopes. Also included are very small areas of a soil similar to Sarita soils but that has no layers of clay accumulation within a depth of 100 inches. This included soil is in widely scattered areas on low mounds.

This soil is used mostly for range, but some areas are used for pasture and crops. The soil is better suited to range or pasture than to other uses. The hazard of soil blowing is severe (fig. 19). Capability unit IVe-4 dryland, IIIe-6 irrigated; Deep Sand range site.

Saspamco Series

The Saspamco series consists of deep, calcareous, friable, gently sloping loamy soils on uplands or high terraces. These soils formed in calcareous loamy material.

In a representative profile (fig. 20) the surface layer is calcareous fine sandy loam about 18 inches thick. It is grayish brown in the upper part and brown in the lower part. Below this is about 32 inches of calcareous fine sandy loam that is light

Figure 19.—Effects of soil blowing in an area of Sarita fine sand, 0 to 5 percent slopes. The fields on the right were tilled and left without protective cover, and the blowing sand accumulated on the fence and the grasses along the roadside.

yellowish brown in the upper part and very pale brown in the lower part. The underlying material, to a depth of 62 inches, is calcareous, yellow loamy fine sand.

These soils are well drained, and permeability is moderately rapid. Runoff is slow, and available water capacity is medium.

About half the acreage of these Saspamco soils is cultivated, and the other half is used for improved pasture or range. The soils are suited to crops, pasture, or range.

Representative profile of Saspamco fine sandy loam, 1 to 3 percent slopes, in pasture, about 2.25 miles west of Floresville on Farm Road 536 from intersection with U.S. Highway 181, and 0.75 mile west on unpaved county road; then 20 feet west and 75 feet south of gate:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak, fine, granular structure; hard, friable; many fine roots; few snail shell fragments; calcareous; moderately alkaline; clear, wavy boundary.

A1—8 to 18 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, friable; common fine roots; few snail shell fragments; few fine pores; calcareous; moderately alkaline; gradual, wavy boundary.

B21—18 to 30 inches, light yellowish-brown (10YR 6/4 fine sandy loam, yellowish brown (10YR 5/4) moist; moderate, very fine, subangular blocky structure; hard, friable; few films, threads, and fine concretions of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; gradual, wavy boundary.

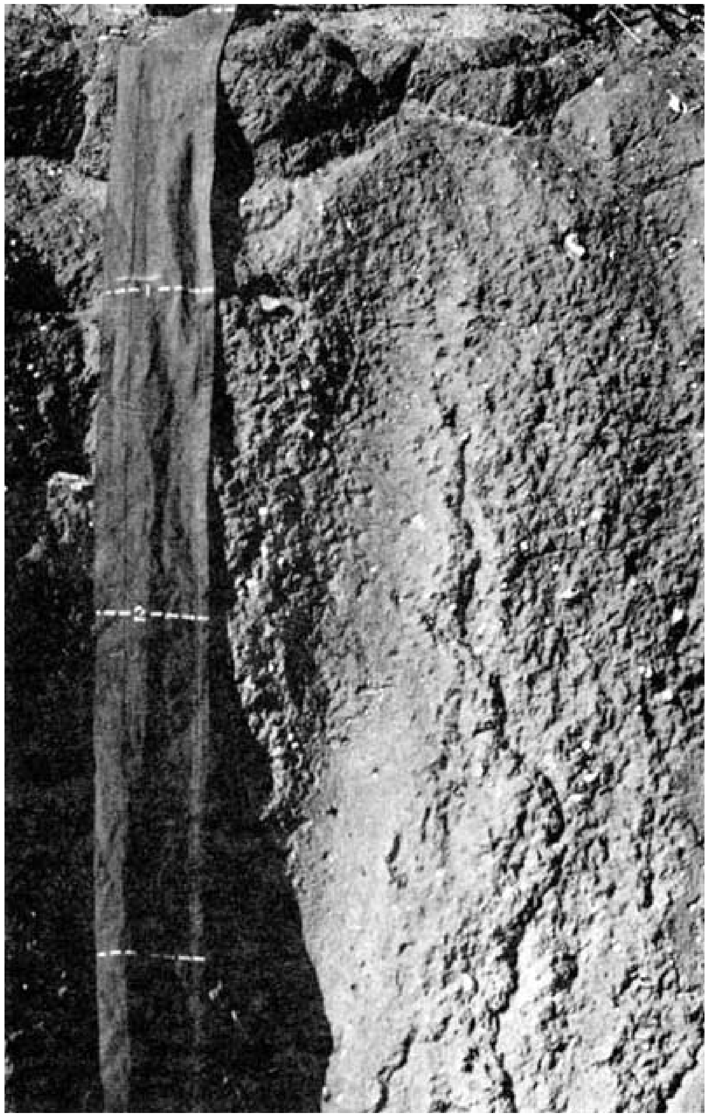

Figure 20.—Profile of a Saspamco fine sandy loam. Snail shell fragments are throughout the profile.

B22—30 to 50 inches, very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; weak, fine, subangular blocky structure; hard, friable; few films, threads, and fine concretions of calcium carbonate; few snail shell fragments; calcareous; moderately alkaline; gradual, wavy boundary.

Cca—50 to 62 inches, yellow (10YR 7/6) loamy fine sand, brownish yellow (10YR 6/6) moist; massive; slightly hard, very friable; estimated 5 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 40 to 60 inches in thickness. Calcium carbonate makes up 10 to 25 percent, by weight, of the soil at a depth of 10 to 40 inches. Pebbles and stones make up 0 to 5 percent, by weight, of any horizon.

The A horizon ranges from 8 to 22 inches in thickness. The A horizon is dark grayish brown, grayish brown, brown, or pale brown.

The B horizon is brown, yellowish-brown, pale-brown, light yellowish-brown, or very pale brown loam or fine sandy loam. Silicate clay makes up 12 to 18 percent and carbonate clay 1 to 6 percent of the B horizon. Visible carbonates, in the form of threads, films, soft masses, and concretions, are 1 to 10 percent, by volume, of the horizon.

The Cca horizon is pale-brown, very pale brown, light yellowish-brown, brownish-yellow, or yellow fine sandy loam or loamy fine sand. Visible carbonates, in the form of threads, films soft masses, and concretions, range from 1 to 15 percent, by volume, of the C horizon.

Saspamco fine sandy loam, 1 to 3 percent slopes (SpB).—This gently sloping soil is on breaks from high terraces to uplands. Areas of this soil range in size from 20 to 120 acres, and they are irregularly oblong in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Colibro soils in slightly lower areas on foot slopes or at the heads of small field drainageways. Also included are Venus and Runge soils in slightly higher areas.

This soil is used for crops, improved pasture, or range. It is suited to cultivated crops, but in some areas chlorosis (yellowing) of plants is a hazard. The hazard of water erosion is moderate. Capability unit IIe-3 dryland, IIe-4 irrigated; Gray Sandy Loam range site.

Saspamco fine sandy loam, 3 to 5 percent slopes (SpC).—This gently sloping soil is on breaks from terraces to uplands. Areas of this soil range from 20 to 120 acres in size, and they are irregularly oblong in shape.

The surface layer is calcareous, grayish-brown fine sandy loam about 8 inches thick. Below this is about 30 inches of calcareous fine sandy loam that is brown in the upper part and pale brown in the lower part. The next layer, about 8 inches thick, is calcareous, very pale brown fine sandy loam that has about 4 percent, by volume, visible carbonates. The underlying material, to a depth of 60 inches, is calcareous, very pale brown loamy fine sand that has about 3 percent visible carbonates.

Included with this soil in mapping are small areas of Saspamco fine sandy loam, 1 to 3 percent slopes, mostly on foot slopes, and also areas of Saspamco soils that have slopes of 8 percent in places. Also included are small areas of Colibro soils in small pockets or low areas and Venus and Runge soils in slightly higher areas. These inclusions are mostly less than 5 acres in size.

This soil is used mostly for range or improved pasture, but small areas are cultivated. The hazard of water erosion is severe. Capability unit IIIe-8 dryland, IIIe-7 irrigated; Gray Sandy Loam range site.

Tabor Series

The Tabor series consists of deep, noncalcareous, very friable, nearly level to gently sloping sandy soils on uplands. These soils formed in acid to alkaline sandy clay loams interbedded with shales and sandier material (fig. 21).

In a representative profile the surface layer is noncalcareous, brown loamy fine sand about 7 inches thick. The subsurface layer is noncalcareous, very pale brown loamy fine sand about 10 inches thick. The next layer is about 39 inches of noncalcareous, light yellowish-brown clay (in the upper part) and sandy clay (in the lower part) mottled with yellow, red, brown, olive, and gray. The underlying material, to a depth of 62 inches, is noncalcareous, light-gray sandy clay loam that is mottled and that has shale fragments.

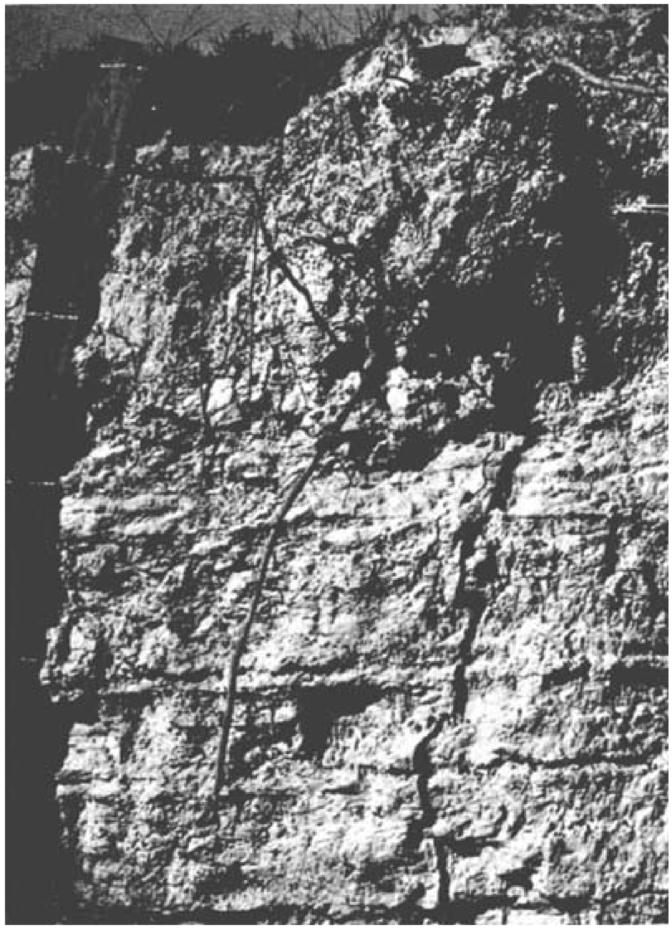

Figure 21.—Profile of Tabor loamy fine sand, 0 to 3 percent slopes, showing strata of interbedded shale.

These soils are moderately well drained, and permeability is very slow. Runoff is slow to medium, and available water capacity is medium.

Tabor soils are in range, improved pasture, and crops. The soils are suited to range, pasture, and some crops.

Representative profile of Tabor loamy fine sand, 0 to 3 percent slopes, in range, 7.5 miles north of Stockdale on Texas Highway 123 to intersection with county road, 2.5 miles east on county road to intersection with another county road, and 0.25 mile south on county road; then 75 yards east of county road:

A1—0 to 7 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak, fine, granular structure; hard, very friable; many fine roots; medium acid; clear, smooth boundary.

A2—7 to 17 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) moist; single grained; hard, very friable; common fine roots; common fine pores; medium acid; abrupt, wavy boundary.

B21t—17 to 32 inches, light yellowish-brown (10YR 6/4) clay, yellowish brown (10YR 5/4) moist; common medium, distinct, yellowish-red (5YR 5/6) and gray (10YR 5/1) mottles; moderate, fine and medium, blocky structure; extremely hard, very firm; common fine roots mainly between peds; continuous distinct clay films; pressure faces on peds; medium acid; gradual, wavy boundary.

B22t—32 to 46 inches, coarsely and distinctly mottled light brownish-gray (10YR 6/2) and brownish-yellow (10YR 6/6) sandy clay; few, fine, faint, gray (10YR 5/1) mottles; moderate, medium and coarse, blocky structure; extremely hard, very firm; few fine pores; distinct continuous clay films; pressure faces on peds; few fine, cemented ferro-manganese concretions; strongly acid; gradual, wavy boundary.

B3t—46 to 56 inches, light yellowish-brown (10YR 6/4) sandy clay, yellowish brown (10YR 5/4) moist; many, coarse, distinct, red (2.5YR 5/6) and olive-brown (2.5Y 4/4) mottles; moderate, coarse, blocky structure; extremely hard, very firm; thin, patchy clay films on ped surfaces; few, fine, cemented ferro-manganese concretions; strongly acid; gradual wavy boundary.

C—56 to 62 inches, light gray (10YR 7/2) sandy clay loam, light brownish gray (10YR 6/2) moist; common, medium and coarse, distinct, brownish-yellow (10YR 6/6), brown (10YR 5/3), and pale-olive (5Y 6/3) mottles; massive; extremely hard, very firm; few shale fragments; medium acid.

The solum is 40 to 65 inches thick. The A horizon ranges from 10 to 20 inches in thickness. The A1 horizon is grayish brown, dark grayish brown, brown, or light gray. The A2 horizon is very pale brown, pale brown, light brownish gray, or pinkish gray. Reaction ranges from slightly acid to strongly acid. The boundary between the A horizon and the Bt horizon is wavy, and the textural change is abrupt.

The B2t horizons are brown, pale brown, light yellowish brown, brownish yellow, yellowish brown, light olive brown, and olive brown. They have few to many mottles of yellow, red, brown, gray or olive. The Bt horizon is clay, sandy clay or clay loam. It is 35 to 50 percent clay in the upper 20 inches. Reaction of the B2t horizon is medium acid or strongly acid.

The B3t horizon is light brownish gray, pale brown, very pale brown, light yellowish brown, or brownish yellow. Mottles range from few to many in yellow, brown, gray, and olive. Reaction of the B3t and C horizons is medium acid to mildly alkaline. A few profiles have calcium carbonate concretions and gypsum crystals.

The C horizon is clay, sandy clay, clay loam, or sandy clay loam. Interbedded thin strata of shale are in the profile in places.

Tabor loamy fine sand, 0 to 3 percent slopes (TbB).—This nearly level to gently sloping, slightly convex soil is in areas that average about 300 acres in size but that range from 30 to 600 acres. This soil is slightly lower than Eufaula and Patilo soils and slightly higher than Crockett soils. Areas of this soil are mostly subrounded to irregular in shape.

Included with this soil in mapping are small areas of as much as 15 acres of a soil similar to this Tabor soil, except that the surface layer is 20 to 40 inches thick. This included soil is in slightly higher areas or on low mounds. Also included are small areas of less than 5 acres of Patilo soils on higher slopes and Crockett soils on foot slopes or in depressions.

This soil is used for crops, range, or improved pasture. It is suited to some of the crops grown in the county. The hazards of soil blowing and water erosion are moderate. Capability unit IIIe-6 dryland, IIIe-5 irrigated; Loamy Sand range site.

Tordia Series

The Tordia series consists of deep, noncalcareous, very firm, nearly level to gently sloping clayey soils on uplands. These soils formed in material, weathered from shale or sandstone that contains volcanic ash.

The surface layer is noncalcareous, very dark gray and dark gray clay about 38 inches thick. It is very firm in the upper part and extremely firm in the lower part.

Below this is noncalcareous, mottled grayish-brown, dark grayish-brown, very dark gray, and dark gray clay about 6 inches thick. The underlying material, to a depth of 60 inches, is noncalcareous, light brownish-gray shale that has lenses of sand.

These soils are well drained, and permeability is very slow. Runoff is medium to slow, and available water capacity is high.

Tordia soils are mostly cultivated, but some areas are used for native range or improved pasture. The soils are suited to most crops, range, and pasture.

Representative profile of Tordia clay, 1 to 4 percent slopes, in a small, triangular pasture, 7 miles west of Poth on Farm Road 541 to Farm Road 1344 in Dewees community and 5.4 miles south on Farm Road 1344; then east of Farm Road 1344:

A11—0 to 4 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; strong, very fine and fine, subangular blocky structure; very hard, very firm; many roots; uncoated sand grains on faces of peds; mildly alkaline; clear, wavy boundary.

A12—4 to 30 inches, very dark gray (10YR 3/1) clay, black (10YR 2/1) moist; moderate, fine and medium, blocky structure; extremely hard, extremely firm; common roots; few pores; uncoated sand grains on faces of peds; noncalcareous; moderately alkaline, diffuse, wavy boundary.

A13—30 to 38 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine and medium, blocky structure; extremely hard, extremely firm; common roots; few pores; uncoated sand grains on faces of peds; noncalcareous; moderately alkaline; gradual, wavy boundary.

B2—38 to 44 inches, mottled grayish-brown (10YR 5/2) and dark-gray (10YR 4/1) clay, dark grayish-brown (10YR 4/2) and very dark gray (10YR 3/1) moist; moderate, very fine, blocky structure; extremely hard, extremely firm; few roots; few pores; uncoated sand grains on faces of peds; few fine, cemented calcium carbonate concretions; noncalcareous in matrix; moderately alkaline; gradual, wavy boundary.

C—44 to 60 inches, light brownish gray (10YR 6/2) shale that fractures conchoidally, grayish brown (10YR 5/2) moist; lenses of sand in horizon; few cracks filled with soil from above; few very fine and fine, cemented calcium carbonate concretions; noncalcareous; moderately alkaline.

The solum is 32 to 48 inches thick. Cracks 1 to 2 inches wide are at the surface and extend to the C horizon. These cracks are more than $^{1}/_{4}$-inch wide at a depth of 20 inches. A few small pieces of petrified wood are on the surface and in the soil.

The A horizon is 20 to 40 inches thick. It is dark gray, very dark gray, or black. In places a thin layer of sand, $^{1}/_{16}$-inch to $^{1}/_{2}$-inch thick, is on the surface. Lenses of sand throughout the A horizon are the result of sand washing into cracks of the soil. Reaction is mildly alkaline or moderately alkaline.

The B2 horizon ranges from 4 to 12 inches in thickness. It is gray, dark gray, grayish brown, or light grayish brown. In most places old cracks in the B2 horizon are filled with darker material like that of the A horizon. Reaction is mildly alkaline or moderately alkaline.

The C horizon is light brownish gray, light gray, or gray. It is shale or sandstone that has volcanic ash, or shaly clay that has darker streaks, generally from old root channels, filled with darker materials of the A and B2 horizons. Reaction of the C horizon is mildly alkaline or moderately alkaline.

Tordia clay, 0 to 1 percent slopes (TrA).—This nearly level soil is on upland flats or broad ridgetops mostly within larger areas of Tordia soils. Areas of this soil range from 30 to 150 acres in size, and they are mostly subrounded in shape.

This soil has a surface layer of very firm, noncalcareous, very dark gray clay about 34 inches thick. Below this is about 8 inches of noncalcareous, dark-gray clay and about 4 inches of noncalcareous, grayish-brown clay. The underlying material, to a depth of 60 inches, is light-gray sandy shale that has lenses of sandy material and a few concretions of calcium carbonate.

Included with this soil in mapping are small areas where the soil is less than 20 inches deep over sandstone and shale. These areas, less than 3 acres in size, are near ridgetops. Also included is soil similar to Tordia soils except that it drains slowly and is slightly saline in places. It is on bottom land flats as large as 20 acres in size. Other inclusions are Coy and Clareville soils in slightly higher areas.

This soil is mostly cultivated, but some areas are being reseeded to grass or have been left idle, and others are used for range. The hazard of water erosion is slight. Capability unit IIIs–3 dryland, IIIs–2 irrigated; Rollin Blacklands range site.

Tordia clay, 1 to 4 percent slopes (TrB).—This gently sloping soil is in areas that average about 200 acres but that range from 50 to 500 acres. Slopes are slightly convex. This soil is slightly lower than Picosa soils. Areas of this soil are irregular to subrounded in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Ustochrepts, shallow. These included areas are near ridgetops and are less than 5 acres in size. Also included are small areas of Picosa soils on narrow ridgetops in places and Coy soils in slightly higher areas.

This soil is used for crops, pasture, and range. The soil is suited to most crops grown in the county, but more and more acreage is being seeded to grass or left as idle cropland. The hazard of water erosion is moderate. Capability unit IIIe-2 dryland, IIIe-2 irrigated; Rolling Blacklands range site.

Ustochrepts

Ustochrepts consist of loamy soils too variable to classify at the series level. These soils are correlated at the subgroup level rather than as a miscellaneous land type because of the added information available for interpretations. They formed in loamy and clayey material interbedded with weakly cemented, tuffaceous sandstone and shale.

The surface layer is very firm, noncalcareous, grayish-brown clay loam about 8 inches thick. The next layer is about 10 inches of noncalcareous, grayish-brown clay. The underlying material, to a depth of 35 inches, is light-gray to white weathered sandstone and shale that has a few darker streaks of clay material and a few calcium carbonate concretions.

The soil is well drained and permeability is slow. Runoff is slow to moderately slow, and available water capacity is low.

Most areas of this soil are used for range or pasture but small areas are cultivated or idle cropland. The soil is better suited to range or improved pasture than to other uses.

Ustochrepts, shallow (Us).—This gently sloping soil is in areas that range in size from 6 to 80 acres. Slopes are 1 to 5 percent and slightly convex. This soil is lower than Picosa soils and in the same landscape with Tordia soils. Areas of this soil are irregularly subrounded in shape.

Included with this soil in mapping are small areas of Picosa soils on small, narrow ridges or on microknolls. Also included are small areas of Tordia soils on foot slopes.

This soil is used mostly for range or pasture but some small areas are cultivated or left as idle cropland. The hazard of water erosion is moderate. Capability unit IVe-3 dryland; Shallow Ridge range site.

Venus Series

The Venus series consists of deep, calcareous, friable, nearly level to gently sloping loamy soils on low terraces. These soils formed in thick beds of calcareous loamy material.

In a representative profile (fig. 22) the surface layer is calcareous, grayish-brown clay loam about 18 inches thick. The next layer is 9 inches of calcareous, grayish-brown clay loam that has a few films, threads, and concretions of calcium carbonate. Below this is calcareous, pale-brown clay loam, about 21 inches thick, that is about 2 percent films, threads, and concretions of calcium carbonate. The underlying material, to a depth of 62 inches, is calcareous, very pale brown loam that is about 5 percent films, threads, and concretions of calcium carbonate.

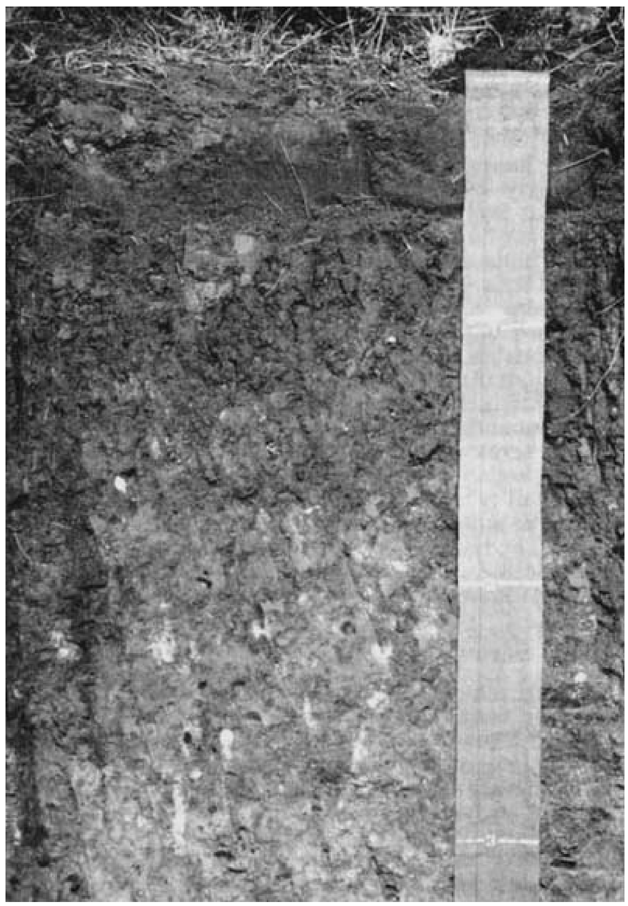

Figure 22.—Profile of Venus clay loam, 0 to 1 percent slopes, showing lighter colored material and soft masses of calcium carbonate below a depth of 20 inches.

These soils are well drained, and permeability is moderate. Runoff is medium to slow, and available water capacity is high.

Venus soils are mostly cultivated, but some areas are used for improved pasture or range. The soils are well suited to crops, improved pasture or range.

Representative profile of Venus clay loam, 0 to 1 percent slopes, in a cultivated field, 5 miles north of Sutherland Springs on Farm Road 539 to paved county road and 0.4 mile west on paved county road; then 50 feet north of paved county road:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak, fine, granular structure; hard, friable; many fine roots; few snail shell fragments; calcareous; moderately alkaline; clear, smooth boundary.

A1—8 to 18 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine and fine, granular structure; hard, friable; common fine roots; few fine pores; few wormcasts; few snail shell fragments; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B21—18 to 27 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate, fine, subangular blocky and granular structure; hard, friable; common fine pores; wormcasts and insect tunnels; shell fragments and visible threads, films, and soft, fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual boundary.

B22—27 to 48 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) moist; moderate, fine and very fine, granular structure; hard, friable; common fine pores; shell fragments and about 2 percent visible threads, films, and fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual boundary.

Cca—48 to 62 inches, very pale brown (10YR 7/3) loam, pale brown (10YR 6/3) moist; weak, granular structure; hard, friable; about 5 percent visible threads, films, and fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to 55 inches thick. The content of organic matter decreases regularly with depth.

The A horizon is 10 to 20 inches thick. It is dark grayish brown, grayish brown, or brown.

The B2 horizons range from 20 to 38 inches in thickness. It is grayish-brown, light brownish-gray, brown, or pale-brown clay loam, sandy clay loam, loam, or silt loam. The B2 horizons are 25 to 35 percent clay at a depth of 10 to 40 inches. Calcium carbonate concretions, films, threads, or soft masses range from 1 to 3 percent, by volume, of the B2 horizons.

The C horizon is loam, sandy clay loam, or clay loam. Calcium carbonate concretions, films, threads, and soft masses range from 2 to 8 percent, by volume, of the C horizon and in some places make up as much as 15 percent of the horizon below a depth of 50 inches. In some places layers of gravel are at a depth of 6 to 8 feet.

Venus clay loam, 0 to 1 percent slopes (VeA).—This soil is on low terraces in areas several thousand feet long and as much as three quarters of a mile wide. Slopes are nearly level. The soil is slightly higher than Aransas soils and lower than Colibro soils. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Karnes soils in small, narrow strips that border flood plains. Also included are Saspamco soils on small, narrow mounds parallel to shallow drainageways or breaks between high and low terraces, and Aransas soils in depressions or old drainageways.

The soil is used mostly for crops, but some areas are used for improved pasture. Few, if any, areas are in native range. The soil is well suited to cultivated crops. The hazard of water erosion is slight. Capability unit IIc-3 dryland, I-3 irrigated; Clay Loam range site.

Venus clay loam, 1 to 3 percent slopes (VeB).—This gently sloping soil is in slightly concave areas on low terraces on breaks to streams or field drainageways or on breaks between nearly level terraces and flood plains. Areas of this soil range in size from 50 to 300 acres, but are dominantly about 80 acres. They are mostly long and narrow in shape.

This soil has a surface layer of calcareous, brown clay loam about 14 inches thick. The next layer is about 26 inches of calcareous, pale-brown clay loam that has a few threads, films, and concretions of calcium carbonate. Below this is about 12 inches of calcareous, pale-brown loam that is about 2 percent films, threads, concretions and soft masses of calcium carbonate. The underlying material, to a depth of 60 inches, is calcareous, very pale brown loam that is about 5 percent films, threads, concretions and soft masses of calcium carbonate.

Included with this soil in mapping are small areas of Karnes soils on breaks to flood plains. Also included are Colibro and Saspamco soils on breaks between terraces or on breaks to uplands.

This soil is mostly cultivated, but some areas are in improved pasture. Small, scattered areas are used for range. The soil is well suited to most crops. The hazards of water erosion is moderate. Capability unit IIe-4 dryland, IIe-4 irrigated; Clay Loam range site.

Vernia Series

The Vernia series consists of deep, noncalcareous, loose, gently sloping to sloping, very gravelly sandy soils on uplands. These soils formed in ancient stream terraces in beds of sand and gravel.

In a representative profile the surface layer is noncalcareous, grayish-brown very gravelly loamy sand about 12 inches thick. The subsurface layer is noncalcareous, pale-brown very gravelly loamy sand about 38 inches thick. The next layer is about 20 inches of noncalcareous, red very gravelly sandy clay loam mottled in shades of red, gray, brown, and yellow in the upper part and pale brown mottled in shades of brown, yellow, and red in the lower part. The underlying material, to a depth of 84 inches, is red, noncalcareous very gravelly sandy clay loam mottled in shades of gray, brown and yellow.

These soils are well drained, and permeability is moderate. Runoff is slow, and available water capacity is low.

Vernia soils are used mostly for range or as gravel pits for road fill (fig. 23). The soils are better suited to range than to other uses.

Representative profile of Vernia very gravelly loamy sand, 1 to 8 percent slopes; 7.5 miles north of Sutherland Springs on Farm Road 539 and 0.25 mile east along an old oil well road to where it branches southeast into a gravel pit; then on the west wall of gravel pit about 75 feet south of the entrance to the pit:

A1—0 to 12 inches, grayish-brown (10YR 5/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) moist; single grained; loose; many fine roots; estimated 50 percent, by volume, water-rounded siliceous pebbles $^{1}/_{4}$-inch to 3 inches in diameter; few 3- to 5-inch cobbles; neutral; diffuse, wavy boundary.

A2—12 to 50 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) moist; single grained; loose; many fine roots in upper part; estimated 80 percent, by volume, siliceous pebbles $^{1}/_{4}$-inch to 3 inches in diameter and a few cobbles 3 to 5 inches in diameter; fine silt coatings on upper and lower surfaces of pebbles; slightly acid; abrupt, wavy boundary.

Figure 23.—A gravel pit in Vernia very gravelly loamy sand, 1 to 8 percent slopes. The material mined from this pit is used as road fill.

B21t—50 to 64 inches, red (2.5YR 4/6) very gravelly sandy clay loam, dark red (2.5YR 3/6) moist; common, medium, distinct, red (10R 4/6), grayish-brown (10YR 5/2), and brownish-yellow (10YR 6/6) mottles; moderate, fine, subangular blocky structure; very hard, very firm; few roots; thin clay films on surfaces of peds and pebbles; few fine pores; estimated 60 percent, by volume, siliceous pebbles $^{1}/_{4}$-inch to 3 inches in diameter; slightly acid; gradual, wavy boundary

B22t—64 to 70 inches, pale-brown (10YR 6/3) very gravelly sandy clay loam, brown (10YR 5/3) moist; common, medium, faint, brownish-yellow (10YR 6/6) and reddish-brown (5YR 5/4) mottles; moderate, fine and medium, subangular blocky structure; very hard, very firm; few fine pores; thin clay films on surfaces of peds and pebbles; estimated 55 percent, by volume, siliceous pebbles $^{1}/_{4}$-inch to 3 inches in diameter; medium acid; gradual lower boundary.

B3t—70 to 84 inches, red (2.5YR 4/6) very gravelly sandy clay loam, dark red (2.5YR 3/6) moist; common, medium, prominent, grayish-brown (10YR 5/2) and brownish-yellow (10YR 6/6) mottles; weak, fine, subangular blocky structure; very hard, firm; patchy clay films on surfaces of peds and pebbles; estimated 55 percent, by volume, siliceous pebbles $^{1}/_{4}$-inch to 3 inches in diameter; strongly acid.

The solum ranges from 72 to 110 inches in thickness. The A horizon ranges from 40 to 80 inches in thickness. The A1 horizon is grayish brown, light brownish gray, brown, or pale brown, and the A2 horizon is pale brown, very pale brown, light brown, or pink. Siliceous pebbles and cobbles make up 35 to 85 percent by volume, of the A horizon. Reaction ranges from slightly acid to mildly alkaline.

The Bt horizon is red, light brownish gray, pale brown, or yellowish red mottled or having a mottled matrix in various shades of red, yellow, brown, or gray. The Bt horizon is gravelly or very gravelly sandy clay loam or clay loam. The upper 20 inches of the Bt horizon is 27 to 35 percent clay and 35 to 70 percent pebbles and cobbles. Reaction is slightly acid to strongly acid.

Vernia very gravelly loamy sand, 1 to 8 percent slopes (VrC).—This gently sloping to sloping soil is in areas that range in size from 10 to 230 acres. It is on small, narrow ridges, isolated knolls, or remnants of old ancient waterways. These areas are mostly parallel to the flood plains of Cibolo Creek and are mostly irregularly oblong in shape, but in places they are irregularly oval.

Included with this soil in mapping are small areas of Nocken soils near breaks to flood plains. Also included are small areas of Eufaula and Patilo soils or Leming soils in lower areas.

This soil is used mostly for range or as a limited source of gravel for road fill. Many gravel pits are in areas of this soil. The soil is best suited to range. The hazard of water erosion is slight. Capability unit VIs-2 dryland; Very Gravelly range site.

Wilco Series

The Wilco series consists of deep, noncalcareous, loose, nearly level to sloping soils on uplands. These soils formed in loamy material, several feet thick, that has thin strata of sandstone and shale.

In a representative profile (fig. 24) the surface layer is noncalcareous, pale-brown loamy fine sand about 16 inches thick. The next layer is about 16 inches of brown, noncalcareous sandy clay mottled in shades of yellow, red, and brown. Below this is about 6 inches of noncalcareous, reddish-yellow sandy clay loam mottled in shades of brown, yellow, and red. The next layer is 7 inches of noncalcareous, light-brown fine sandy loam mottled strong brown. The underlying material, to a depth of 60 inches, is calcareous, very pale brown fine sandy loam that has fragments of shale and a few calcium carbonate concretions.

These soils are well drained, and permeability is slow. Runoff is slow, and available water capacity is medium.

Wilco soils are mostly cultivated, but some areas are used for native range or improved pasture. The soils are suited to crops, range, or pasture.

Representative profile of Wilco loamy fine sand, 0 to 3 percent slopes, 5.5 miles west of Floresville on Texas Highway 97 to unpaved county road and 0.25 mile north on unpaved county road; then 35 yards west of county road.

Ap—0 to 6 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; loose; very friable; many fine roots; medium acid; clear, smooth boundary.

A1—6 to 16 inches, pale-brown (10YR 6/3) loamy fine sand, brown (10YR 5/3) moist; single grained; soft, very friable; many fine roots; medium acid; abrupt, wavy boundary.

B21t—16 to 20 inches brown (10YR 5/3) sandy clay, dark brown (10YR 4/3) moist; many, medium and coarse, distinct, yellowish-red (5YR 5/6) mottles; moderate, fine, blocky structure; very hard, very firm; few fine roots; few fine pores; thin, continuous clay films on surfaces of peds; slightly acid; gradual, wavy boundary.

B22t—20 to 32 inches brown (7.5YR 5/4) sandy clay, dark brown (7.5YR 4/4) moist; common, fine and medium, distinct, yellowish-red (5YR 5/6) and yellowish-brown (10YR 5/4) mottles; moderate, fine, blocky structure; very hard, very firm; few fine roots; common clay skins on peds; neutral; gradual, wavy boundary.

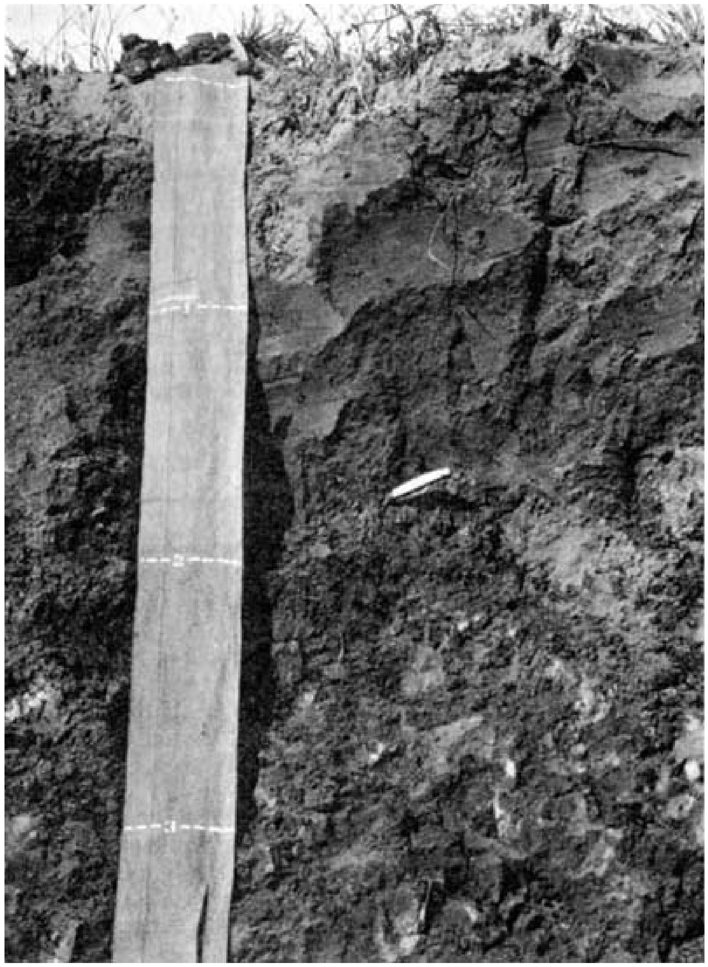

Figure 24.—Profile of Wilco loamy fine sand, 0 to 3 percent slopes, showing the abrupt boundary between the loamy fine sand surface layer and the sandy clay subsoil.

B23t—32 to 38 inches, reddish-yellow (7.5YR 6/6) sandy clay loam, strong brown (7.5YR 5/6) moist; many, coarse, distinct, yellowish-red (5YR 5/6) mottles; weak and moderate, fine, blocky structure; hard, firm; few fine roots; few clay skins on peds; neutral; gradual, wavy boundary.

B3—38 to 45 inches, light yellowish-brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; few, fine, faint, strong-brown (7.5YR 5/6) mottles; weak, medium, blocky structure; hard, friable; mildly alkaline; clear, smooth boundary.

C—45 to 60 inches, very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; massive; slightly hard friable; estimated 30 percent by volume, small fragments of gray (10YR 6/1) clayey shale; few, fine, weakly cemented calcium carbonate concretions; calcareous; moderately alkaline.

The solum is 40 to 72 inches thick. Secondary carbonates that make up less than 5 percent of the matrix are at a depth of 40 to 60 inches.

The A horizon is 10 to 20 inches thick. It is pale brown, light yellowish brown, brown, yellowish brown, or light brown. Reaction is medium acid or slightly acid.

The B2t, B3, and C horizons are pale brown, brown, strong brown, light yellowish brown, reddish yellow, very pale brown, or yellowish brown mottled in shades of red, yellow, brown or olive. The B21t and B22t horizons are clay, sandy clay, or clay loam, ranging from 35 to 48 percent clay in the upper 20 inches. Reaction ranges from medium acid to mildly alkaline. The B2t horizon ranges from 16 to 46 inches in thickness. The B23t horizon is sandy clay loam, sandy clay, or clay loam. The B3 horizon is fine sandy loam, loam, sandy clay loam, or clay loam. Reaction of the B23t and B3 horizons ranges from neutral to moderately alkaline. The B3 horizon is calcareous in places. The B3 horizon is 5 to 15 inches thick.

The C horizon is fine sandy loam or sandy clay loam. Small, broken fragments of sandstone or shale are in most places. Reaction is mildly alkaline or moderately alkaline.

Wilco loamy fine sand, 0 to 3 percent slopes (WcB).—This nearly level to gently sloping soil is in areas that range in size from 20 to 575 acres. It is in slightly higher areas than Floresville, Miguel, and Runge soils. Areas of this soil are irregularly oblong in shape. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Wilco loamy fine sand, 3 to 5 percent slopes, on the sides of major field drainageways. Also included are Miguel soils at the heads of field drainageways and Leming soils on foot slopes.

This soil is used mostly for crops, but some areas are used for improved pasture and range. It is suited to crops. The hazards of soil blowing and water erosion are moderate. Capability unit IIIe-6 dryland, IIIe-5 irrigated; Loamy Sand range site.

Wilco loamy fine sand, 3 to 8 percent slopes (WcC).—This gently sloping to sloping soil is in slightly convex areas on uplands. Areas of this soil are irregularly oblong or oval in shape and are slightly lower than Wilco loamy fine sand, 0 to 3 percent slopes. They are on the sides or walls of well-defined field drainageways.

This soil has a surface layer of noncalcareous, pale-brown loamy fine sand about 14 inches thick. The next layer is about 22 inches of noncalcareous, yellowish-brown sandy clay mottled in shades of red, brown, yellow, and olive. Below this is about 12 inches of noncalcareous, reddish-yellow, mottled sandy clay loam.

The underlying material, to a depth of 60 inches, is calcareous, very pale brown, mottled sandy clay loam that has fragments of sandstone and shale.

Included with this soil in mapping are small areas of Wilco loamy fine sand, 0 to 3 percent slopes, on foot slopes. Small areas of Floresville soils are near ridge-tops, and small areas of Miguel soils are in depressions or at the heads of field drainageways.

This soil is used for crops, improved pasture, and range, and it is well suited to these uses. The hazards of soil blowing and water erosion are moderate to severe. Capability unit IVe-4 dryland, IIIe-6 irrigated; Loamy Sand range site.

Wilco loamy fine sand, 3 to 8 percent slopes, eroded (WcC2).—This gently sloping to sloping soil is on uplands. Mapped areas are within larger areas of other Wilco soils and on the sides or walls of field drainageways. Areas of this soil are irregularly oblong in shape and range in size from 10 to 80 acres.

This soil has a surface layer of noncalcareous, brown loamy fine sand about 10 inches thick. The next layer is about 18 inches of noncalcareous, sandy clay mottled in shades of red, yellow, and brown. It is pale brown in the upper 10 inches and very pale brown in the lower 8 inches. Below this is about 12 inches of very pale brown sandy clay loam mottled in shades of red, yellow, and brown. The underlying material, to a depth of 60 inches, is reddish-yellow sandy clay loam mottled in shades of red, yellow, and brown and that has fragments of shale.

Gullies, 40 to 80 feet apart, 6 to 30 inches deep, and 1 to 15 feet wide are common in areas of this soil. Most of these gullies are less than 18 inches deep and can be crossed by farm machinery.

Included with this soil in mapping are areas of uneroded Wilco soils between gullies. Also included are a few areas in which the underlying material is at a depth of less than 40 inches.

Most areas of this soil were cultivated at one time, but they have been reseeded to grass or have been idle for some years. Small areas in larger areas of cultivated Wilco soils are still cultivated. The hazards of soil blowing and water erosion are severe. Capability unit VIe-1 dryland, IVe-1 irrigated; Loamy Sand range site.

Willamar Series

The Willamar series consist of deep, noncalcareous, friable, nearly level to gently sloping loamy soils on uplands. These soils formed in stratified loamy materials.

In a representative profile the surface layer is noncalcareous, dark-gray fine sandy loam about 7 inches thick. The next layer is about 15 inches of noncalcareous sandy clay loam that is dark gray in the upper part and gray in the lower part. Below this is about 10 inches of calcareous, grayish-brown sandy clay loam that is about 15 percent soft masses and concretions of calcium carbonate. The underlying material, to a depth of 60 inches, is calcareous loam that is light gray in the upper part and very pale brown in the lower part and that contains soft masses and concretions of calcium carbonate.

These soils are somewhat poorly drained, and permeability is very slow. Runoff is very slow, and available water capacity is low.

About half the acreage of Willamar soils was cultivated at one time, but now much of that acreage is used for improved pasture or is idle. Some areas are used for range. The soils are better suited to range or pasture than to other uses.

Representative profile of Willamar fine sandy loam, 0 to 2 percent slopes, in pasture, 4.2 miles southeast of Poth on Farm Road 541, then 225 feet northeast of Farm Road 541:

A1—0 to 7 inches, dark-gray (10YR 4/1) fine sandy loam, very dark gray (10YR 3/1) moist; massive; hard, friable; common fine roots; few fine pores; slightly acid; abrupt, wavy boundary.

B21t—7 to 15 inches, dark-gray (10YR 4/1) sandy clay loam, very dark gray (10YR 3/1) moist; moderate, coarse, prismatic structure and moderate, medium, blocky; very hard, very firm; common fine roots between peels; thin, continuous clay films on surfaces of peds; neutral; gradual, wavy boundary.

B22t—15 to 22 inches, gray (10YR 5/1) sandy clay loam, dark gray (10YR 4/1) moist; moderate, coarse, prismatic structure and moderate, coarse, blocky; extremely hard, very firm; few roots between peds; patchy clay films on surfaces of peds; few fine ferro-manganese concretions; mildly alkaline; gradual lower boundary.

B3ca—22 to 32 inches, grayish-brown (10YR 5/2) sandy clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky structure; very hard, firm; about 15 percent, by volume, soft masses and weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual, smooth boundary.

Cca—32 to 40 inches, light-gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; few dark streaks form old root channels filled with darker material from above; about 20 percent, by volume soft masses and weakly cemented calcium carbonate concretions; calcareous; moderately alkaline; gradual lower boundary.

C—40 to 60 inches, very pale brown (10YR 8/3) loam, very pale brown (10YR 7/3) moist; massive; hard friable; about 5 percent, by volume, weakly cemented calcium carbonate concretions; calcareous; moderately alkaline.

The solum is 28 to 38 inches thick. Secondary carbonates are at a depth of 20 to 34 inches.

The A horizon ranges from 4 to 7 inches in thickness. It is dark gray, gray, or grayish brown. Reaction is slightly acid to mildly alkaline.

The Bt horizons are 10 to 16 inches thick. They are dark-gray, gray, or dark grayish-brown sandy clay loam or clay loam. Clay makes up 26 to 35 percent of the Bt horizons. Reaction is mildly alkaline or moderately alkaline.

The B3ca horizon is 7 to 16 inches thick. It is grayish-brown or light brownish-gray sandy clay loam, clay loam, or loam. Visible calcium carbonates in the form of soft masses or weakly cemented concretions make up a few to 20 percent, by volume, of the B3ca horizon.

The Cca and C1 horizons are pale brown, light-gray, or very pale brown calcareous sandy clay loam or loam. Visible carbonates in the form of soft masses or cemented concretions make up 10 to 30 percent of the Cca horizon, decreasing in percentage with depth. Reaction is moderately alkaline or strongly alkaline.

Willamar fine sandy loam, 0 to 2 percent slopes (WmA).— This nearly level to gently sloping soil is in areas that range in size from 20 to 225 acres. This soil is lower than Clareville, Floresville, and Miguel soils. Areas of this soil are irregular to subrounded in shape.

Included with this soil in mapping are small areas of Miguel soils in slightly higher areas in places, and Clareville soils, also in slightly higher areas, mostly on the outer fringes of areas of this mapping unit.

This soil is used for crops, range, or improved pasture. Some areas that were cultivated are now used for improved pasture or have been idle for several years. The soil is better suited to pasture or range than to other uses. The hazard of water erosion is moderate. Capability unit IVs-1 dryland; IIIs-1 irrigated; Hardland range site.

Yahola Series

The Yahola series consists of deep, calcareous, friable, nearly level to moderately steep loamy soils on bottom lands. These soils formed in slightly altered, loamy, calcareous alluvium.

In a representative profile the surface layer is calcareous, brown fine sandy loam about 15 inches thick. Below this is about 28 inches of calcareous, pale-brown fine sandy loam that has thin strata of loamy fine sand and silty clay loam, and about 17 inches of calcareous, light yellowish-brown fine sandy loam that has thin strata of loamy fine sand, fine sand, and silty clay loam. To a depth of 80 inches is calcareous, very pale brown loamy fine sand that has strata of fine sandy loam, silt loam, and fine sand.

These soils are well drained, and permeability is moderately rapid. Runoff is slow, and available water capacity is medium.

Most of the Yahola soils are used for range or pecan orchards. Small areas are used for improved pasture in places.

Representative profile of Yahola fine sandy loam in an area of Yahola-Karnes complex, 0 to 20 percent slopes, in range, 2.8 miles west of Stockdale on the old Stockdale-Floresville road; then below the bridge 50 feet west of Cibolo Creek and 75 feet south of road:

A1—0 to 15 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) moist; weak, fine, granular structure; hard, friable; many fine roots; few wormcasts; calcareous; moderately alkaline; gradual, smooth boundary.
C1—15 to 43 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; massive; slightly hard, very friable; thin strata of loamy fine sand and silty clay loam in lower part; calcareous; moderately alkaline; gradual boundary.
C2—43 to 60 inches, light yellowish-brown (10YR 6/4) fine sandy loam, yellowish brown (10YR 5/4) moist; massive; slightly hard, very friable; thin strata of loamy fine sand fine sand, or silty clay loam; calcareous; moderately alkaline; gradual boundary.
C3—60 to 80 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist-massive; slightly hard, very friable; strata of fine sandy loam, silt loam, and fine sand; calcareous; moderately alkaline.

These soils are calcareous throughout. Bedding planes are within 50 inches of the surface. All horizons are grayish brown, brown, pale brown, very pale brown, yellowish brown or light yellowish brown. Between depths of 10 to 40 inches is mostly fine sandy loam but in some places is loamy fine sand or loam. In most places the soil material is stratified with thin layers of silty clay loam, fine sandy loam, loamy fine sand, or fine sand. Between depths of 10 and 40 inches, clay makes up 5 to 18 percent of the soil material. These strata are discontinuous, and they range in thickness from a few inches to more than one foot.

Yahola soils in Wilson County are outside the range of the series in that the colors below the surface layer are yellower than defined for the series. This difference does not alter use and management.

Yahola-Karnes complex, 0 to 20 percent slopes (YkE).—These soils are nearly level on bottom lands and moderately steep on stream banks. They are closely associated in intricate patterns too long and narrow to map separately.

Yahola fine sandy loam makes up about 45 percent of this complex, Karnes fine sandy loam, about 35 percent, and other soils, about 20 percent. Yahola soils are on flood plains below the Karnes soils, which are on stream banks or escarpments to high terraces.

The Yahola soil has the profile described as representative of the Yahola series. The Karnes soil has a calcareous, brown fine sandy loam surface layer about 10 inches thick. Below this is about 28 inches of calcareous fine sandy loam that is brown in the upper part and pale brown in the lower part. The underlying material, to a depth of 52 inches, is calcareous, very pale brown fine sandy loam.

Included with these soils in mapping are small areas of a calcareous fine sand, similar to Yahola soils, adjacent to stream beds or on mounds in flood plains, and small areas of Aransas soils in flood plains. Also included are areas of Orthents, severely eroded. Gullies in these areas are 1 to 12 feet deep and 2 to 10 feet wide.

These soils are used mostly for range or pecan orchards, but some areas are used for improved pasture. The soils are not suited to cultivated crops because of the hazard of flooding. Overflow, enough to damage crops, occurs at least once each year. The hazard of water erosion is slight for Yahola soils and severe for the steeper Karnes soils. Capability unit Vw-2 dryland; Loamy Bottomland range site.

Zavala Series

The Zavala series consists of deep, noncalcareous, friable, nearly level loamy soils on bottom lands. These soils formed in recent loamy alluvial material.

In a representative profile the surface layer is noncalcareous, brown fine sandy loam about 14 inches thick. The underlying material, to a depth of 60 inches, is friable, noncalcareous, brown fine sandy loam that has thin strata of lighter and darker colored loam and loamy fine sand.

These soils are well drained, and permeability is moderately rapid. Runoff is slow, and available water capacity is medium.

Zavala soils are used mostly for range or improved pasture, but some small areas are cultivated. These soils are subject to occasional to frequent overflow.

Representative profile of Zavala fine sandy loam, 11 miles northwest of Floresville on U.S. Highway 181 to county road and 1 mile in a westerly direction on county road; then 50 feet from the western bank of Calaveras Creek and 50 feet from road:

A1—0 to 14 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, fine, granular structure; soft friable; many fine roots; slightly acid; gradual, smooth boundary.

C—14 to 60 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; massive; slightly hard, friable; common evident strata of loam and light yellowish-brown (10YR 6/4) loamy fine sand; noncalcareous; mildly alkaline.

All horizons are brown, light brown, pale brown, light yellowish brown, yellowish brown, or strong brown. The A horizon ranges from 6 to 20 inches in thickness.

Strata in the C horizon vary in thickness from $^{1}/_{4}$-inch to 24 inches. Clay makes up 5 to 18 percent of the soil material at a depth of 10 to 40 inches. Individual strata are loamy fine sand or loamy textures of silty clay loam to sandy loam.

Zavala fine sandy loam (Za).—This nearly level soil is on bottom lands. Slopes are 0 to 1 percent. Areas of this soil are much longer than they are wide. They range in size from 15 to 150 acres. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Leming soils in narrow bands on breaks to uplands. Also included are small areas of Gowen soils in slight depressions and a soil similar to Zavala soils but lighter in color and coarser in texture. This included soil is in narrow bands that border flood plains.

This soil is used mostly for range or improved pasture, but some areas are cultivated. A few areas of this soil are subject to overflow about once in 1 to 10 years, but water remains on the surface for only a few hours. The hazard of water erosion is slight. Capability unit IIc-4 dryland, I-4 irrigated; Loamy Bottomland range site.

Zavala fine sandy loam, frequently flooded (Zf). —This nearly level soil is on bottom lands of creeks and large field drainageways. Slopes are 0 to 1 percent.

This soil is slightly lower than Zavala fine sandy loam. Areas of this soil are long and narrow, and they range in size from 20 to 150 acres.

This soil has a surface layer of noncalcareous, brown fine sandy loam about 10 inches thick. The underlying material, to a depth of 60 inches, is noncalcareous, light-brown fine sandy loam that has thin strata of lighter and darker colored loamy fine sand, silty clay loam, and loam (fig. 25).

Included with this soil in mapping are small areas of a soil similar to Zavala soils but lighter in color and coarser in texture. This included soil is on low mounds near stream channels or on flood plains. Also included are small areas of Frio soils in slight depressions on flood plains.

This soil is used mainly for range, but some areas are in improved pasture. This soil floods after each heavy rain or at least once a year, which is enough to damage crops. The hazard of water erosion is slight. Capability unit Vw-2 dryland; Loamy Bottomland range site.

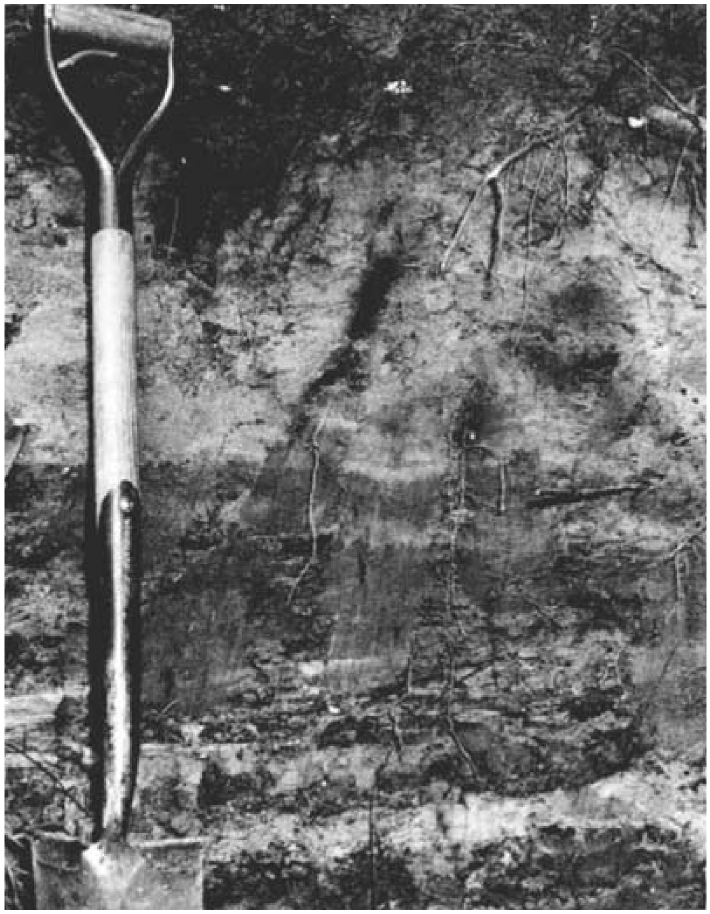

Figure 25.—Profile of Zavala fine sandy loam, frequently flooded, showing strata of light- and dark-colored material.

Use and Management of the Soils

This section discusses use and management of the soils of Wilson County for dryland and irrigated crops, for range, for wildlife, for recreation, and for engineering.

Capability Grouping

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

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

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. These are discussed in the following paragraphs.

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

Class I soils have few limitations that restrict their use.
Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.
Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

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

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

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Wilson County are described, and suggestions for the use and management of the soils are given.

Management by dryland capability units

The choice of crops that can be produced successfully on dryland soils is limited. The main crops are peanuts, grain sorghums, blackeyed peas, and watermelons, but peanuts and watermelons are limited to soils that have a loamy or sandy surface layer. The main pasture grasses are coastal bermudagrass, Kleingrass, blue panicum, johnsongrass, buffelgrass, and improved varieties of bluestems. The main concern in dryland farming is the limited, poorly distributed rainfall.

A good cropping system helps conserve moisture, control erosion, and maintain or improve tilth and fertility. The inclusion of grasses or a high-residue crop helps improve content of organic matter. Contour farming, terraces, diversion terraces, and other measures that control water are needed in some areas. Grassed waterways are needed if suitable terrace outlets are not available (fig. 26). The soils should be tilled only when it is necessary to prepare a seedbed or control weeds. In normal years and wet years, cultivated crops and pasture grasses respond to fertilization according to soil tests.

Figure 26.—A grassed waterway in an area of Coy clay loam, 1 to 4 percent slopes, that carries excess runoff from terraced fields without erosion.

In the following pages each of the dryland capability units in Wilson County is described, and suggestions for use and management of the soils are given. The dryland capability classification of each soil is given in the "Guide to Mapping Units."

Capability Unit IIe-1 Dryland

In this unit are deep, noncalcareous, well-drained, gently sloping soils. Permeability is slow to moderately slow.

The soils in this unit are easy to till. The subsoil material slows the movement of air, roots, and water. Available water capacity is medium. The hazard of water erosion is moderate.

Most of the acreage of these soils is cultivated. These soils are suited to peanuts, watermelon, grain sorghum, corn, cotton, small grains, truck crops, flax, forage sorghums, and most pasture grasses. The principal crops are peanuts, corn, and grain sorghum.

The main concerns of management are conserving moisture, maintaining or improving tilth, and controlling soil erosion. A suitable cropping system includes grain sorghums and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, and to prevent surface crusting. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIe-2 Dryland

Runge fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is moderate.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. Available water capacity is high. The hazard of water erosion is moderate.

Most of the acreage of this soil is cultivated. This soil is suited to peanuts, watermelon, grain sorghum, corn, small grains, truck crops, cotton, forage sorghums, and most pasture grasses. The principal crops are peanuts, grain sorghum, corn, and forage sorghums.

The main concerns of management are conserving moisture, controlling soil erosion, and maintaining or improving tilth. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, to prevent surface crusting, and to reduce evaporation of water from the soil. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIe-3 Dryland

Saspamco fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. It is deep, calcareous, well drained, and gently sloping. Permeability is moderately rapid. Available water capacity is medium.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. The hazard of water erosion is moderate.

About half the acreage of this soil is cultivated. This soil is suited to crops, such as small grains, that grow well in cool seasons and to most native grasses and pasture grasses. The principal crops are small grains, corn, and forage sorghums.

The main concerns of management are conserving moisture, preventing erosion, and maintaining or improving tilth. A suitable cropping system includes small grains or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, to prevent surface crusting, and to reduce evaporation of water from the soil. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIe-4 Dryland

In this unit are deep, calcareous, well-drained, gently sloping soils. Permeability is moderate to moderately rapid.

Available water capacity is medium to high. Air, roots, and water readily penetrate the soil material. The hazard of water erosion is moderate.

Most of the acreage of these soils is cultivated. These soils are suited to grain sorghum, corn, cotton, flax, small grains, truck crops, forage sorghums, and most pasture grasses. The principal crops are grain sorghum, corn, small grains, and forage sorghums.

The main concerns of management are conserving moisture, preventing soil erosion and surface crusting, and maintaining or improving tilth. A suitable crop-ping system includes grain sorghum or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, to prevent surface crusting, and to reduce evaporation of water from the soil. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIe-5 Dryland

Clareville clay loam, 1 to 3 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is moderately slow.

This soil is easy to till. Air, roots, and water readily penetrate the soil material. Available water capacity is high. The hazard of water erosion is moderate.

Most of the acreage of this soil is cultivated. This soil is suited to grain sorghum, corn, flax, small grains, truck crops, forage sorghums, cotton, and most pasture grasses. The principal crops are grain sorghum, corn, flax, and small grains.

The main concerns of management are conserving moisture, preventing soil erosion, and maintaining or improving tilth. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to increase water intake, to prevent surface crusting, and to maintain tilth. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIw-1 Dryland

Gowen clay loam is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderate. This soil is subject to occasional overflow, and it remains wet for longer periods after rains than other soils.

This soil is easy to till, but compacted layers form if the soil is plowed to the same depth every year. Air, roots, and water penetrate the soil material easily. Available water capacity is high. The hazard of water erosion is slight.

The soil is suited to grain sorghum, corn, small grains, forage sorghums, truck crops, cotton, and most pasture grasses. The principal crops are small grains, grain sorghum, forage sorghums, and corn.

The main concerns of management are maintaining tilth, avoiding compaction by varying plow depth from season to season, and controlling surface water. A suitable cropping system includes small grains and other crops that produce large amounts of residue. Crop residues left on the soil after harvest help to maintain tilth and to prevent compaction.

Capability Unit IIs-1 Dryland

In this unit are deep, calcareous to noncalcareous, well-drained, nearly level soils. Permeability is very slow.

These soils are not difficult to till, but tillage must be timely. Available water capacity is high. These soils impede the movement of air, roots, and water. The hazard of water erosion is slight.

These soils are suited to grain sorghums, corn, flax, small grains, cotton, truck crops, forage sorghums, and most pasture grasses. The principal crops are grain and forage sorghums, corn, and flax.

The main concerns of management are conserving moisture, maintaining tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depth from season to season. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to prevent compaction, and to maintain tilth.

Capability Unit IIs-2 Dryland

Floresville fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is slow.

The lower layers of this soil slow the movement of air, roots, and water. The hazard of erosion is slight, and available water capacity is medium.

This soil is suited to peanuts, watermelon, blackeyed peas, grain sorghum, corn, cotton, small grains, truck crops, flax, forage sorghums, and most pasture grasses. The principal crops are peanuts, small grains, corn, grain sorghum, and forage sorghums.

The main concerns of management are conserving moisture, preventing soil crusting, and maintaining tilth. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to prevent surface crusting, to maintain tilth, and to increase water intake.

Capability Unit IIc-1 Dryland

Clareville clay loam, 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderately slow.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. Available water capacity is high. The hazard of water erosion is slight.

Most of the acreage of this soil is cultivated. This soil is suited to grain sorghum, corn, flax, small grains, truck crops, forage sorghums, cotton, and most pasture grasses. The principal crops are grain sorghum, corn, flax, and small grains.

The main concerns of management are conserving moisture and maintaining or improving tilth. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to increase water intake, and to maintain tilth.

Capability Unit IIc-2 Dryland

Runge fine sandy loam 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderate.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. Available water capacity is high. The hazard of water erosion is slight.

Most of the acreage of this soil is cultivated. This soil is suited to peanuts, watermelon, grain sorghum, corn, small grains, truck crops, cotton, forage sorghums, and most pasture grasses. The principal crops are peanuts, grain sorghum, corn, and forage sorghums.

The main concerns of management are conserving moisture and maintaining or improving tilth. A suitable cropping system provides grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, to prevent surface crusting, and to reduce evaporation of water from the soil.

Capability Unit IIc-3 Dryland

Venus clay loam, 0 to 1 percent slopes, is the only soil in this unit. It is deep, calcareous, well drained, and nearly level. Permeability is moderate.

The surface layer of this soil is crusty. Free lime in the profile tends to make the soil somewhat droughty. Available water capacity is high. Air, roots, and water penetrate the soil material readily. The hazard of water erosion is slight.

This soil is suited to grain sorghum, corn, cotton, flax, small grains, truck crops, forage sorghums, and most pasture grasses. The principal crops are grain sorghum, corn, small grains, and forage sorghums.

The main concerns of management are conserving moisture and maintaining or improving tilth. A suitable cropping system includes grain sorghum or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, to prevent surface crusting, and to reduce evaporation of water from the soil.

Capability Unit IIc-4 Dryland

Zavala fine sandy loam is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderately rapid. This soil is flooded for short periods during years of above-average rain-fall or during high-intensity rainstorms.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. Available water capacity is medium.

Part of the acreage of this soil is cultivated, and part is used for pasture and range. This soil is suited to peanuts, watermelon, grain sorghum, corn, small grains, truck crops, forage sorghums, and most pasture grasses. The principal crops are corn, small grains, forage sorghums, peanuts, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture and maintaining or improving tilth. A suitable cropping system includes small grains or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to increase water intake, and to maintain tilth.

Capability Unit IIIe-1 Dryland

In this unit are deep, noncalcareous, well drained to moderately well drained, gently sloping soils. Permeability is very slow.

The soils in this unit are easy to till. Available water capacity is medium to high. The clay or sandy clay subsoils impede the movement of air, roots, and water. The hazard of water erosion is moderate.

Most of the acreage of these soils is cultivated. These soils are suited to peanuts, watermelon, blackeyed peas, grain sorghum, corn, small grains, truck crops, forage sorghums, and most pasture grasses. The principal crops are peanuts, grain sorghum, forage sorghums, small grains, corn, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture, maintaining or improving tilth, controlling erosion, and preventing surface crusting. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface of the soil after harvest help to conserve moisture, to improve tilth, and to prevent surface crusting. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIIe-2 Dryland

Tordia clay, 1 to 4 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is very slow.

The soil is difficult to till; it forms a poor seedbed if it is tilled when the surface layer is too wet or too dry. The clay in the soil impedes the movement of air, roots, and water. Available water capacity is high. The hazard of water erosion is moderate.

Most of the acreage of this soil is cultivated. This soil is suited to grain sorghum, forage sorghums, corn, small grains, and most pasture grasses. The principal crops are grain, sorghum, forage sorghums, corn, flax, small grains, and Coastal bermudagrass pastures.

The main concerns of management are conserving moisture, controlling erosion, preventing surface crusting, maintaining tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depth from season to season. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to prevent compaction and surface crusting, and to maintain tilth. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIIe-3 Dryland

In this unit are deep, calcareous to noncalcareous, well-drained, nearly level to gently sloping soils. Permeability is very slow.

These soils are difficult to till; to avoid compaction they must be cultivated when they are not too wet or too dry. Available water capacity is high. The clay in these soils impedes the movement of air, roots, and water. The hazard of water erosion is moderate.

These soils are suited to grain sorghum, corn, flax, small grains, cotton, truck crops, forage sorghums, and most pasture grasses. The principal crops are grain sorghum, forage sorghums, corn, flax, and small grains.

The main concerns of management are conserving moisture, controlling erosion, maintaining tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depth from season to season. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to increase water intake, to prevent surface crusting and compaction, and to maintain tilth. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIIe-4 Dryland

This capability unit consists of deep, noncalcareous, well-drained, gently sloping soils. Permeability is slow to moderately slow.

The soils in this unit are easy to till. The lower layers slow the movement of air, roots, and water. Available water capacity is medium. The hazard of water erosion is moderate to severe.

Most of the acreage of these soils is cultivated. These soils are suited to peanuts, watermelon, grain sorghum, corn, cotton, small grains, flax, forage sorghums, and most pasture grasses. The principal crops are peanuts, grain sorghum, corn, and small grains.

The main concerns of management are conserving moisture, controlling soil erosion, and maintaining or improving tilth. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the soil after harvest help to conserve moisture, to improve tilth, and to prevent surface crusting. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIIe-5 Dryland

Runge fine sandy loam, 3 to 5 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is moderate.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. Available water capacity is high. The hazard of water erosion is severe.

Most of the acreage of this soil is cultivated. This soil is suited to peanuts, watermelon, blackeyed peas, grain sorghum, corn, small grains, forage sorghums, and most pasture grasses. The principal crops are peanuts, corn, grain sorghum and forage sorghums, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture, controlling water erosion, and maintaining or improving tilth. A suitable cropping system includes grain sorghum or other crops that produce large amounts of residue. Crop residues left on the soil after harvest help to conserve moisture, to improve tilth, to prevent surface crusting, to control erosion, and to reduce evaporation of water from the soil. Terracing and contour farming help to control water erosion and to conserve soil moisture.

Capability Unit IIIe-6 Dryland

In this unit are deep, noncalcareous, well-drained to somewhat poorly drained, nearly level to gently sloping soils. Permeability is slow to very slow.

The soils in this unit are easy to till, but the lower layers slow or impede the movement of air, roots, and water. Available water capacity is low to medium. The hazards of water erosion and soil blowing are moderate.

Most of the acreage of these soils is cultivated. These soils are suited to peanuts, watermelon, blackeyed peas, corn, small grains, grain and forage sorghums, and most pasture grasses. The principal crops are peanuts, watermelon, blackeyed peas, small grains, grain sorghum, forage sorghums, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture, maintaining tilth, and controlling soil erosion. A suitable cropping system includes small grains, grain sorghum, and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve soil moisture, to improve tilth, to prevent surface crusting, and to reduce soil blowing and water erosion. Stripcropping also helps to control soil blowing.

Capability Unit IIIe-7 Dryland

Colibro sandy clay loam, 3 to 5 percent slopes, is the only soil in this unit. It is deep, calcareous, well drained, and gently sloping. Permeability is moderately rapid.

Available water capacity is medium. Air, roots, and water penetrate the soil material readily. The hazard of water erosion is moderate.

This soil is cultivated in places. It is suited to small grains, grain sorghum, forage sorghums, and most pasture grasses. The principal crops are small grains and forage sorghums.

The main concerns of management are conserving moisture, preventing soil erosion and surface crusting, and maintaining or improving tilth. A suitable crop-ping system includes grain sorghum, small grains, or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, to prevent surface crusting, and to reduce evaporation of water from the soil. Terracing and contour farming help to control water erosion and to conserve moisture.

Capability Unit IIIe-8 Dryland

Saspamco fine sandy loam, 3 to 5 percent slopes, is the only soil in this unit. It is deep, calcareous, well drained, and gently sloping. Permeability is moderately rapid.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. Available water capacity is medium. The hazard of water erosion is severe.

This soil is cultivated in places. It is suited to crops, such as small grains, that grow well in cool seasons, and to most native grasses and pasture grasses. The principal crops are small grains, corn, and forage sorghums.

The main concerns of management are conserving moisture, preventing soil erosion and surface crusting, and maintaining or improving tilth. A suitable cropping system includes small grains or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to prevent surface crusting, and to maintain tilth. Terracing and contour farming help to control water erosion and to conserve soil moisture.

Capability Unit IIIw-1 Dryland

Aransas clay is the only soil in this unit. It is deep, calcareous, poorly drained, and nearly level. Permeability is very slow. This Aransas soil is subject to occasional overflow, and it remains wet for longer periods after rains than other soils.

This soil is difficult to till, and tillage must be timely. Available water capacity is high. The movement of air, roots, and water is impeded in the lower layers. The hazard of water erosion is slight.

Most of the acreage of this soil is cultivated. This soil is suited to grain sorghum, cotton, truck crops, and most pasture grasses. The principal crops are grain sorghum, corn, small grains, forage sorghums, and johnsongrass pasture.

The main concerns of management are maintaining tilth avoiding compaction by not plowing too deeply and by varying plow depth from season to season, and by controlling surface water. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to maintain tilth and to prevent compaction.

Capability Unit IIIs-1 Dryland

In this unit are deep, noncalcareous, well drained to moderately well drained, nearly level soils. Permeability is very slow.

The soils in this unit are easy to till, but the lower layers impede the movements of air, roots, and water. Available water capacity is medium to high. The hazard of erosion is slight.

Most of the acreage of these soils is cultivated. These soils are suited to peanuts, watermelon, blackeyed peas, grain sorghum, forage sorghums, corn, small grains, truck crops, and most pasture grasses. The principal crops are peanuts, grain sorghum, forage sorghums, small grains, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture, maintaining or improving tilth, and preventing surface crusting. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to improve tilth, and to prevent surface crusting.

Capability Unit IIIs-2 Dryland

Karnes loam, 0 to 3 percent slopes, is the only soil in this unit. It is deep, calcareous, well drained, and nearly level to gently sloping. Permeability is moderately rapid.

This soil is easy to till. Air, roots, and water penetrate the soil material readily. This soil is droughty and some plants are affected by chlorosis (yellowing) because of the high content of lime. Available water capacity is medium. The hazard of water erosion is moderate.

Most of the acreage of this soil is cultivated. This soil is better suited to crops, such as small grains, that grow well in cool seasons than to other crops. The principal crops are small grains, grain sorghum, forage sorghums, corn, and Coastal bermudagrass or johnsongrass pasture.

The main concerns of management are conserving moisture, preventing soil erosion, preventing surface crusting, and maintaining or improving tilth. A suitable cropping system includes small grains or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to prevent surface crusting, and to maintain tilth. Terracing and contour farming help to conserve soil moisture and to reduce soil erosion.

Capability Unit IIIs-3 Dryland

Tordia clay, 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is very slow.

This soil is difficult to till. It forms a poor seedbed if the surface is too dry or too wet. The clayey soil impedes the movement of air, roots, and water. Available water capacity is high. The hazard of water erosion is slight.

Most areas of this soil are cultivated. The soil is suited to grain sorghum, forage sorghums, corn, small grains, and most pasture grasses. The principal crops are grain sorghum, forage sorghums, corn, flax, small grains, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture, preventing surface crusting, maintaining tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depths from season to season. A suitable cropping system includes grain sorghum and other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to prevent compaction and surface crusting, and to maintain or improve tilth.

Capability Unit IVe-1 Dryland

In this unit are deep, noncalcareous, well drained to moderately well drained, gently sloping soils. Permeability is very slow.

Rills, gullies, and thinner surface layers in places are evidences of erosion. Available water capacity is medium to high. The movement of air, roots, and water are impeded in the lower layers. The hazard of water erosion is severe.

Most areas of these soils were once cultivated but are now seeded to grass or are idle. These soils are best suited to an improved pasture grass such as Coastal bermudagrass. The principal crops are peanuts, grain sorghum, forage sorghums, corn, and Coastal bermudagrass pasture.

The main concerns of management are controlling erosion, conserving moisture, and improving tilth. In cultivated areas a suitable cropping system includes small grains, forage sorghums, or other crops that produce high residue. Crop residues left on the soil after harvest until the time for seeding the next crop help to control soil erosion and to conserve moisture. Terracing and contour farming also help to control water erosion and to conserve moisture. Grassed waterways are needed if suitable terrace outlets are not available.

Capability Unit IVe-2 Dryland

Floresville fine sandy loam, 2 to 5 percent slopes, eroded, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is slow.

Rills, gullies, and thinner surface layers are evidences of erosion. Available water capacity is medium. The movement of air, roots, and water are impeded in the clayey lower layers. The hazard of water erosion is severe.

Most of the acreage of this soil was once cultivated, but most areas are now seeded to grass or are idle. Small areas in larger areas of uneroded soils are still cultivated. This soil is better suited to an improved pasture grass such as Coastal bermudagrass than to other crops. The principal crops are peanuts, grain sorghum, forage sorghums, corn, small grains, and Coastal bermudagrass pasture.

The main concerns of management are controlling erosion, conserving moisture, and improving tilth. In cultivated areas a suitable cropping system includes small grains, forage sorghums, or other crops that produce high residue. Crop residue left on the soil until the time for seeding the next crop helps to control erosion and to conserve moisture. Terracing and contour farming also help to control water erosion and to conserve moisture. Grassed waterways are needed if suitable terrace outlets are not available.

Capability Unit IVe-3 dryland

Ustochrepts, shallow, is the only soil in this unit. It is shallow, noncalcareous, well drained and gently sloping. Permeability is slow. This soil is underlain by shaly sandstone.

The soil is difficult to till; it forms a poor seedbed if it is tilled when the surface layer is too wet or too dry. The clayey soil slows the movement of air, roots, and water. Available water capacity is low. The hazard of water erosion is moderate.

This soil is used for range and crops. It is suited to range, improved pasture, or such cool-season crops as small grains. Row crops are not suited to this soil. Moisture is a limitation, especially in years of low rainfall. The principal crops are small grains, grain sorghum, forage sorghums, corn, and johnsongrass pasture.

The main concerns of management are conserving moisture, controlling erosion, maintaining tilth, and avoiding compaction by plowing when not too wet and by varying plow depth from season to season. A suitable cropping system includes small grains and other close-growing crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to prevent compaction and surface crusting, and to maintain tilth.

Capabilities Unit IVe-4 Dryland

In this unit are deep, noncalcareous, well-drained, nearly level to sloping soils. Permeability is moderately rapid to slow.

These soils are easy to till, but the lower layers slow the movement of air, roots, and water. Lack of moisture is a concern, especially in years of low rainfall. Available water capacity is very low to medium. The hazard of water erosion is moderate, and the hazard of soil blowing is severe to moderate.

Most of the acreage of these soils is cultivated. These soils are suited to peanuts, watermelon, blackeyed peas, corn, small grains, grain sorghum, forage sorghums, and most pasture grasses. The principal crops are peanuts, watermelon, blackeyed peas, small grains, forage sorghums, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture, preventing soil erosion, and maintaining tilth. A suitable cropping system includes small grains, grain sorghum, forage sorghums, or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to control soil blowing and water erosion, and to improve tilth. Stripcropping also helps to control soil blowing.

Capability Unit IVs-1 Dryland

Willamar fine sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is deep, noncalcareous, somewhat poorly drained, and nearly level to gently sloping. Permeability is very slow.

The surface layer of this soil is hard and crusty. The movement of air, roots, and water is impeded in this soil. The soil material compacts if it is tilled when it is too dry or too wet. Available water capacity is low. The hazard of water erosion is moderate.

This soil is used for crops, pasture, and range. It is suited to grain and forage sorghums, small grains, corn, flax, truck crops, and most pasture grasses. The principal crops are grain sorghum, forage sorghums, corn, and Coastal bermudagrass pasture.

The main concerns of management are conserving moisture, preventing surface crusting, controlling erosion, maintaining tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depths from season to season. A suitable cropping system provides grain sorghum or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to conserve moisture, to control erosion, to prevent surface crusting and compaction, and to maintain tilth. Terraces and contour farming on gentle slopes help to control water erosion and to conserve moisture.

Capability Unit IVs-2 Dryland

In this unit are deep, noncalcareous, well-drained to somewhat excessively drained, undulating soils. Permeability is moderately slow to rapid.

Available water capacity is low. Air, roots, and water penetrate the soil material rapidly. The hazard of soil blowing is severe.

These soils are better suited to range or improved pasture than to other uses. They are used mostly for native range and improved Coastal bermudagrass pasture.

The main concern of management is establishing an adequate cover of vegetation to help to conserve moisture and to control soil blowing.

Capability Unit Vw-1 Dryland

In this unit are deep, noncalcareous, well-drained, nearly level soils on flood plains. Permeability is moderate to moderately rapid.

These soils are frequently flooded and are subject to scouring and deposition of fresh alluvial sediment during each overflow. Available water capacity is medium to high. Air, roots, and water easily penetrate the soil material. The hazard of water erosion is slight.

These soils are not suitable for cultivated crops because of flooding. They are better suited to range, improved pasture, or wildlife habitat than to other uses.

The main concern of management is maintaining an adequate cover of vegetation. Control of brush and weeds is needed in places.

Capability Unit Vw-2 Dryland

In this unit are deep, calcareous to noncalcareous, well-drained, nearly level to moderately steep soils. Permeability is moderately slow to moderately rapid. The soil material consists of mixed alluvial sediment on flood plains.

These soils are frequently flooded and are subject to scouring and deposition of fresh alluvial sediment during each overflow. Available water capacity is medium to high. Air, roots, and water easily penetrate the soil material. The hazard of erosion is slight to severe.

These soils are not suitable for cultivated crops because of flooding. They are better suited to range, improved pasture, pecan orchards, or wildlife habitat than to other uses.

The main concern of management is maintaining an adequate cover of vegetation. Control of brush and weeds is needed in places.

Capability Unit Vw-3 Dryland

In this unit are deep, calcareous to noncalcareous, poorly drained to somewhat poorly drained, nearly level soils. Permeability is very slow. The soil material consists of alluvial sediment on flood plains.

These soils are frequently flooded and are subject to scouring and deposition of fresh alluvial sediment during each overflow. Water is likely to stand on the surface for several days after heavy rains. Available water capacity is high. The lower layers of these soils impede the movement of air, roots, and water. The hazard of erosion is slight.

These soils are not suitable for cultivated crops because of flooding. They are better suited to range, improved pasture, pecan orchards, or wildlife habitat than to other uses.

The main concern of management is maintaining an adequate cover of vegetation. Control of brush and weeds is needed in places.

Capability Unit VIe-1 Dryland

Wilco loamy fine sand, 3 to 8 percent slopes, eroded, is the only soil in this unit. It is deep, noncalcareous, eroded, well drained and gently sloping to sloping. Permeability is slow.

Rills, gullies, and thinner surface layers are evidences of erosion. Available water capacity is medium. The lower layers impede the movement of air, roots, and water. The hazards of water erosion and soil blowing are severe.

Most of the acreage of this soil was once cultivated, but most areas are now seeded to grass or are idle, because the soil is too steep and too eroded to be cultivated. This soil is better suited to improved pasture, such as Coastal bermudagrass, or to wildlife habitat than to other uses. The principal crops when these soils were cultivated were peanuts and corn.

The main concerns of management are establishing an adequate cover of vegetation to help to control water erosion and soil blowing, to conserve moisture, and to maintain tilth. Brush and weed control are needed in most areas.

Capability Unit VIs-1 Dryland

Nocken stony soils are the only soils in this unit. They are moderately deep, noncalcareous, and well drained. They are underlain by sandstone.

Available water capacity is low. Air, roots, and water move slowly through the soil or their movement is impeded. The hazard of water erosion is severe.

These soils are too stony and, in places, too steep to cultivate. They are better suited to native vegetation and to some varieties of introduced grasses than to other plants. These soils are mostly used for range, but some areas are used as wildlife habitat and recreational areas.

The main concern of management is establishing an adequate cover of vegetation to increase the intake of water and to decrease the hazard of water erosion. Brush and weed control are needed in most areas.

Capability Unit VIs-2 Dryland

Vernia very gravelly loamy sand, 1 to 8 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping to sloping. Permeability is moderate.

Available water capacity is very low. Air, roots, and water easily penetrate the soil material. The soil is droughty.

This soil is not suitable for cultivated crops because of slopes and the very gravelly soil material. It is better suited to native vegetation than to other uses. It is used for range or is mined for road-fill material. Many gravel pits are in areas of this soil. The soil is also suited to wildlife habitat and recreation areas.

The main concern of management is keeping an adequate cover of grass and trees to conserve soil moisture and to control erosion.

Capability Unit VIIe-1 Dryland

Orthents, rolling, severely eroded, is the only soil in this unit. This soil has been so severely eroded that it is now dissected by many deep gullies and washes. Vegetative cover is very sparse, and some areas are bare.

Available water capacity is low. The exposed clayey materials impede or slow the movement of air, roots, and water. The hazard of water erosion is severe.

The soil has no value for farming. It is better suited to wildlife habitat, recreation, or water impoundment areas than to other uses. A few small areas of soil that has some value for grazing are included with this soil in mapping.

The main concerns of management are controlling water erosion and establishing a cover of vegetation.

Capability Unit VIIs-1 Dryland

Picosa loam, 1 to 8 percent slopes, is the only soil in this unit. It is very shallow to shallow, noncalcareous, well drained, and gently sloping to sloping. Permeability is moderate. This soil is underlain by weakly consolidated sandstone.

Available water capacity is very low, and the hazard of water erosion is severe.

This soil is better suited to range than to cultivated crops. It is mostly used for range.

The main concerns of management are controlling water erosion and conserving soil moisture. An adequate cover of grass is needed to reduce runoff, to conserve moisture, and to control water erosion. Brush and weed control are needed in most areas.

Capability Unit VIIIs-1 Dryland

Only the land type rock outcrop is in this capability unit. It is gently sloping to sloping, nearly barren, and too shallow and too droughty to support vegetation.

Rock outcrop has little value for farming. It is suitable only for use as wildlife habitat or recreation areas.

Management by irrigated capability units

Much of the acreage in Wilson County is suitable for irrigation but lacks an adequate supply of good-quality water. About 30,000 acres is irrigated, mainly by sprinkler systems that tap ground-water reservoirs, but surface irrigation is also used, mainly on the flood plains and terraces along the San Antonio River and Cibolo Creek.

The quality of the irrigation water is important in crop response. The local river and creek water is normally of good quality; dissolved salts make up 300 to 900 parts per million. Ground water is controlled by the rocks through which the water moves. Chemical analyses of 215 samples of water from 211 selected wells and springs in Wilson County show that the chemical quality of the ground water varies widely. Dissolved solids range from less than 100 parts per million to more than 6,000 parts per million *(3)*. The Carrizo Sand generally yields the best quality water, followed by the Queen City and Wilcox Group. The Jackson Group yields the poorest quality water.

In the following pages each of the irrigated capability units in Wilson County is described, and suggestions for use and management of the soils are given. The irrigated capability classification of each soil is given in the "Guide to Mapping Units."

Capability Unit I-1 Irrigated

Clareville clay loam, 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderately slow.

Available water capacity is high. Air, roots, and water penetrate the soil material easily. Runoff is slow, and the hazard of water erosion is slight.

Grain sorghum is the principal crop, but most crops grown in the county grow well on this soil.

Maintaining or improving tilth and using water correctly are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghum. Crop residues left on the surface after harvest help to control erosion, to improve tilth, and to increase water intake.

A surface or sprinkler irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit I-2 Irrigated

Runge fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderate.

Available water capacity is high. Air, roots, and water penetrate the soil material easily. Runoff is medium, and the hazard of erosion is slight.

Peanuts and grain sorghum are the principal crops, but most crops grown in the county grow well on this soil.

Maintaining or improving tilth and using water correctly are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghum or small grains. Crop residues left on the surface after harvest help to control erosion, to improve tilth, and to increase water intake.

A surface or sprinkler irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit I-3 Irrigated

Venus clay loam, 0 to 1 percent slopes, is the only soil is this unit. It is deep, calcareous, well drained, and nearly level. Permeability is moderate.

Available water capacity is high. Air, roots, and water penetrate the soil material easily. Runoff is slow, and the hazard of water erosion is slight.

Grain sorghum and corn are the principal crops, but small acreages are used for truck crops, small grains, forage sorghums, and johnsongrass pasture (fig. 27).

Figure 27.—Sorghum cut from silage in an area of Venus clay loam, 0 to 1 percent slopes, that was leveled for irrigation. The yield was about 23 tons per acre.

Maintaining or improving tilth and using water correctly are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghum. Crop residues left on the surface after harvest help to control erosion, to improve tilth, and to increase water intake.

A surface or sprinkler irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion.

Land leveling is needed in some places where surface systems are used.

Capability Unit IIe-1 Irrigated

Zavala fine sandy loam is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderately rapid.

This soil is occasionally flooded for short periods during years of above-average rainfall. Available water capacity is medium. Air, roots, and water easily penetrate the soil material. Runoff is slow, and the hazard of water erosion is slight.

Peanuts and corn are the principal crops, but most crops grown in the county grow well on this soil.

Maintaining or improving tilth and using water correctly are the main concerns of management. A suitable cropping system provides small grains, grain sorghums, or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to control erosion, to improve tilth, and to increase water intake.

Surface and sprinkler irrigation systems are suitable for the soil in this unit. A system of either type is needed to apply irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIe-1 Irrigated

In this unit are deep, noncalcareous, well drained, gently sloping soils. Permeability is moderately slow to slow.

Available water capacity is medium. The lower layers impede the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult because of the clayey lower layers. Runoff is medium, and the hazard of water erosion is moderate.

Peanuts and corn are the principal crops, but most crops grown in the county grow well on these soils.

Controlling erosion, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to improve tilth, and to increase water intake. Terracing and contour farming help to control erosion and to conserve moisture.

Surface and sprinkler irrigation systems are suitable for the soils in this unit. A system of either type is needed to apply the necessary irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIe-2 Irrigated

Runge fine sandy loam, 1 to 3 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is moderate.

Available water capacity is high. Air, roots, and water easily penetrate the soil material. Runoff is medium, and the hazard of water erosion is moderate.

Peanuts and grain sorghum are the principal crops, but most crops grown in the county grow well on this soil.

Controlling erosion, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghum or small grains. Crop residues left on the surface after harvest help to control erosion, to improve tilth, and to increase water intake. Terracing and contour farming help to control erosion and to conserve moisture.

Surface and sprinkler irrigation systems are suitable for the soil in this unit. A system of either type is needed to apply the necessary irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIe-3 Irrigated

Clareville clay loam, 1 to 3 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is moderately slow.

Available water capacity is high. Air, roots, and water easily penetrate the soil material. Runoff is medium, and the hazard of water erosion is moderate.

Grain sorghum is the principal crop, but most crops grown in the county grow well on this soil.

Controlling erosion, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghums. Crop residues left on the surface after harvest help to control erosion, to improve tilth, and to increase water intake. Terracing and contour farming help to control erosion and to conserve moisture.

Surface and sprinkler irrigation systems are suit-able for the soil in this unit. A system of either type is needed to apply the necessary irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIe-4 Irrigated

In this unit are deep, calcareous, well drained, and gently sloping soils. Permeability is moderately rapid to moderate.

Available water capacity is medium to high. Air, roots, and water penetrate the soil material easily. Runoff is slow to medium, and the hazard of water erosion is moderate.

Grain sorghum and corn are the principal crops, but small acreages are used for truck crops, small grains, flax, forage sorghums, and johnsongrass pasture.

Controlling erosion, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to prevent surface crusting, to improve tilth, and to increase water intake. Terracing and contour farming help to control erosion and to conserve moisture.

Surface and sprinkler irrigation systems are suitable for the soils of this unit. A system of either type is needed to apply the necessary irrigation water to meet soil and crop needs without waste and erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIw-1 Irrigated

Gowen clay loam is the only soil in this capability unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is moderate.

This soil is occasionally flooded, and it remains wet for longer periods after rains than other soils. Available water capacity is high. Air, roots, and water easily penetrate the soil material. Runoff is slow, and the hazard of erosion is slight.

Corn and grain sorghum are the principal crops, but most crops grown in the county grow well on this soil.

Maintaining or improving tilth, using water correctly, and avoiding compaction by timely plowing are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghum. Crop residues left on the surface after harvest help to maintain or improve tilth, to increase water intake, and to prevent compaction. Controlling outside water is needed in places.

A surface or sprinkler irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIs-1 Irrigated

In this unit are deep, calcareous to noncalcareous, well-drained to poorly drained, nearly level soils. Permeability is very slow.

Available water capacity is high. The lower layers impede the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is very difficult because of the clayey lower layers. Runoff is slow to very slow, and the hazard of water erosion is slight.

Grain sorghum and corn are the principal crops, but small acreages are used for flax, small grains, forage sorghums, truck crops, and johnsongrass pasture.

Using water correctly, maintaining or improving tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depths from season to season are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghum. Crop residues left on the surface after harvest help to control soil erosion, to improve tilth, and to prevent compaction.

An irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion.

Capability Unit IIs-2 Irrigated

In this unit are deep, noncalcareous, well drained to moderately well drained, nearly level soils. Permeability is very slow.

Available water capacity is medium to high. The lower layers impede the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult. Runoff is slow, and the hazard of water erosion is slight.

Peanuts and Coastal bermudagrass pasture are the principal crops, but small acreages of truck crops, corn, forage sorghums, and grain sorghum are grown on these soils.

Maintaining or improving tilth, preventing surface crusting, and using water correctly are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of grain sorghum. Crop residues left on the surface after harvest help to prevent surface crusting, to improve tilth, and to increase water intake.

A surface or sprinkler irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIs-3 Irrigated

Karnes loam, 0 to 3 percent slopes, is the only soil in this unit. It is deep, calcareous, well drained, and nearly level to gently sloping. Permeability is moderately rapid.

This soil has a crusty surface layer. Air, roots, and water penetrate the soil material easily. Available water capacity is medium. The high content of lime causes chlorosis, or yellowing, of plants in places. Runoff is slow to medium, and the hazard of water erosion is moderate.

Grain sorghum and corn are the principal crops, but small acreages of truck crops, small grains, forage sorghums, and johnsongrass pasture are grown on this soil.

Maintaining or improving tilth, controlling erosion, preventing surface crusting, and using water correctly are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of small grains or grain sorghum. Crop residues left on the surface after harvest help to control erosion, to prevent surface crusting, to maintain or improve tilth, and to increase water intake.

A surface or sprinkler irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIs-4 Irrigated

Floresville fine sandy loam, 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level. Permeability is slow.

Available water capacity is medium. The clayey lower layers slow the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult because of this clayey lower layer. Runoff is slow, and the hazard of water erosion is slight.

Peanuts and corn are the principal crops, but most crops grown in the county grow well on this soil.

Maintaining or improving tilth and using water correctly are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to improve tilth, and to increase water intake.

Surface and sprinkler irrigation systems are suitable for the soil in this unit. A system of either type is needed to apply irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIIe-1 Irrigated

In this unit are deep, noncalcareous, well drained to moderately well drained, gently sloping soils. Permeability is very slow.

Available water capacity is medium to high. The lower layers impede the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult. Runoff is medium, and the hazard of water erosion is moderate.

Peanuts and Coastal bermudagrass pasture are the principal crops, but small acreages of truck crops, corn, forage sorghums, and grain sorghum are also grown on these soils.

Controlling erosion, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to prevent surface crusting, to improve tilth, and to increase water intake. Terracing and contour farming help to control erosion and to conserve moisture.

Surface and sprinkler irrigation systems are suitable for the soils in this unit. A system of either type is needed to apply the needed irrigation water without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIIe-2 Irrigated

Tordia clay, 1 to 4 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and gently sloping. Permeability is very slow.

Available water capacity is high. The underlying layers impede the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult. Runoff is medium, and the hazard of water erosion is moderate.

Grain sorghum, forage sorghums, and corn are the principal crops, but small acreages of flax and small grains are also grown on this soil.

Controlling erosion, using water correctly, maintaining or improving tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depths from season to season are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to prevent surface crusting, to improve tilth, and to prevent soil compaction. Terracing and contour farming help to control erosion and to conserve moisture.

An irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion.

Capability Unit IIIe-3 Irrigated

In this unit are deep, calcareous to noncalcareous, well-drained, nearly level to gently sloping soils. Permeability is very slow.

Available water capacity is high. The lower layers impede the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult. Runoff is medium, and the hazard of water erosion is moderate.

Grain sorghum and corn are the principal crops, but small acreages are used for flax, cotton, small grains, forage sorghum, and truck crops.

Controlling erosion, using water correctly, maintaining or improving tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depths from season to season are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to improve tilth, to increase water intake, and to prevent compaction. Terracing and contour farming help to control erosion and to conserve moisture.

An irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion.

Capability Unit IIIe-4 Irrigated

In this unit are deep, noncalcareous, well-drained, gently sloping soils. Permeability is slow to moderately slow.

Available water capacity is medium to high. Air, roots, and water move slowly through the soil material. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult. Runoff is medium to rapid, and the hazard of water erosion is moderate to severe.

Peanuts and corn are the principal crops, but most crops grown in the county are suited to these soils.

Controlling erosion, preventing surface crusting, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to improve tilth, to prevent surface crusting, and to increase water intake. Terracing and contour farming help to control erosion and to conserve moisture.

A sprinkler irrigation system is needed to help provide timely applications of irrigation water to meet soil and crop needs without waste or erosion.

Capability Unit IIIe-5 Irrigated

In this unit are deep, noncalcareous well-drained to somewhat poorly drained, nearly level to gently sloping soils. Permeability is slow to very slow.

Available water capacity is medium to low. The lower layers slow or impede the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations in the root zone is difficult. Runoff is slow to medium, and the hazards of soil blowing and water erosion are moderate.

Peanuts are the principal crop, but small acreages are used for watermelon, blackeyed peas, corn, grain sorghum, forage sorghums, and Coastal bermudagrass pasture.

Controlling erosion, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system includes small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residue left on the surface until the time for seeding the next crop reduces soil blowing and water erosion. It also helps to maintain or improve tilth. Stripcropping also helps to control soil blowing.

A sprinkler irrigation system helps to apply irrigation water to meet soil and crop needs without waste or erosion. Surface irrigation systems are not suitable for these soils.

Capability Unit IIIe-6 Irrigated

In this unit are deep, noncalcareous, well-drained, nearly level to sloping soils. Permeability is moderately rapid to slow.

Available water capacity is medium to very low. The lower layers slow the movement of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult. Runoff is slow to very slow; the hazard of soil blowing is moderate to severe, and the hazard of water erosion is moderate.

Peanuts are the principal crop, but small acreages are used for watermelon, blackeyed peas, corn, small grains, and forage sorghums.

Controlling erosion, using water correctly, and maintaining or improving tilth are the main concerns of management. A suitable cropping system includes small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residue left on the surface until the time for seeding the next crop reduces soil blowing and water erosion. It also helps to maintain or improve tilth. Stripcropping also helps to control soil blowing.

A sprinkler irrigation system helps to apply irrigation water to meet soil crop needs without waste or erosion. Surface irrigation systems are not suitable for these soils.

Capability Unit IIIe-7 Irrigated

In this unit are deep, calcareous, well-drained, gently sloping soils. Permeability is moderately rapid.

Available water capacity is medium. Air, roots, and water penetrate the soil material readily. Runoff is slow to medium, and the hazard of water erosion is moderate.

Grain sorghum and corn are the principal crops, but small acreages are used for small grains, flax, forage sorghums, and johnsongrass pasture.

Controlling erosion, using water correctly, preventing surface crusting, and maintaining or improving tilth are the main concerns of management. A suitable cropping system includes small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to prevent surface crusting, to improve tilth, and to increase water intake. Terracing and contour farming help to control erosion and to conserve moisture.

A sprinkler irrigation system helps to apply irrigation water to meet soil and crop needs without waste or erosion. Surface irrigation systems are not suitable for these soils.

Capability Unit IIIs-1 Irrigated

Willamar fine sandy loam, 0 to 2 percent slopes, is the only soil in this unit. It is deep, noncalcareous, somewhat poorly drained, and nearly level to gently sloping. Permeability is very slow.

The surface layer of this soil is hard and crusty. The lower layers impede the movements of air, roots, and water. If low-quality irrigation water is used, the leaching of salt accumulations from the root zone is difficult. Available water capacity is low. Runoff is slow to very slow, and the hazard of water erosion is moderate.

Grain sorghum, forage sorghums, and corn are the principal crops, but small acreages are used for small grains, flax, and Coastal bermudagrass pastures.

Controlling erosion, using water correctly, preventing surface crusting, maintaining or improving tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depths from season to season are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface after harvest help to control erosion, to prevent surface crusting and compaction, to increase water intake, and to improve tilth. Terracing and contour farming help to control erosion and to conserve moisture.

A surface or sprinkler irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion. Land leveling is needed in some places where surface systems are used.

Capability Unit IIIs-2 Irrigated

Tordia clay, 0 to 1 percent slopes, is the only soil in this unit. It is deep, noncalcareous, well drained, and nearly level.

Permeability is very slow. Available water capacity is high. The clayey underlying layers impede the movement of air, roots, and water. Runoff is slow, and the hazard of water erosion is slight.

Grain sorghum and forage sorghums are the principal crops, but small acreages are used for corn, small grains, and Coastal bermudagrass pasture.

Preventing surface crusting, using water correctly, maintaining or improving tilth, and avoiding compaction by plowing when the soil is not too wet and by varying plow depths from season to season are the main concerns of management. A suitable cropping system provides small grains, grain sorghum, or other crops that produce large amounts of residue. Crop residues left on the surface help to control erosion, to prevent surface crusting and soil compaction, and to improve tilth.

An irrigation system is needed to apply the correct amount of irrigation water to meet soil and crop needs without waste or erosion.

Capability Unit IIIs-3 Irrigated

In this unit are deep, noncalcareous, moderately well drained to somewhat excessively drained, undulating soils. Permeability is moderately slow to rapid.

Available water capacity is low. Air, roots, and water penetrate the soil material easily. Runoff is slow to very slow, and the hazard of soil blowing is severe.

Improved Coastal bermudagrass pasture is the principal irrigated crop, but small acreages are used for peanuts, watermelon, and corn.

Controlling soil blowing, using water correctly, and maintaining tilth are the main concerns of management. A suitable cropping system provides for small grains or other crops that produce large amounts of residue. Crop residues left on the surface until the time for seeding the next crop help to control soil blowing, to improve soil tilth, and to conserve moisture. Stripcropping also helps to reduce the hazard of soil blowing.

A sprinkler irrigation system helps to apply irrigation water to meet soil and crop needs without waste or erosion. Surface irrigation systems are not suitable for these soils.

Capability Unit IVe-1 Irrigated

In this unit are deep, noncalcareous, well drained to moderately well drained, gently sloping to sloping soils. Permeability is slow to very slow.

Rills, gullies, and thinner surface layers are evidence of erosion. Available water capacity is medium to high. The lower layers slow or impede the movement of air, roots, and water. Runoff is slow to rapid, and the hazard of water erosion is severe.

Peanuts, watermelons, and corn are the principal crops, but small acreages are used for grain sorghum, forage sorghums, blackeyed peas, and Coastal bermudagrass pasture.

Controlling erosion, conserving moisture, and improving tilth are the main concerns of management. A suitable cropping system provides for large amounts of residue, such as that left after harvest of small grains or grain sorghum. Crop residues left on the surface until the time for seeding the next crop help to control erosion, to conserve moisture, and to improve tilth.

A sprinkler irrigation system helps to apply irrigation water to meet soil and crop needs without waste or erosion. Surface irrigation systems are not suitable for these soils.

Predicted Yields

Table 2 lists predicted yields of the principal crops grown in the county. The predictions are based on records kept by farmers, on observations and experiences of soil scientists and others who have knowledge of yields in the county, and on information taken from research data. Predicted yields are average yields per acre that can be expected on good commercial farms managed at a level that produces the highest economic return.

Yields are given for both dryland and irrigated soils if the soils are used for both methods of farming. If only one method is practical, yields for only this method are given. Not included in this table are soils that are used only as range or for recreation.

Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included because their acreage is small or because reliable data on yields are not available.

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

In dryland areas—

1. Rainfall is effectively used and conserved.
2. Surface and subsurface drainage systems are installed where needed.
3. Residue is managed to maintain soil tilth.
4. Minimum but timely tillage is used.
5. Insect-, disease-, and weed-control measures are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Adapted crop varieties are used at recommended seeding rates.

In irrigated areas, these additional practices are used—

8. Suitable quality irrigation water is used.
9. Irrigation is timed to meet the needs of the soil and of the crop.
10. Irrigation systems are properly designed and efficiently used.

Use of the Soils for Range

By R. J. Pederson, field specialist, range, Soil Conservation Service.

This section contains information about the use of soils as range in Wilson County. It also explains range condition classes and describes the range sites in the county.

Livestock raising is one of the major enterprises of the county. Range used for grazing makes up about 35 percent of the total area of the county. Several ranches in the county vary in size from 500 to 7,000 acres. Livestock farms, which outnumber ranches, use between 10 and 400 acres of range as sources of forage. On these farms the stock is given supplemental forage and feed grown on cropland. Range is also used for grazing and as habitat for deer and other wildlife, as recreation areas, for scenery or open spaces, for wood products, and as an area for underground water storage.

The largest area of range is in the northern part of the county in an area called the Sand Hills. The deep sandy soil in that area produces a savannah of post oak and mid tall grasses which is best suited to range. Other areas used as range are in the southeastern and southwestern sections of the county. The soils in those areas are deep, alkaline, and clayey. They are suited to growing grass for livestock. Also, much of the bottom land along the San Antonio River and Cibolo Creek is in native vegetation and is used for grazing, as wildlife habitat, and for recreation.

The original plant cover in Wilson County consisted principally of mid and tall grasses and associated forbs. Continuous heavy grazing for many years has resulted in deterioration of the plant cover, excessive crusting of the soil, more rapid runoff, and lower forage production. The better forage plants have declined and have been replaced by weeds, brush, and shorter grasses.

The success of the stockman in producing forage and protecting the soil depends largely upon keeping abundant good forage plants growing vigorously. This is done primarily by selecting the kind of livestock to which the range is well suited, limiting grazing to protect the plant cover, and making seasonal adjustments in the number of livestock to make the best use of the available forage.

Range sites and condition classes

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

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community that reproduces itself and does not change as long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing there when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

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

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

Invaders are plants that cannot compete with plants in the climax plant community for moisture, nutrients, and light. Hence, invaders come in and grow along with increasers after the climax vegetation has been reduced by grazing. Many are annual weeds, and some are shrubs that have some grazing value, but others have little value for grazing.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow there.

A range is in excellent condition if 76 to 100 percent of the vegetation is of the original, or climax stand. It is in good condition if the percentage is 51 to 75; in fair condition if the percentage is 26 to 50; and in poor condition if the percentage is less than 25.

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

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

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

Descriptions of range sites

In the following pages the range sites of Wilson County are described and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when it is in excellent condition. To find the range site in which each soil has been placed, refer to the "Guide to Mapping Units."

Clay Loam range site

The soils in this site are deep, nearly level to gently sloping clay loams. Permeability is moderate to moderately slow, and available water capacity is high.

The climax plant community is grassland and a few shrubs and forbs. The approximate species composition, by weight, is little bluestem and four flower trichloris, 35 percent; pinhole bluestem and silver bluestem, 10 percent; plains bristlegrass and spike bristlegrass, 5 percent; side-oats grama, buffalograss, and vine-mesquite, 15 percent; plains lovegrass and meadow dropseed, 10 percent; Texas wintergrass, 5 percent; other grasses, 15 percent: and such forbs as engelmanndaisy, sensitivebrier, bundleflower, zexmenia, and others, 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy use are little bluestem and trichloris. Buffalograss and Texas wintergrass increase and dominate in places when this site is in lowered condition. Whitebrush, mesquite, and other woody plants are the common invaders.

Total annual yield on range in excellent condition is approximately 5,500 pounds air-dry herbage in years of favorable growing conditions and 3,000 pounds in dry years.

Clayey Bottomland range site

The soils in this site are deep, nearly level clays. Permeability is very slow, and available water capacity is high. These soils are adjacent to the San Antonio River and Cibolo Creek and their main tributaries. Because it receives extra water from runoff or flooding, this site has a good potential for a mixture of trees, grasses, and forbs.

The climax plant community is a mixture of trees, shrubs, cool-season and warm-season grasses, and forbs. The approximate species composition, by weight, is oak, elm, hackberry, pecan and woody vines and shrubs, 10 percent; little bluestem, switchgrass, and fourflower trichloris, 35 percent; Virginia wildrye, Texas wintergrass, and southwestern bristlegrass, 25 percent; vine mesquite, buffalograss, white tridens, and others, 25 percent; and such forbs as engelmanndaisy, yellow neptunia, spring aster, blood ragweed, and annuals, 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are the tall, warm-season grasses. The short- and cool-season grasses, trees, shrubs, and forbs increase in the plant community. This site provides good habitat for wildlife, and it is also used for recreation. Woody plants can be managed mechanically.

Total annual yield on range in excellent condition is approximately 6,000 pounds air-dry herbage in years of favorable growing conditions and 4,000 pounds in dry years.

Deep Sand range site

Sarita fine sand, 0 to 5 percent slopes, is the only soil in this site. It is deep and nearly level to gently sloping. Permeability is moderately rapid, and available water capacity is very low. Deep-rooted plants grow better than other plants in this soil.

The climax plant community is open grassland and live oak. The approximate species composition, by weight, is little bluestem, 60 percent; crinkleawn, indiangrass, and switchgrass, 15 percent; brownseed paspalum, 10 percent; other grasses, 5 percent; such forbs as snoutbean, western indigo, bullnettle, and annuals, 5 percent; and live oak, 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are bluestem, switchgrass, and indiangrass. Basamscale, fringeleaf paspalum, and three-awn increase in the plant community. If overuse is prolonged, annual forbs, red lovegrass, and grassbur dominate, and mesquite commonly invades. Range seeding is difficult on this site because of the hazard of soil blowing and the rapid drying of the surface.

Total annual yield on range in excellent condition is approximately 5,000 pounds air-dry herbage in years of favorable growing conditions and 2,000 pounds in dry years.

Deep Sand Savannah range site

Eufaula and Patilo soils, undulating, are the only soils in this site. They are undulating fine sands. Permeability is rapid to moderately slow, and available water capacity is low. Air, roots, and water rapidly penetrate the soils.

The climax plant community is savannah that includes oak, hickory, tall grasses, and some shrubs and forbs. The approximate species composition, by weight, is post oak, blackjack oak, hickory, beautyberry, greenbrier, and other shrubs, 15 percent; little bluestem, 50 percent; indiangrass, 10 percent; sand lovegrass, beaked panicum, crinkle-awn, switchgrass, brownseed paspalum, and purpletop, 10 percent; fringeleaf paspalum, mourning lovegrass, fall witchgrass, and other grasses, 10 percent, and such forbs as tickclover, snoutbean, tephrosia, and annuals, 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are little bluestem, indiangrass, switchgrass, and sand lovegrass. Oak and annual forbs increase, and such plants as yankeeweed, smutgrass, pricklypear, cactus, and low brush become abundant if continuous heavy grazing is prolonged.

This site is difficult to reseed because of the hazard of soil blowing and the rapid drying of the surface. The woody plant cover can be controlled (fig. 28).

Total annual yield on range in excellent condition is approximately 5,000 pounds air-dry herbage in years of favorable growing conditions and 2,000 pounds in dry years.

Gray Sandy Loam range site

The soils in this site are deep, nearly level to gently sloping loams, sandy clay loams, and fine sandy loams. Permeability is moderately rapid. These soils are droughty because of their high content of lime and their crusty surface layers. Available water capacity is medium.

Figure 28.—Effects of brush control on Patilo fine sand in the Deep Sand Savannah range site. The partial kill of post oak trees allowed more light, which increased grass production.

The climax plant community is open grassland and scattered shrubs. The approximate species composition, by weight, is twoflower and fourflower trichloris, 25 percent; Arizona cottontop, pinhole bluestem, and silver bluestem, 10 percent; green sprangletop and lovegrass tridens, 10 percent; plains bristlegrass, 15 percent; vine mesquite, curly mesquite, and buffalograss, 10 percent; plains lovegrass, hooded windmillgrass, fall witchgrass, and others, 20 percent; such low brush as Texas kidneywood, blackbrush, spiny hackberry, and vine ephedra, 5 percent; and snoutbean, bundleflower, bushsunflower, orange zexmenia, and other forbs, 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are trichloris, cottontop, green sprangletop, and plains lovegrass. Buffalograss, curly mesquite, and hooded windmillgrass increase in the plant community. The brush species increase, invade, and eventually dominate, but when this occurs the site can be reseeded, and brush can be controlled.

Total annual yield on range in excellent condition is approximately 4,000 pounds air-dry herbage in years of favorable growing conditions and 2,000 pounds in dry years.

Hardland range site

Willamar fine sandy loam, 0 to 2 percent slopes, is the only soil in this site. It is deep and nearly level to gently sloping. Permeability is very slow, and available water capacity is low.

The climax plant community is grassland. The approximate species composition, by weight, is fourflower trichloris and little bluestem, 25 percent; Arizona cottontop and pink pappusgrass, 25 percent; plains lovegrass, sideoats grama, vine mesquite, and pinhole bluestem, 25 percent; buffalograss and curly mesquite, 10 percent; spike lovegrass, sedges, Texas wintergrass, and other grasses, 10 percent; and such forbs as ruellia and annuals, 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are bluestem, trichloris, and plains lovegrass. Short grasses and Texas wintergrass increase in the plant community. Annual forbs and grasses and many species of low brush invade and dominate when this site is in poor condition.

Total annual yield on range in excellent condition is approximately 5,000 pounds air-dry herbage in years of favorable growing conditions and about 3,000 pounds in dry years.

Loamy Bottomland range site

The soils in this site are deep, nearly level to moderately steep fine sandy loams, clay loams, and silty clay loams on low terraces of flood plains. These soils receive extra water from runoff and flooding. Permeability is moderately slow to moderately rapid, and available water capacity is medium to high.

The climax plant community is a mixture of trees, shrubs, grasses, and forbs. The approximate species composition, by weight, is fourflower trichloris and little bluestem, 40 percent; big cenchrus, switchgrass, and southwestern bristlegrass, 15 percent; Texas wintergrass and Virginia wildrye, 10 percent; side-oats grama, plains bristlegrass, and vine mesquite, 15 percent; and other grasses, 15 percent. Pecan, elm, live oak, hackberry, and woody vines and shrubs and such forbs as spiderlily, hairy ruellia, snoutbean, and others make up the remaining 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are bluestem and switchgrass. Trees, woody plants, Texas wintergrass, and forbs increase in the plant community. This site provides good habitat for wildlife, and it is also used for recreation. Woody plants can be controlled and managed mechanically.

Total annual yield on range in excellent condition is approximately 6,500 pounds air-dry herbage in years of favorable growing conditions and 3,500 in dry years.

Loamy Sand range site

The soils in this site are deep, nearly level to sloping loamy fine sands. Permeability is slow to very slow. Available water capacity is low to medium.

The climax plant community is grassland and scattered oak. The approximate species composition, by weight, is little bluestem or seacoast bluestem, crinkle-awn, and switchgrass, 50 percent; brownseed paspalum, 10 percent; side-oats grama, cottontop, pinhole bluestem, and silver bluestem, 10 percent; knotroot panicum, plains bristlegrass, and fall witchgrass, 10 percent; fringeleaf paspalum and hooded windmillgrass, 10 percent; such forbs as bushsunflower, orange zexminia, snoutbean, western indigo, and gayfeather, 5 percent; and such woody plants as live oak, post oak, hackberry, and others, 5 percent. Nearly all species are of value for grazing by cattle.

Bluestem, switchgrass, and crinkle-awn decrease with continuous heavy grazing. Fringeleaf paspalum and hooded windmillgrass increase and annual forbs become abundant in the plant community. Mesquite and pricklypear commonly invade (fig. 29).

Total annual yield on range in excellent condition is approximately 4,000 pounds air-dry herbage in years of favorable growing conditions and 2,000 pounds in dry years.

Rolling Blacklands range site

The soils in this site are deep, nearly level to gently sloping clays to clay loams. Permeability is very slow, and available water capacity is high. Cracks more than 20 inches deep form in these soils when they are dry.

Figure 29.—Area of a Wilco loamy fine sand in an area of overgrazed Loamy Sand range site. A dense growth of mesquite, prickly-pear, and other brush and low-growing grasses and weeds have invaded the area.

The climax plant community is grassland dominated by mid and short grasses. The approximate species composition, by weight, is side-oats grama, vine mesquite, and twoflower trichloris, 25 percent; Texas cupgrass and pinhole bluestem, 20 percent; plains lovegrass, 10 percent; plains bristlegrass and Texas wintergrass, 15 percent; buffalograss and curly mesquite, 15 percent; other grasses, 10 percent; and perennials and annuals forbs, 5 percent. Nearly all species produce forage for livestock.

The climax plants decrease with continuous heavy grazing by cattle are plains lovegrass, vine mesquite, side-oats grama, and bluestems. Buffalograss, curly mesquite, and Texas wintergrass increase in the plant community. Red grama, Texas grama, mesquite, and low brush invade, but when this occurs the site can be reseeded and brush can be controlled (fig. 30).

Total annual yield on range in excellent condition is approximately 4,000 pounds air-dry herbage in favor-able years and 2,500 pounds in dry years.

Sandstone Hills range site

Nocken stony soils and Rock outcrop, 1 to 8 percent slopes, are in this site. They are deep, gently sloping to sloping fine sandy loams and rock outcrops on low hills and long, narrow ridgetops (fig. 31). Permeability is moderately slow. Available water capacity is low.

The climax plant community is moderate-sized savannah and stunted post oak and blackjack oak associated with grasses and forbs. The approximate species composition, by weight, is little bluestem, 45 percent; indiangrass, purpletop, and sand lovegrass, 15 percent; silver bluestem, 10 percent; fringeleaf paspalum, three-awn, and windmillgrass, 10 percent; post oak, blackjack oak, and catclaw acacia, 15 percent; and sensitivebrier, snoutbean, aster, knotweed, leaf-flower, and annuals, 5 percent. Most species are of value for grazing by cattle.

Figure 30.—Area of Luling clay in Rolling Blacklands range site. The brush and mesquite trees have been controlled mechanically, and the site has been reseeded with native grasses.

Figure 31.—Landscape of Nocken stony soils in an area of Sandstone Hills range site showing the typical native vegetation.

The climax plants that decrease with continuous heavy grazing are bluestem, indiangrass, and sand lovegrass. Three-awn, red lovegrass, gummy lovegrass, and annual forbs increase and dominate. When this happens the site can be reseeded. It has fair value for wildlife.

Total annual yield on range in excellent condition is approximately 3,000 pounds air-dry herbage in years of favorable growing conditions and 1,500 pounds in dry years.

Sandy Loam range site

The soils in this site are deep, nearly level to gently sloping fine sandy loams. Permeability is moderate to moderately slow. Available water capacity is medium to high.

The climax plant community is grassland and scattered oak. The approximate species composition, by weight, is little bluestem or fourflower trichloris, 40 percent; Arizona cottontop and silver bluestem or pinhole bluestem, 20 percent; side-oats grama and plains bristlegrass, 10 percent; hooded windmillgrass, fringeleaf paspalum, plains lovegrass, and other grasses, 20 percent; post oak and live oak, 5 percent; and such forbs as western indigo, bundleflower, and zexmenia, 5 percent. Most species are of value for grazing by cattle.

Bluestem is the climax plant that decreases with continuous heavy grazing. Such plants as hooded windmillgrass and annuals increase in the plant community. Many woody plants, principally mesquite, invade.

Total annual yield on range in excellent condition is approximately 5,000 pounds air-dry herbage in years of favorable growing conditions and about 2,500 pounds in dry years.

Shallow Ridge range site

The soils in this site are shallow to very shallow, gently sloping to sloping loamy or clay loams. Permeability is moderate to slow, and available water capacity is low to very low.

The climax plant community is a mixture of grasses, shrubs, and forbs. The approximate species composition, by weight, is side-oats grama, vine mesquite, and Texas cupgrass, 35 percent; plains lovegrass and Texas wintergrass, 15 percent; sedges, 5 percent; pinhole bluestem, 10 percent; plains bristlegrass, buffalograss, and curly mesquite, 10 percent; fall witchgrass, three-awn, and other grasses, 10 percent; such forbs as orange zexmenia, desert rue, knotweed, leafflower, and guarea, 5 percent; and such woody plants as agarito, elbowbush, guayacan, and blackbrush, 10 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are side-oats grama, plains lovegrass, and pinhole bluestem. Buffalograss and curly mesquite increase, and as the site continues to deteriorate, it is invaded by hairy tridens, red grama, annuals, and mesquite.

The total annual yield on range in excellent condition is approximately 2,500 pounds air-dry herbage in years of favorable growing conditions and 1,000 pounds in dry years.

Tight Sandy Loam range site

The soils in this site are deep nearly level to gently sloping fine sandy loams. Permeability is slow to very slow, and available water capacity is medium to high.

The climax plant community is grassland that has open stands of oak in places. The approximate species composition, by weight, is little bluestem, 15 percent; pinhole bluestem, silver bluestem, and trichloris, 15 percent; Arizona cottontop and side-oats grama, 15 percent; pink pappusgrass, 5 percent; buffalograss and curly mesquite, 10 percent; plains lovegrass and fringeleaf paspalum, 15 percent; Texas wintergrass, 15 percent; such forbs as bush sunflower, orange zexmenia, primrose, and legumes, 5 percent; and woody plants 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continued heavy grazing are bluestem and cottontop. Short grasses and Texas wintergrass increase, and low brush, Texas grama, three-awn, and annuals invade.

Total annual yield on range in excellent condition is approximately 4,500 pounds air-dry herbage in favorable years and 2,000 pounds in dry years.

Very Gravelly range site

Vernia very gravelly loamy sand, 1 to 8 percent slopes, is the only soil in this site. It is deep and gently sloping to sloping. Permeability is rapid, and available water capacity is low.

The climax plant community is an open stand of oak trees that has a thin understory of grasses. The approximate species composition, by weight, is little bluestem, 55 percent; indiangrass, switchgrass, beaked panicum, and purpletop, 15 percent; brownseed paspalum, side-oats grama, hairy dropseed, and other grasses, 10 percent; post oak and blackjack oak, 10 percent; hawthorn, greenbrier, and other low shrubs, 5 percent; and such forbs as lespedeza, tickclover, snoutbean, and spiderwort, 5 percent. Most species are of value for grazing by cattle.

The climax plants that decrease with continuous heavy grazing are little bluestem, switchgrass, and indiangrass. Woody plants and brownseed paspalum increase, and annual forbs, annual three-awn, and woody plants dominate when this site is in poor condition.

Total annual yield on range in excellent condition is approximately 3,500 pounds air-dry herbage in years of favorable growing conditions and 2,500 pounds in dry years.

Use of the Soils for Wildlife

When the first settlers came to Wilson County, wildlife was abundant, but it declined as the area developed. This decline was the result of many years of wasteful hunting before regulatory game laws and of a decline in the natural vegetation because of farming and heavy stocking of range.

In the last few years, the wildlife population has increased. Farmers and ranchers are finding that wildlife is a good secondary crop. With this in mind, they have started management programs to improve the existing food, cover, and water available to wildlife.

Among the wildlife that abounds in Wilson County are white-tailed deer, javelina, bobwhite, turkey, mourning dove, cottontail rabbit, jackrabbit, armadillo, opossum, and raccoon. Waterfowl populations are not significant, but they include some ducks, geese, sandhill cranes, and shore birds. In farm ponds and on the San Antonio River and Cibolo Creek, fishing is fair to excellent. In rivers and creeks, the principal species are buffalofish, bass, flathead catfish, channel catfish, yellow catfish, perch, and crappie, and in ponds are channel catfish, bass, redear, and crappie.

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

In table 3, soils of the county are rated for producing four elements of wildlife habitat and for two groups, or kinds, of wildlife. The ratings indicate relative suitability. A rating of *good* means that habitat elements and kind of habitat generally are easily created, improved, and maintained. Management has few or no limitations, and satisfactory results are expected when the soil is used for the prescribed purpose.

A rating of *fair* means the element of wildlife habitat can be created, improved, or maintained in most places. Moderate intensity of management and fairly frequent attention is required for satisfactory results.

A rating of *poor* means the limitations for the designed element of wildlife habitat or kind of wildlife are severe. Habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort.

A rating of *very poor* means that unsatisfactory results are to be expected. It is either impossible or impractical to create, improve, or maintain habitat on soils in this category.

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

Habitat elements

Grain and seed crops are such annual grain-producing plants as corn, sorghum, millet, wheat and oats.

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

Wild herbaceous upland plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Examples are sunflower, wooly croton, perennial lespedeza, wild bean, pokeweed, and cheatgrass. On range, typical plants are bluestem, grama, perennial forbs, and legumes.

Hardwood trees and shrubs are nonconiferous trees, shrubs, and woody vines that produce wildlife food in the form of fruits, nuts, buds, catkins, or browse. Such plants commonly grow in their natural environment, but they can be planted and developed through wildlife management programs. Typical species in this category are pecan, hackberry, persimmon, pyracantha, anagua, grape, oak, and red haw.

Kinds of wildlife

Table 3 rates the soils according to their suitability as habitat for the two kinds of wildlife in the county—openland and rangeland. These ratings are related to ratings made for the elements of wildlife habitat.

Openland wildlife are birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Examples are quail, dove, meadowlark, field sparrow, cottontail rabbit, and fox.

Rangeland wildlife are birds and mammals that normally live in grassland areas. Examples are coyote, rabbit, javelina, mourning dove, armadillo, quail, thrush, wild turkey, vireo, deer, squirrel, and raccoon.

Use of the Soils for Recreation

The population in Wilson County is continuing to grow as part of the San Antonio metropolitan area, and use of land for nonfarm enterprises is increasing. City dwellers in great numbers are turning to outdoor activities for recreation. Owners of farms, ranches, and woodlands within easy reach of large metropolitan areas have an opportunity for potentially profitable enterprises by developing recreational areas (fig. 32).

Figure 32.—Recreation pond in an area of Wilco loamy fine sand. Picnic tables and barbecue pits are in the shaded area, and the pond is stocked with fish.

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 4 the soils are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

In table 4 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can easily be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use must be able to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use, and do not have slopes or stoniness that greatly increase the cost of leveling or of building access roads.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Engineering Uses of the Soils

By G. P. Johnson, JR., civil engineer, Soil Conservation Service.

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage, condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bed-rock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal or sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 5, 6, and 7, which show, respectively, several estimated soil properties significant to engineering; interpretations of engineering properties of the soils; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 4 and 6, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially small ones, is needed because many delineated areas of a given soil mapping unit contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning in soil science but are not known to all engineers. The Glossary defines many of these terms.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified Soil Classification System *(2)* used by SCS engineers Department of Defense, and others, and the AASHTO system *(1)* adopted by the American Association of State Highway and Transportation Officials.

In the Unified Soil Classification System soils are classified according to particle-size distribution plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designed by symbols for both classes; for example, CL-ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Estimated soil properties significant in engineering

Several estimated soil properties significant in engineering are given in table 5. Estimates are made for typical soil profiles, and by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made during mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 5.

Most soils in the survey are deep enough over bedrock that bedrock generally does not affect their use. However, weakly cemented sandstone is at a depth of 22 to 40 inches in Nocken soils, weakly consolidated sandstone and shale are at a depth of 5 to 14 inches in Picosa soils, and shale or sandstone is at a depth of 32 to 48 inches in Tordia soils.

Hydrologic soil groups give runoff potential after rainfall. Four major soil groups are used. The soils are classified on the basis of the rate of intake of water at the end of storms of long duration after prior wetting and opportunity for swelling, and without the protective effects of vegetation.

Soils in hydrologic group A (low runoff potential) have high infiltration rates even when they are thoroughly wetted. They are chiefly deep, well-drained to excessively drained sands or gravels. These soils have a high rate of water transmission.

Soils in hydrologic group B have moderate infiltration rates when they are thoroughly wetted. They are chiefly moderately deep to deep, moderately well drained to well drained soils that are moderately fine textured to moderately coarse textured. These soils have a moderate rate of water transmission.

Soils in hydrologic group C have slow infiltration rates when they are thoroughly wetted. They are chiefly soils that have a layer that impedes downward movement of water, or soils that are moderately fine textured to fine textured. These soils have a slow rate of water transmission.

Soils in hydrologic group D (high runoff potential) have very slow infiltration rates when they are thoroughly wetted. They are chiefly clay soils that have a high swelling potential, soils that have a permanent high water table, soils that have a claypan or clay layer at or near the surface, and shallow soils over nearly impervious material. These soils have a very slow rate of water transmission.

Soil texture is described in table 5 in the standard terms used by the Department of Agriculture. These terms take into account the percentage of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semi-solid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 5, but in table 7 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 5 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the change in the volume of soil material when the content of moisture changes. It is the extent to which the soil shrinks as it dries out or swells when it gets wet. This shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils causes much damage to building foundations, roads, and other structures. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 5, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such soil properties as drainage, texture, total acidity, and electrical conductivity of the soil material. Corrosivity for concrete is influenced mainly by the content of sodium or magnesium sulfate, but also by soil texture and acidity. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so protective measures for steel and more resistant concrete should be used to avoid or minimize damage.

Interpretations of engineering properties of the soils

The estimated interpretations in table 6 are based on the engineering properties of soils shown in table 5, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Wilson County. In table 6, ratings are used to summarize limitations or suit-ability of the soils for specified purposes. Table 6 also lists the features that affect the planning, installation, and maintenance of irrigation systems, terraces and diversions, and grassed waterways.

Soil limitations are indicated by the ratings slight, moderate, and severe. A rating of *slight* means soil properties generally are favorable for the rated use, and that any limitations are minor and easily overcome. A rating of *moderate* means that some soil properties are unfavorable for the rated use but can be overcome or modified by special planning and design. A rating of *severe* means that the soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special design, or intensive maintenance.

Soil suitability is rated by the terms *good, fair*, and *poor*, which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material is evaluated between depths of 18 inches and 72 inches. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Properties that affect difficulty of layout and construction are slope, risk of soil erosion, and lateral seepage. Slope and lateral seepage also affect the flow of effluent. Large rocks or boulders increase the cost of construction of septic tank absorption fields.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solid waste. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The embankments are compacted to medium density and the pond is protected from flooding. In determining the suitability of soils for the construction of sewage lagoons, properties are considered that affect the pond floor and the embankments. Those that affect the pond floor are permeability, content of organic matter, and slope. If the floor needs to be leveled, depth to bedrock is important. The soil properties that affect embankments are the engineering properties of the embankment material, as interpreted from the Unified Soil Classification, and the amounts of stones. Stones influence the ease of excavation and the ease of compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet. Examples are excavations for pipelines, sewer lines, telephone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or from a high water table.

The ratings for dwellings without basements in table 6 are for structures not more than three stories high that are supported by foundation footings placed in undisturbed soil. The features that affect the rating of a soil for dwellings are those that relate to capacity to support a load and to resist settlement under load, and are those that relate to the ease of excavation. Soil properties that affect capacity to support a load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfills are used to dispose of refuse. The waste is spread in thin layers, compacted, and covered with soil. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill use are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Ratings apply only to a depth of about 6 feet, and therefore ratings of slight or moderate may not be valid if excavating trenches are much deeper. For some soils, reliable predictions can be made to a depth of 10 to 15 feet, but regardless of that, every site should be investigated before it is selected.

The ratings for local roads and streets in table 6 are for an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade and the workability and quantity of available cut and fill material. The AASHTO and Unified classifications and the shrink-swell potential indicate traffic-supporting capacity of a soil. Wetness and flooding affect the stability of soils. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoirs are areas of water held behind a dam or embankment. Soils suitable for use as pond reservoir areas have low seepage, which is related to their permeability and depth over fractured or permeable bedrock or other permeable material.

Dikes, levees, and other embankments require soil material that is resistant to seepage and piping and that has favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among unfavorable factors.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in a properly compacted embankment that has been provided with adequate drainage, and the relative ease of excavating the material at borrow areas.

Topsoil is used to topdress an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response to plants when fertilizer is applied; and absence of substances toxic to plants. The texture of a soil and the content of stone fragments are characteristics that affect the suitability of a soil for use as topdressing. Also considered in the ratings is the damage that results in the area from which the topsoil is taken.

The irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, and soil blowing; texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of the soil below the surface layer and in fragipans or other layers that restrict movement of water; available water capacity; need for drainage; depth of the water table; and depth over bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff and allow it to soak into the soil or flow slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slope; depth over bedrock or unfavorable material; stoniness;

permeability; and resistance to water erosion, soil slipping, and soil blowing. A suitable soil provides outlets for runoff, and vegetation is not difficult to establish.

Grassed waterways carry off excess water from terraced fields and other areas. Soils that are shallow to sandstone and shale are poorly suited as sites for waterways, because such soils are droughty and vegetation is difficult to establish. The Picosa soil, for example, is very shallow to sandstone and shale.

Most soils in Wilson County are not suitable as sources of sand and gravel, so they were not rated for this use in table 6. Eufaula, Patilo, Poth, and Sarita soils are fair sources of sand.

In most soils in Wilson County, drainage is not a concern of management, so soil features affecting drainage were not rated in table 6. Only in the poorly drained Aranas soils and the somewhat poorly drained Kaufman, Leming, and Willamar soils is drainage a concern.

Engineering test data

Table 7 shows engineering test data for some of the major soil series in Wilson County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Compaction (or moisture-density) data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the optimum moisture content is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed maximum dry density. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

The tests for liquid limit and plasticity index measure the effect of water on the consistence of soil material, as has been explained for table 5.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of oven-dry soil material.

Linear shrinkage is a decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Formation and Classification of the Soils

In this section the major factors that affect the formation of the soils in Wilson County are discussed, and important processes in the differentiation of soil horizons are briefly described. Then, the current system of classification is explained, and each series in the county is placed in some of the categories of that system. The soil series in the county, including a profile representative of each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soil is the product of the interaction of the five major factors of soil formation: climate, living organisms (especially vegetation), parent material, relief, and time *(4).* The relative importance of each factor differs from place to place, and each modifies the effects of the other four. In some cases one factor dominates in the formation of a soil.

Climate

Precipitation, temperature, and wind have been important in the development of the soils of Wilson County. The wet climate of past geologic ages influenced the deposition of parent materials. Later rainfall was variable, and it influenced differences in soil development. Mature soils, such as those of the Alum, Crockett, Patilo, and Tabor series, which occur in the eastern and northeastern parts of the county, have been leached of their carbonates and salts, and in places have undergone reduction and transfer of iron. In the southern, central, and western parts of the county, rainfall has been great enough to leach carbonates from the upper horizons of some soils, but not great enough to leach them entirely from the soil. Consequently, such soils as those of the Clareville, Floresville, Marcelinas, Miguel, and Runge series have a calcium-carbonate layer below the root zone. Many of the younger soils, such as those of the Colibro, Karnes, Saspamco, and Venus series, have free lime throughout their profile.

The mild temperatures in the county have influenced the kinds of organisms and their growth in and on the soil. Also, temperature changes, though not too great from season to season, have had some effect on the weathering process and on chemical reactions in the soils. Wetting and drying of the soils has had an affect on their development.

Wind has affected formation of soils in this county, particularly in the northern and northwestern parts. Eufaula and Santa soils formed from aeolian deposits and were later affected by shifting sands on exposed surfaces.

Living organisms

Vegetation, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to soil development. They add to the supply of organic matter and nitrogen in the soils and contribute to the change in structure and porosity of the soils. They also bring about changes in the levels of plant nutrients.

Plants, mainly mid and tall grasses and hardwood trees, have affected soil formation more than other organisms. The plants contributed to the accumulation of organic materials. Decaying grass, leaves, stems, and roots have caused the prairie soils to be darker and to have a higher content of organic matter than those formed under hardwood trees. For example, Aranas, Clareville, Coy, Elmendorf, Luling, Runge, and Tordia soils formed under grass and have a medium to high content of organic matter. On the other hand, Eufaula, Santa, Patilo, and Tabor soils formed under hardwoods, and they have a low content of organic matter.

Earthworms are the most conspicuous form of animal life in the soil. Despite relatively low rainfall and periods when the soil is completely dry, earthworms have had an important part in soil development. Wormcasts, common in Frio, Loire, Kansas, Runge, and Venus soils, facilitate the movement of air, roots, and water in the soil.

The influence of man as a soil-forming factor should not be overlooked. At first, he burned the vegetation and planted his crops. In recent years he fenced the range, stocked it, and permitted it to be overgrazed. Then he plowed the land and planted crops. Because of poorly timed tillage and his use of heavy machinery, he compacted the soil and in some areas reduced aeration and infiltration of water. By harvesting the crops, exposing the bare soil to the elements, and allowing runoff and soil blowing, he reduced the amount of organic matter and the proportion of silt and clay particles in the plow layer. In some areas he changed the moisture regime by irrigating. These activities have had a marked effect on the soils of the county.

Parent material

Parent material is the unconsolidated mass from which a soil forms. It determines the limits of the chemical and mineral composition of the soil. In Wilson County the soils developed from materials in the Tertiary and Quartenary Systems. The rocks are all of sedimentary origin and consist primarily of a series of alternating sand, silt, and clay strata. The Tertiary System is divided into the Eocene and Pliocene Series, and the Quartenary System consists of the Pleistocene and Recent ages *(3).*

The Eocene Series in the Tertiary System is represented by the Wilcox Group, and the Carrizo Sand, Reklaw, Queen City Sand, Weches, Sparta Sand, Crockett, and Yegua Formations.

The Wilcox Group, Queen City Sand, Reklaw, and Yegua Formations consist of thin-bedded clay, silt, and medium to fine sand, sandstone, and sandy shale. Some rocks are ferruginous and have a characteristic reddish-brown color. Soils that formed in these materials include those of the Crockett, Floresville, Miguel, Nocken, Rosanky, and Wilco series.

The Carrizo Sand Formations is composed mostly of massive beds of medium and coarse sands. The soils that formed in these materials are the Eufaula, Patilo, and Sarita series.

The Weches and Sparta Sand Formations are composed of medium to fine gray to reddish-tan sand and clay, and some fossiliferous glauconitic shale and sand. Soils forming in these materials are those of the Alum, Marcelinas, Patilo, Poth, and Wilco series.

The Crockett Formation consists of fossiliferous clay and shale that have a few sandstone and limestone lenses and minor amounts of selenite and glaconite. The main soils that formed from these materials are Coy, Luling, Elmendorf, and Denhawken soils.

The Pliocene Series consist mainly of Uvalde Gravel and occurs in a small area extending a few miles on either side of the San Antonio River and Cibolo Creek in the vicinity of the Carrizo Sand outcrop. The Vernia soil is the main soil in this material.

The Pleistocene Series of the Quarternary System in Wilson County is made up of alluvium consisting mainly of calcareous silt and fine sand that contains snail shells. The soils formed in these materials are those of the Clareville, Colibro, Karnes, Saspamco, and Venus series.

Recent geologic sediment is on all flood plains of rivers, creeks, and their main tributaries. The alluvium consists of clay, silt, and sand. The soils formed in these materials are those of Aranas, Gowen, Loire, Frio, Kaufman, Yahola, and Zavala series.

Relief

Relief influences soil formation through its effect on drainage, runoff, erosion, plant cover, and soil temperature. Most soils in Wilson County are nearly level to gently sloping, but in small areas soils are steeper.

On steeper soils, where runoff is rapid, the soil material is likely to be removed by erosion almost as fast as horizons can develop. Nocken and Picosa soils, for example, formed in more sloping soils than did Rosanky and Tordia soils. They are thinner, and their profiles are not so well developed. Clareville, Crockett, Floresville, and Miguel soils formed in nearly level to gently sloping areas. Much of the rain that falls on these soils does not run off but is absorbed. This causes leaching, which affects other soil-forming processes that aid in the formation of distinct soil horizons. Depressions or concave areas receive runoff from the higher lying soils. These soils stay wet for longer periods and they tend to accumulate more sediment from floods and overflow. The Aranas, Frio Gowen, and Kaufman soils, for example, are nearly level soils that receive extra water from runoff or flooding.

Time

The length of time that climate, living organisms, and relief have acted on parent material affects the kind of soil that develops, but the effects of time are modified by the other factors of soil formation. Soils that do not have clearly expressed horizons are considered to be young or immature soils, and those that have well-expressed horizons are considered old or mature.

Soils, such as Yahola and Zavala, that formed in recent alluvium, are immature because alluvium has not been in place long enough for a well-developed profile to form. Old or mature soils, such as those of the Crockett, Floresville, Miguel, Tabor, and Wilco series show marked horizon differentiation. Most of the mature soils in the county are well drained and nearly level to gently sloping, and they have been in place for a long time.

Processes of Horizon Differentiation

Several processes have been involved in the differentiation of soil profile horizons in Wilson County. Among these are (1) accumulation of organic matter, (2) leaching of calcium carbonate and salts, (3) reduction and transfer of iron, and (4) formation and translocation of silicate clay minerals. In most soils more than one of these processes have been active in the development of soil profile horizons.

Accumulation of organic matter in the upper part of the soil profile has been important in the formation of an A1 horizon. The soils of Wilson County contain small to large amounts of organic matter. Eufaula, Sarita, Tabor, and other soils that have a sandy surface layer contain little organic matter, while such soils as Clareville, Coy Elmendorf, and Runge contain large amounts. Eroded soils normally have small amounts of organic matter.

Much leaching of carbonates and salts has occurred in Alum, Crockett, Poth, Rosanky, and Tabor soils. Some leaching has occurred in Clareville, Floresville, Leming, Miguel, and Runge soils, because the upper horizons are free of lime but calcium carbonate has accumulated below the root zone. Other soils, such as Coy Elmendorf, Luling, and Marcelinas soils are slightly leached, because carbonates occur about 12 to 20 inches below the surface layer. These soils have clayey and loamy surface layers, and not enough time has passed for removal of the carbonates.

Reduction and transfer of iron, a process called gleying, is evident in some of the poorly drained soils of the county. The gray color in the subsoil indicates a reduction and loss of iron. Some horizons have yellowish-red to brown to strong-brown mottles and concretions that indicate a segregation of the iron. Kaufman, Leming, and Willamar soils are examples of somewhat poorly drained, grayish soils that are mottled in the lower horizons.

Translocation of clay minerals has taken place in Clareville, Elmendorf, Floresville, Miguel, Runge, and Wilco soils and has contributed to horizon development. The B horizons have accumulated clay (clay films) in the pores and on the surfaces of peds. These soils were probably leached of carbonates and soluble salts before silicate clays were translocated.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification and then through use of soil maps, we can apply our knowledge of soils to specific fields and to other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and comparison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. Because this system is under continual study *(5, 7),* readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 8, the soil series of Wilson County are placed in four categories of the current system. Classes of the current system are briefly defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. The five soil orders in Wilson County are Alfisols, Entisols, Inceptisols, Mollisols, and Vertisols.

Alfisols have a light-colored surface layer low in organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent. Entisols have little or no evidence of development of pedogenic horizons. Inceptisols have a light-colored surface layer low in organic matter, but they lack a clay-enriched B horizon. Mollisols have a dark-colored surface layer high in organic matter, and they have a base saturation of more than 50 percent. Vertisols are clayey soils that have deep, wide cracks for part of the year in most years.

SUBORDER. Each order is subdivided into suborders that are based primarily on those soils characteristics that seem to produce classes that have the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or those soil differences that result from the effects of climate or vegetation.

GREAT GROUP. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and those that have thick, dark-colored surface horizons. The features used are self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like.

SUBGROUP. Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others called intergrades that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order.

FAMILY. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reactions, soil temperature, permeability, thickness of horizons, and consistence.

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

Additional Facts About the County

This section is mainly for readers who are not familiar with Wilson County. It discusses history, climate, farming, and natural resources. The statistics given are mainly from reports published by the U.S. Bureau of the Census and the Texas Almanac, 1964-65, published by the Dallas Morning News.

History

The area which became Wilson County was wilderness until the period of American settlement. It was once the hunting grounds of the Tonkawa, the Comanche, and the Lipan-Apache Indians. The first Europeans in the region were probably the early Spanish explorers and travelers who passed through on their way to east Texas.

The county was named for James C. Wilson. It was created from Bexar and Karnes Counties in 1860 with Sutherland Springs as the county seat. The seat of government was changed to Lodi in 1867. Floresville was surveyed and laid out in July 1873, and there the first courthouse was built. The population of the county in 1870 was 2,556 and by 1880 it had reached 7,118. In 1960 the population was 13,267. Floresville had 2,126 residents; Poth, 1,119; Stockdale, 1,110; La Vernia, 700; and Saspamco, 300. Most people in the county today are farmers and ranchers, but some residents commute to larger cities.

Climate

By Robert B. Orton, State climatologist, National Weather Service, U.S. Department of Commerce.

Wilson County has a subtropical climate with mild, dry winters and hot, humid summers. Tropical maritime air masses predominate throughout spring, summer, and fall. Modified polar air masses exert considerable influence during winter, creating a continental climate characterized by large variations in temperature. Temperature and precipitation data are given in table 9.

Average annual precipitation is 28.96 inches. Peak rainfall, because of thundershowers, occurs late in spring, and a secondary peak occurs early in fall. A total of 47.25 inches fell in 1968, the wettest year on record, but only 7.88 inches fell in 1917, the driest year. Prevailing winds are southerly to southeasterly throughout the year, except during December when winds are predominantly northerly. The county receives approximately 50 percent of the total possible sunshine in winter, 57 percent in spring, 74 percent in summer, and 66 percent in fall. The average relative humidity, measured at noon, Central Standard Time, is estimated to be 62 percent in January, 59 percent in April, 50 percent in July, and 54 percent in October.

Winter is marked not by prolonged periods of cold weather but by short, cold periods of 36 to 72 hours, because polar air masses undergo considerable modification before they reach the area. The weather changes often. Normally, daytime temperatures are sufficiently mild to cause little or no interference with outdoor work or recreation. Considerable cloudiness generally persists through morning, dissipating by noon, and skies are clear to partly cloudy most afternoons.

The weather changes often early in spring. March is the driest month in an average year, but thundershower activity increases in April and peaks in May. Considerable early morning cloudiness continues in spring, but clouds dissipate earlier in the day than they do in winter.

Daytime temperatures are hot in summer. Daily highs reach or exceed 90°F. almost every day during July and August. Heavy thundershower activity continues into June, but July is hot and dry with little variation in the weather regime from day to day. Rainfall increases late in August as tropical disturbances in the Gulf of Mexico become more frequent.

Warm weather continues through September, and precipitation increases. The weather changes more often in fall than in summer. Daytime temperatures in October and November are pleasantly mild while nights are crisp and cool. Long periods of uninterrupted fair weather and light winds occur.

The average length of the frost-free season in Wilson County is 280 days. The average dates of the last freeze in spring and the first freeze in fall are February 24 and December 1, respectively. Mean annual lake evaporation is 56 inches, exceeding precipitation by about 28 inches in an average year.

Farming

Cattle raising was the first enterprise in the county. Today, about 35 percent of the total acreage remains in native range, mainly in the northern, northwestern, and southeastern parts of the county. Most ranchers carry on a cow-calf operation. Dairying is important in the county, accounting for about one-fourth of all farm income.

In 1871 the main staple crops were cotton, corn, sugar cane, and tobacco. In 1902 insects destroyed most of the cotton crop, and cotton declined in importance. Today the main crops are peanuts, grain sorghums, corn, watermelons, flax, blackeyed peas, and vegetables. Also, some cotton is still grown.

Natural Resources

Soil is one of the most important natural resources in the county. In it grow forage for livestock and wildlife and food and fiber for market and home use. Most people in the county earn their livelihood from the soil.

Oil and gas are produced from many wells, and they provide a major source of income to some landowners.

Water is an important resource. Many irrigation wells throughout the county supply water for supplemental irrigation. The San Antonio River and Cibolo Creek also furnish water for irrigation, and future plans call for large reservoirs to furnish water for municipal, industrial, and recreational uses.

Various kinds of wildlife live on ranches and farms. White-tail deer are numerous in areas of range. Birds in the county include bobwhite quail and mourning dove. Fox, raccoon, skunk, coyote, opossum, and many species of snakes are native to the county.

Clay is mined in the northwestern part of the county near Saspamco. Brick, tile, and sewer pipe are manufactured from this clay in plants at Saspamco and Elmendorf in Bexar County. Sand and gravel, taken from pits in the northern and northwestern areas of the county, satisfy local needs.

Literature Cited

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69 *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp. illus.

(3) Anders, R. B. 1957. Ground-water geology of Wilson County, Texas. Texas Board of Water Engineers Bul. 5710. 62 pp., illus.

(4) Baldwin, M., Kellogg, C. E., and Thorpe, J. 1938. Soil classification. U.S. Dep. Agric. Yearb., pp. 979-1001, illus.

(5) Simonson, Roy W. 1962. Soil classification in the United States. Science 137: 1027-1034.
(6) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplement issued in May 1962]
(7) 1960. Soil classification, a comprehensive system. 7th approximation. 265 pp. illus. [Supplements issued in March 1967 and September 1968]

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as crumbs, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil that has 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 the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Base saturation. The degree to which material that has base-exchange properties is saturated with exchangeable cations other than hydrogen, expressed as a percentage of the cation-exchange capacity.

Bedding planes. The arrangement of sediment in layers, strata, or beds. Synonym: stratification.

Bench terrace. A shelflike embankment of earth that has a level or nearly level top and a steep or nearly vertical downhill face, constructed along the contour of sloping land or across the slope to control runoff and erosion. The downhill face of the bench may be made of rocks or masonry, or it may be planted to vegetation.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Climax vegetation. The stabilized plant community on a particular site; it reproduces itself and does not change so long as the environment does not change.

Complex slope. Short and irregular slopes. Planning and construction of terraces, diversions, and other water-control measures are extremely difficult.

Complex, soil. A mapping unit consisting of different kinds of soils that occur in such small individual areas or in such an intricate pattern that they cannot be shown separately on a publishable soil map.

Compressible. The soil is relatively soft and decreases excessively in volume when a load is applied.

Concretions. Grains, pellets, or nodules of various sizes, shapes and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Cutbanks cave. Walls of cuts are not stable. The soil sloughs easily.

Depth to rock. Bedrock is so near the surface that it affects specified use of the soil.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, 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 different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat *poorly drained* soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Decreaser. Any of the climax range plants most heavily grazed. Because they are the most palatable, they are first to be destroyed by overgrazing.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

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 wind (sandblast), running water, and other geological agents.

Excess lime. The amount of carbonates in the soil is so high that it restricts the growth of some plants.

Fast intake. Water infiltrates rapidly into the soil.

Favorable. Features of the soil are favorable for the intended use.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Genesis, soil. The manner in which a soil originates. Refers especially to the processes initiated by climate and organisms that are responsible for the development of the solum, or true soil from the unconsolidated parent material, as conditioned by relief and age of landform.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Gleization. The reduction, translocation, and segregation of soil compounds, notably of iron, usually in the lower horizons, as a result of waterlogging with poor aeration and drainage; expressed in the soil by mottled colors dominated by gray. The soil-forming processes leading to the development of a gley soil.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Gypsum. Calcium sulphate.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Increasers. Species in the climax vegetation that increase in relative amount as the more desirable plants are reduced by close grazing; increasers commonly are shorter than decreasers, and some are less palatable to livestock.

Invaders. On range, plants that come in and grow after the climax vegetation has been reduced by grazing. Generally, invader plants are those that follow disturbance of the surface. (Most weeds are "invaders.")

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

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.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

*Controlled floodin*g.—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, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements 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.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Large stones. Rock fragments 10 inches or more across affect the specified use.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Low strength. The soil has inadequate strength to support loads.

Miscellaneous land type. A mapping unit for areas of land that have little or no natural soil; or that are too nearly inaccessible for orderly examination; or that occur where, for other reasons, it is not feasible to classify the soil.

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 their thickness and arrangement in the soil profile.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few*, *common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Percs slowly. Water moves through the soil slowly, affecting the specified use.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil series, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Piping. The soil is susceptible to the formation of tunnels or pipelike cavities by moving water.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are—*excellent*, *good, fair,* and *poor*. The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climax vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH
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. Only the upper part of this, modified by organisms and other soil-building forces, is regarded by soil scientists as soil. Most American engineers speak of the whole regolith, even to great depths, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Rooting depth. A layer that greatly restricts the downward rooting of plants occurs at a shallow depth.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Seepage. Water moves through the soil so quickly that it affects the specified use.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Shrink-swell. The soil expands on wetting and shrinks on drying, which may cause damage to roads, dams, building foundations, or other structures.

Silica. Silica is a combination of silicon and oxygen. The mineral form is called quartz.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeters) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Site index. A numerical means of expressing the quality of a forest site that is based on the height of the dominant stand at an arbitrarily chosen age; for example, the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Slow intake. Water infiltrates slowly into the soil.

Small stones. Rock fragments that are less than 10 inches across may affect the specified use.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II 0.2 to 0.02 millimeter) III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underling material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stone line. A concentration of coarse rock fragments in soils that generally represents an old weathering surface. In a cross section the line may be one stone or more thick. The line generally overlies material that weathered in place, and it is ordinarily overlain by sediment of variable thickness.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than 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 together without any regular cleavage as in many claypans and hardpans.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are sand, *loamy sand, sandy loam, loam*, *silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer. Suitable soil material is not thick enough for use as borrow material or topsoil.

Tilth, soil. The condition of the soil in relation to the growth of plants especially soil structure. Good tilth refers to the friable slate and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Type soil. A subdivision of the soil series that is made on the basis of differences in the texture of the surface layer.

Unstable fill. Banks of fill are likely to cave or slough.

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Weathering. Physical and chemical changes produced in rocks at or near the earth's surface by atmospheric agents. These changes result in more or less complete disintegration and decomposition of the rock

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poor graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an oven-dry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

Tables

The tables in this soil survey contain information that affects land use planning in this survey area. More current data tables may be available from the Web Soil Survey at the Tabular Data tab.

NRCS Accessibility Statement

The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at helpdesk@helpdesk.itc.nrcs.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.