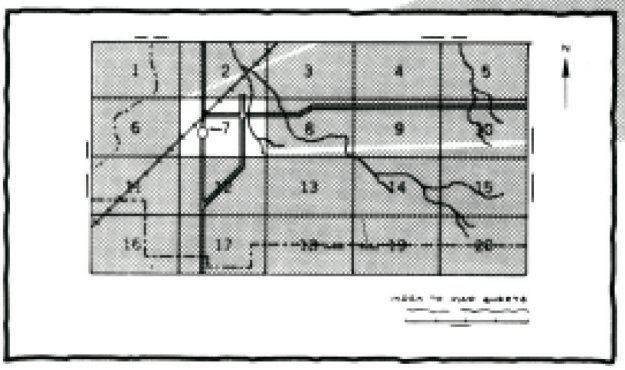
Soil Survey of

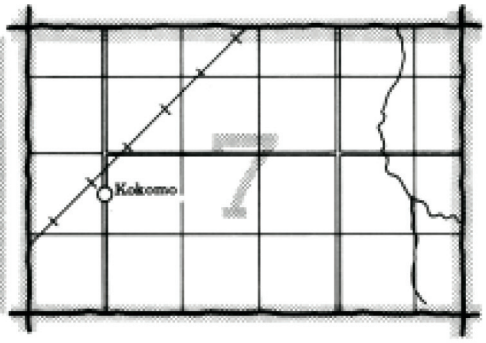
Donley County, Texas

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

HOW TO USE

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





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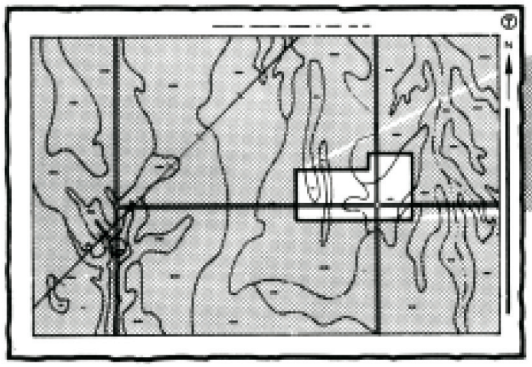
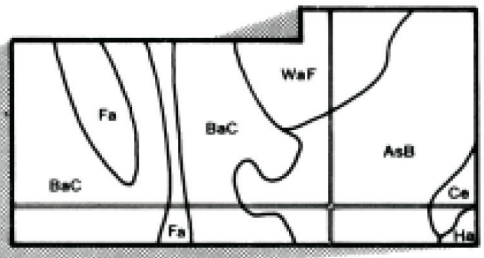
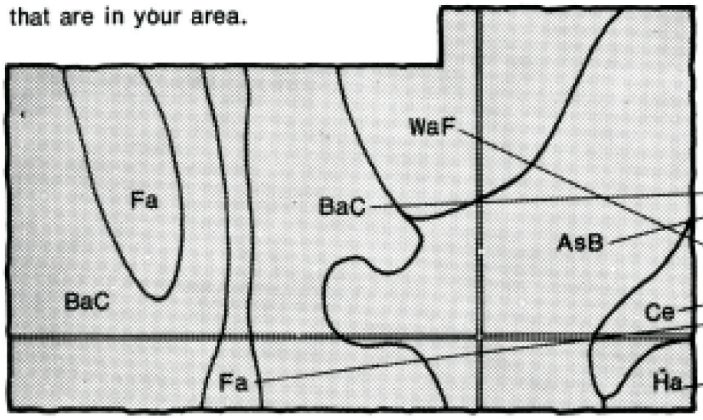




4. List the map unit symbols that are in your area.

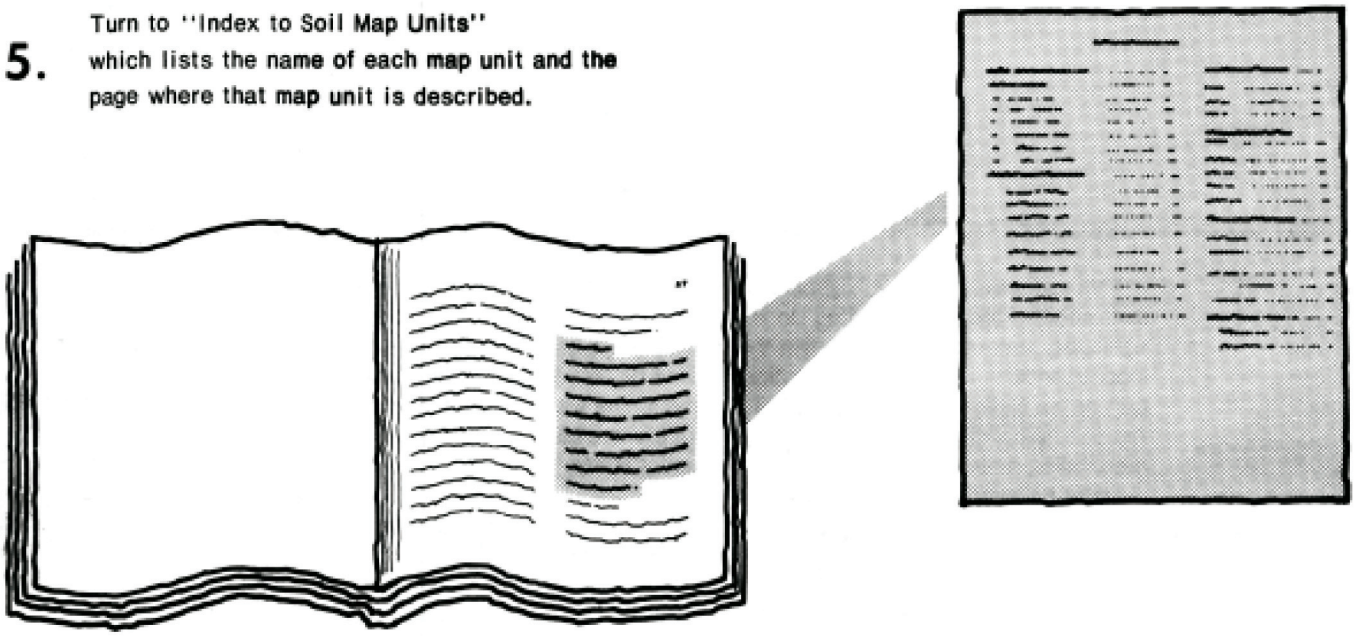


Symbols

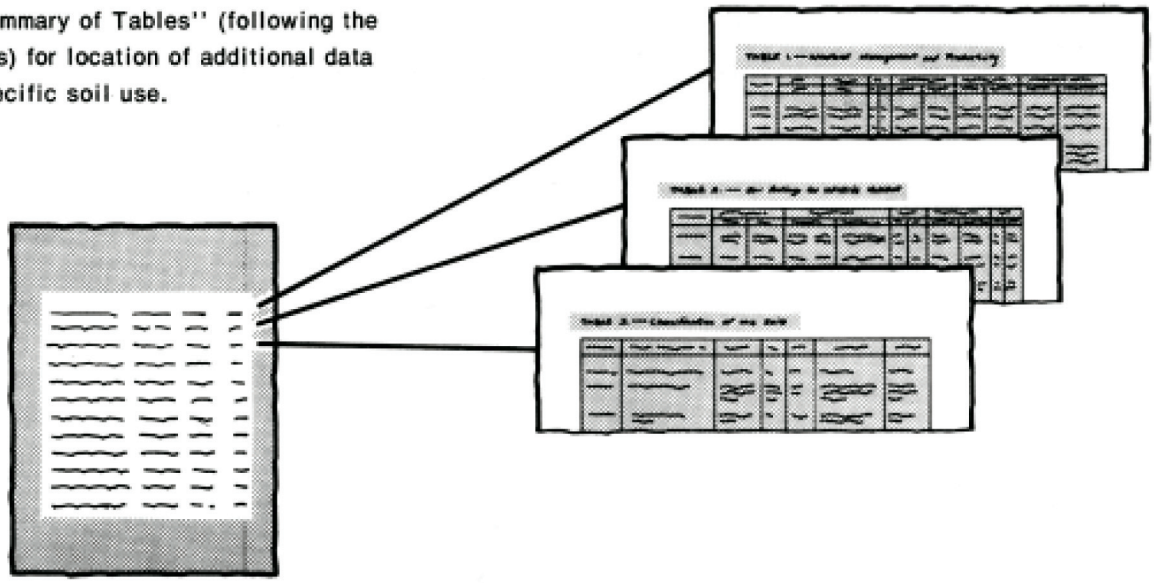
- AsB
- BaC
- Ce
- Fa
- Ha
- WaF

THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1969-1975. Soil names and descriptions were approved in 1975. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1977. 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 Donley County Soil and Water Conservation District.

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

Cover: An area of rangeland in the Burson-Aspermont association, steep. The vegetation is redberry juniper trees.

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Foreword

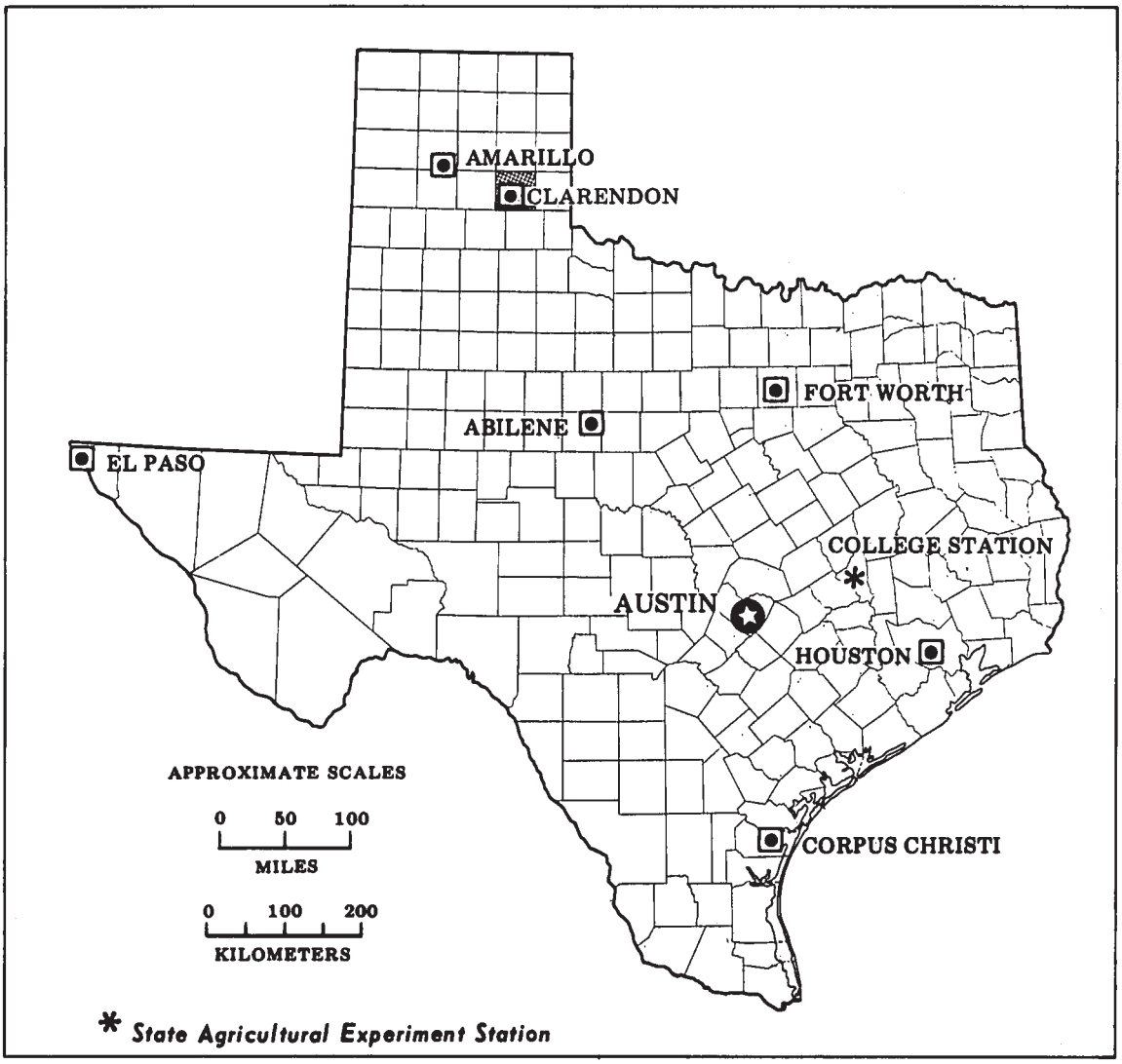
This soil survey contains information that can be used in land-planning programs in Donley County, Texas. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the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

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

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

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

George C. Marks
State Conservationist
Soil Conservation Service



Location of Donley County in Texas.

Soil Survey of Donley County, Texas

by Jack C. Williams and Jerald O. Crump,
Soil Conservation Service

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

DONLEY COUNTY is in the Texas Panhandle. It is in the Great Plains region; the northwestern part of the county is in the High Plains area, and the rest of the county is in the Rolling Plains area. The total area of the county is 581,760 acres, or 909 square miles. The survey area is mostly a nearly level to rolling plain that slopes upward in elevation from the southeast to the northwest. The elevation rises from about 2,075 feet above sea level near the southeastern corner of the county to about 3,265 feet in the northwestern corner.

Farming and ranching are the main enterprises in Donley County. About 79 percent of the acreage in the county is rangeland; 15 percent is cropland; 4 percent is pastureland, hayland, or orchards; and the rest is urban land and areas of surface water. Beef cattle production is the principal ranching enterprise. Cotton, wheat, and grain sorghum are the main cultivated crops. About 18,000 acres of cropland, hayland, and pastureland is irrigated.

The soils in Donley County formed under grass vegetation and are dominantly dark colored, loamy, and dry. If the soils are not protected by a vegetative cover, soil blowing and water erosion are hazards. Like other areas in the Great Plains, the survey area is subject to periods of drought.

General nature of the county

This section gives general information on the settlement and population, climate, agriculture, and natural resources of Donley County.

Settlement and population

The area that is now Donley County was settled in the late 1870's. Settlers established several large cattle ranches. Donley County was organized in 1882. It was named for S.P. Donley, a Texas Supreme Court Justice.

In 1970, according to the census of that year, the population of Donley County was 3,641. Clarendon, the county seat, had a population of about 1,974. Other towns in the county are Hedley, which had a population of 439; Lelia Lake, 125; Howardwick, 110; and Ashtola, 20.

Greenbelt Lake, which is near Howardwick, provides waterbased recreation and supplies water to Clarendon and to several other cities. Rail transportation is provided by the Burlington and Northern Railroad and the Chicago, Rock Island, and Pacific Railroad. Federal and state highways, several farm to market roads, and a network of county roads provide automobile access to most areas of the county.

Climate

Robert B. Orton, climatologist, National Weather Service, U.S. Department of Commerce, helped prepare this section.

Table 1 gives data on temperature and precipitation for Donley County as recorded at Clarendon in the period 1933 to 1969. The weather station in Clarendon is at an elevation of 2,700 feet.

Clarendon is located below the edge of the High Plains area, near the Caprock escarpment; therefore, its climate is more similar to that in the region to the north and west than to that in the lower rolling plains area to the south and east. The climate at Clarendon is a dry-steppe type. Winters are mild. The mean annual rainfall is 21.51 inches, 82 percent of which falls in the warm season from April through October. Donley County also has a continental climate, characterized by a wide range in temperature between the winter lows and summer highs.

The warm-season rainfall is the result of many thunderstorms, which commonly occur when moist air from the Gulf of Mexico penetrates the area and is lifted by cool fronts from the north or northwest. Showers are most frequent in May, June, and July. In the colder

months, frequent masses of drier polar air enter the area from the north and northwest, minimizing the influence of the moist Gulf air; consequently, the period from November through March is relatively dry. Precipitation in winter usually falls as light snow. In exceptionally wet years, high intensity rainfall of short duration can occur, causing rapid runoff and the resulting soil erosion. In 1960, the wettest year on record, 40.86 inches of rain was recorded at Clarendon. In 1927, the driest year on record, the annual rainfall was only 12.62 inches.

The temperatures at Clarendon vary widely. In winter, polar air masses from Canada bring sharp drops in temperature, but the winters at Clarendon generally are mild. Cold spells rarely last more than 48 hours because of sunshine and warm southwesterly winds. In summer, afternoons are sometimes hot, but most evenings and nights are cool. The highest temperature on record at Clarendon, 117 degrees F, occurred on August 12, 1936. The lowest temperature on record, -11 degrees F, occurred on January 9, 1930.

The prevailing winds at Clarendon are from the southwest in November through April and from the south in May through October. Winds are strongest in spring and weakest late in summer and in fall.

On the average, Clarendon receives about 66 percent of the total possible sunshine in winter, 70 percent in spring, 77 percent in summer, and 73 percent in fall. The relative humidity at noon averages 50 percent in January, 42 percent in April, 43 percent in July, and 45 percent in fall. Thunderstorms occur on an average of 48 days each year. A few, particularly those that occur late in spring, are accompanied by violent wind or hailstorms. On the average, free water (lake) evaporation exceeds precipitation by 46 inches. The warm season, or freeze-free period, averages 206 days. The mean date of the last 32 degree or lower temperature in spring is April 9, and the date of the first 32 degree or lower temperature in fall is November 1.

Agriculture

Agriculture is the main industry in Donley County. Cattle ranching and nonirrigated and irrigated farming are the main agricultural enterprises.

Cattle ranching in Donley County dates to the 1870's, when the availability of low-cost land and high quality grasses attracted ranchers to the county. Small areas of land were cultivated in the 1890's. And in the early 1900's, large areas of the native grassland were converted to crops, including cotton, sorghum, and winter wheat.

Today, about three-fourths of the agricultural income in the county is derived from cattle ranching. Livestock operations are primarily cow-calf. Supplemental feeding usually takes place in November through March. Calves are sold or are grazed on winter wheat.

Cotton, winter wheat, and grain sorghum are the main crops in the county. Raising livestock is a minor enterprise on the larger farms.

Natural resources

Soil is the most important natural resource in the county. The forage for livestock and the food and fiber for market and for domestic consumption are products of the soil.

Water is an important natural resource in the county. Irrigation wells supply high quality water for crops. There are many springs in the county that flow most of the year. Some water is exported from the county by the Greenbelt Water Authority.

Caliche and gravel are plentiful in Donley County. They are mined for commercial use, mainly for use in local road construction.

How this survey was made

Soil scientists made this survey to learn what soils are in the survey area, where they are, and how they can be used. They observed the steepness, length, and shape of slopes; the size of streams and the general pattern of drainage; the kinds of native plants or crops; and the kinds of rock. They dug many holes to study soil profiles. A profile is the sequence of natural layers, or horizons, in a soil. It extends from the surface down into the parent material, which has been changed very little by leaching or by plant roots.

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

The areas shown on a soil map are called map units. Most map units are made up of one kind of soil. Some are made up of two or more kinds. The map units in this survey area are described under "General soil map for broad land use planning" and "Soil maps for detailed planning."

While a soil survey is in progress, samples of some soils are taken for laboratory measurements and for engineering tests. All soils are field tested to determine their characteristics. Interpretations of those characteristics may be modified during the survey. Data are assembled from other sources, such as test results, records, field experience, and state and local specialists. For example, data on crop yields under defined management

are assembled from farm records and from field or plot experiments on the same kinds of soil.

But only part of a soil survey is done when the soils have been named, described, interpreted, and delineated on aerial photographs and when the laboratory data and other data have been assembled. The mass of detailed information then needs to be organized so that it can be used by farmers, rangeland managers, engineers, planners, developers and builders, home buyers, and others.

General soil map for broad land use planning

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

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

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

Map unit descriptions

1. Mobeetie-Veal-Potter

Deep to very shallow, gently sloping to steep, loamy soils; on uplands

This map unit makes up about 33 percent of the county (fig. 1). The slopes range from 1 to 45 percent. Mobeetie soils make up about 41 percent of this unit, Veal soils 15 percent, Potter soils 11 percent, and minor soils 33 percent.

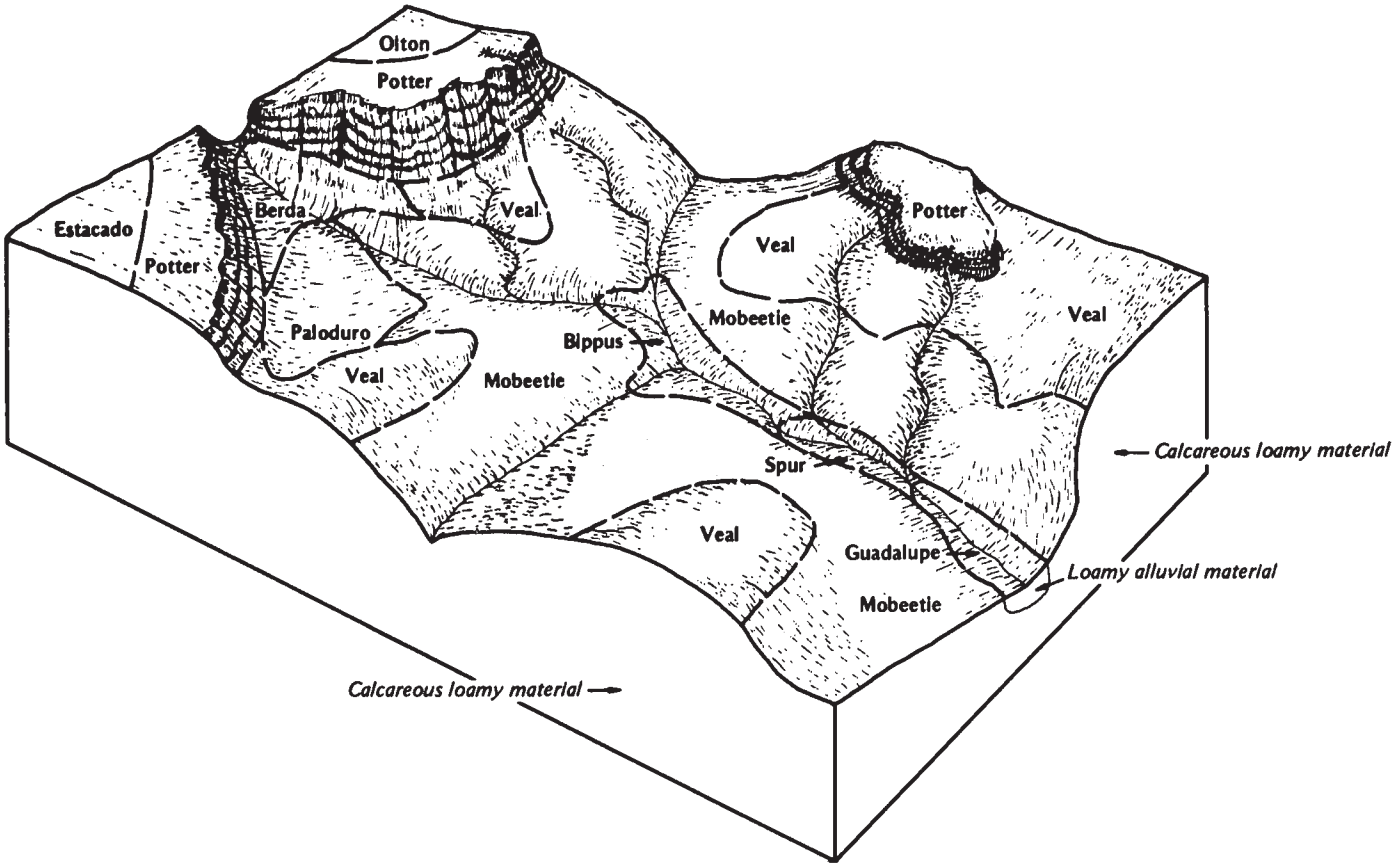


Figure 1.—Typical pattern of soils and parent material in the Mobeetie-Veal-Potter map unit.

Mobeetie soils are on uplands and have slopes of 1 to 45 percent. Typically, the surface layer is grayish brown fine sandy loam about 7 inches thick. The subsoil, to a depth of 20 inches, is pale brown fine sandy loam; to a depth of 35 inches, it is very pale brown fine sandy loam. The substratum, to a depth of 60 inches, is very pale brown fine sandy loam. The soil is very friable and moderately alkaline throughout.

Veal soils are on uplands and have slopes of 1 to 16 percent. Typically, the surface layer is very friable, grayish brown fine sandy loam about 6 inches thick. The subsoil, to a depth of 12 inches, is friable, brown sandy clay loam; to a depth of 26 inches, it is friable, pinkish gray sandy clay loam; and to a depth of 45 inches, it is friable, pink sandy clay loam. The substratum, to a depth of 80 inches, is friable, pink sandy clay loam. The soil is moderately alkaline throughout.

Potter soils are on uplands and have slopes of 1 to 45 percent. Typically, the surface layer is friable loam about 11 inches thick; it is brown to a depth of 5 inches and light brownish gray below that. The underlying material, to a depth of 15 inches, is friable, light gray loam; and to a depth of 60 inches, it is pinkish white, loamy caliche. A few hard fragments of caliche are in the surface layer. To a depth of 15 inches, the soil is moderately alkaline.

The minor soils in this map unit are the Berda, Bippus, Estacado, Guadalupe, Likes, Lincoln, Miles, Olton, Paloduro, Polar, Springer, Spur, and Tivoli soils. Areas of Badland and Rock outcrop also are included. Berda soils are deep, sloping to steep, loamy soils on uplands. Bippus, Miles, Olton, and Paloduro soils are deep, nearly level to sloping, loamy soils on uplands. Estacado soils are deep, nearly level to rolling, loamy soils on uplands. Likes and Springer soils are deep, nearly level to sloping, sandy soils on uplands. Lincoln, Spur, and Guadalupe soils are deep, nearly level soils on the bottom of drainageways and on alluvial fans; Lincoln soils are sandy, and Spur and Guadalupe soils are loamy. Polar soils are deep, hilly, loamy soils on convex, gravelly ridges. Tivoli soils are deep, gently sloping to steep, sandy soils on upland dunes. Badland consists of strongly sloping to very steep, eroding upland areas. Rock outcrop consists of barren areas of exposed bedrock along rock escarpments.

This map unit is used almost entirely as rangeland.

This unit has low potential for cultivated crops because of the steep slopes, very shallow soils, and the hazard of water erosion. In a few small areas, some of the minor soils can be used for crops, mainly wheat and sorghum.

This unit has medium potential for use as rangeland. The steep slopes, the hazard of water erosion, and the very shallow root zone of these soils limit the amount of forage that can be produced in favorable years. The native range plants are short, mid, and tall grasses. In some areas, mesquite trees and sand sagebrush have invaded the rangeland.

This unit has medium potential for most urban uses. The main limitations are the steep slopes and the shallowness to bedrock. This unit has medium potential for recreation uses. The steep slopes and the small stones on the surface are limitations for camp areas, picnic areas, playgrounds, and paths and trails.

In a few areas, the caliche rock and gravel are mined for use as roadbed material.

2. Obaro-Aspermont-Quinlan

Deep to shallow, gently sloping to steep, loamy soils; on uplands

This map unit makes up about 22 percent of the county (fig. 2). The slopes range from 1 to 45 percent. Obaro soils make up about 29 percent of this unit, Aspermont soils 11 percent, Quinlan soils 11 percent, and minor soils 49 percent.

Obaro soils are on uplands and have slopes of 5 to 16 percent. Typically, the surface layer is reddish brown silty clay loam about 8 inches thick. The subsoil, to a depth of 15 inches, is reddish brown silty clay loam; to a depth of 32 inches, it is yellowish red silty clay loam. The substratum, to a depth of 60 inches, is red, weakly cemented, calcareous siltstone. To a depth of 32 inches, the soil is friable and moderately alkaline.

Aspermont soils are on uplands and have slopes of 1 to 45 percent. Typically, the surface layer is friable, reddish brown silty clay loam about 9 inches thick. The subsoil, to a depth of 25 inches, is friable, reddish brown silty clay loam; to a depth of 45 inches, it is friable, yellowish red silty clay loam. The substratum, to a depth of 70 inches, is firm, yellowish red silty clay loam. The soil is moderately alkaline throughout.

Quinlan soils are on ridges and convex slopes on uplands. Slopes range from 5 to 16 percent. Typically, the surface layer is very friable, yellowish red loam about 7 inches thick. The subsoil is friable, yellowish red loam about 5 inches thick. The substratum, to a depth of 60 inches, is red, weakly cemented, calcareous siltstone. To a depth of 12 inches, the soil is moderately alkaline.

The minor soils in this map unit are the Acuff, Burson, Carey, Clairemont, Guadalupe, Lincoln, Miles, Mobeetie, and Veal soils. Acuff, Carey, and Miles soils are deep, nearly level to sloping, loamy soils on uplands. Burson soils are very shallow, steep, loamy soils on hillsides and ridges. Clairemont and Guadalupe soils are deep, nearly level, loamy soils on bottom lands. Lincoln soils are deep, nearly level, sandy soils on bottom lands. Mobeetie soils are deep, gently sloping to steep, loamy soils on uplands. Veal soils are deep, gently sloping to rolling, loamy soils on uplands.

This map unit is used mainly as rangeland.

This unit has low potential for cultivated crops because of the steep slopes, shallowness to rock, and the hazard of water erosion. Where these soils are cultivat-

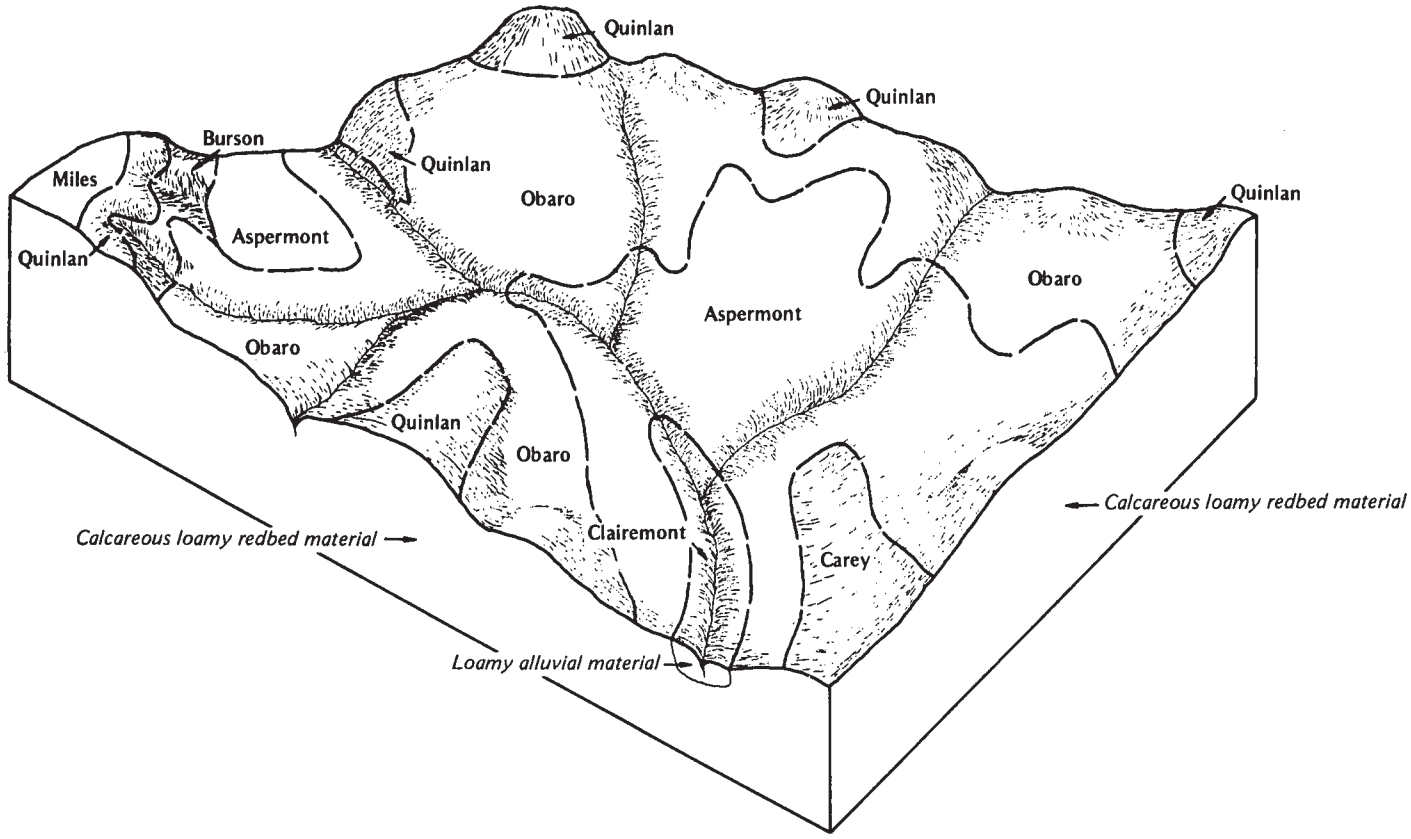


Figure 2.—Typical pattern of soils and parent material in the Obaro-Aspermont-Quinlan map unit.

ed, wheat, cotton, and grain sorghum are the main crops.

This unit has medium potential for use as rangeland. The steep slopes, shallowness to rock, and the hazard of water erosion limit the amount of forage that can be produced in favorable years. The native range plants are mainly short and mid grasses. In some areas, mesquite has invaded the rangeland.

This unit has medium potential for most urban uses. The main limitations are the steep slopes and the shallowness to bedrock.

This unit has medium potential for recreation uses. The steep slopes and the clay content of the surface layer are limitations for camp areas, picnic areas, playgrounds, and paths and trails.

In a few areas, the redbed material underlying these soils is mined for use in roadbeds.

3. Miles-Veal-Acuff

Deep, nearly level to sloping, loamy soils; on uplands

This map unit makes up about 17 percent of the county (fig. 3). The slopes range from 0 to 5 percent. Miles soils make up about 63 percent of this unit, Veal soils 15 percent, Acuff soils 9 percent, and minor soils 13 percent.

Miles soils are on uplands and have slopes of 0 to 5 percent. Typically, the surface layer is very friable, brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 7 and 52 inches, it is friable, reddish brown sandy clay loam; to a depth of 72 inches, it is friable, yellowish red sandy clay loam; and to a depth of 80 inches, it is very friable, reddish yellow sandy clay loam. The soil is neutral to a depth of 28 inches, mildly alkaline between depths of 28 to 52 inches, and moderately alkaline below that.

Veal soils are on uplands and have slopes of 1 to 5 percent. Typically, the surface layer is very friable, grayish brown fine sandy loam about 6 inches thick. The subsoil, to a depth of 12 inches, is friable, brown sandy clay loam; to a depth of 26 inches, it is friable, pinkish gray sandy clay loam; and to a depth of 45 inches, it is friable, pink sandy clay loam. The substratum, to a depth of 80 inches, is friable, pink sandy clay loam. The soil is moderately alkaline throughout.

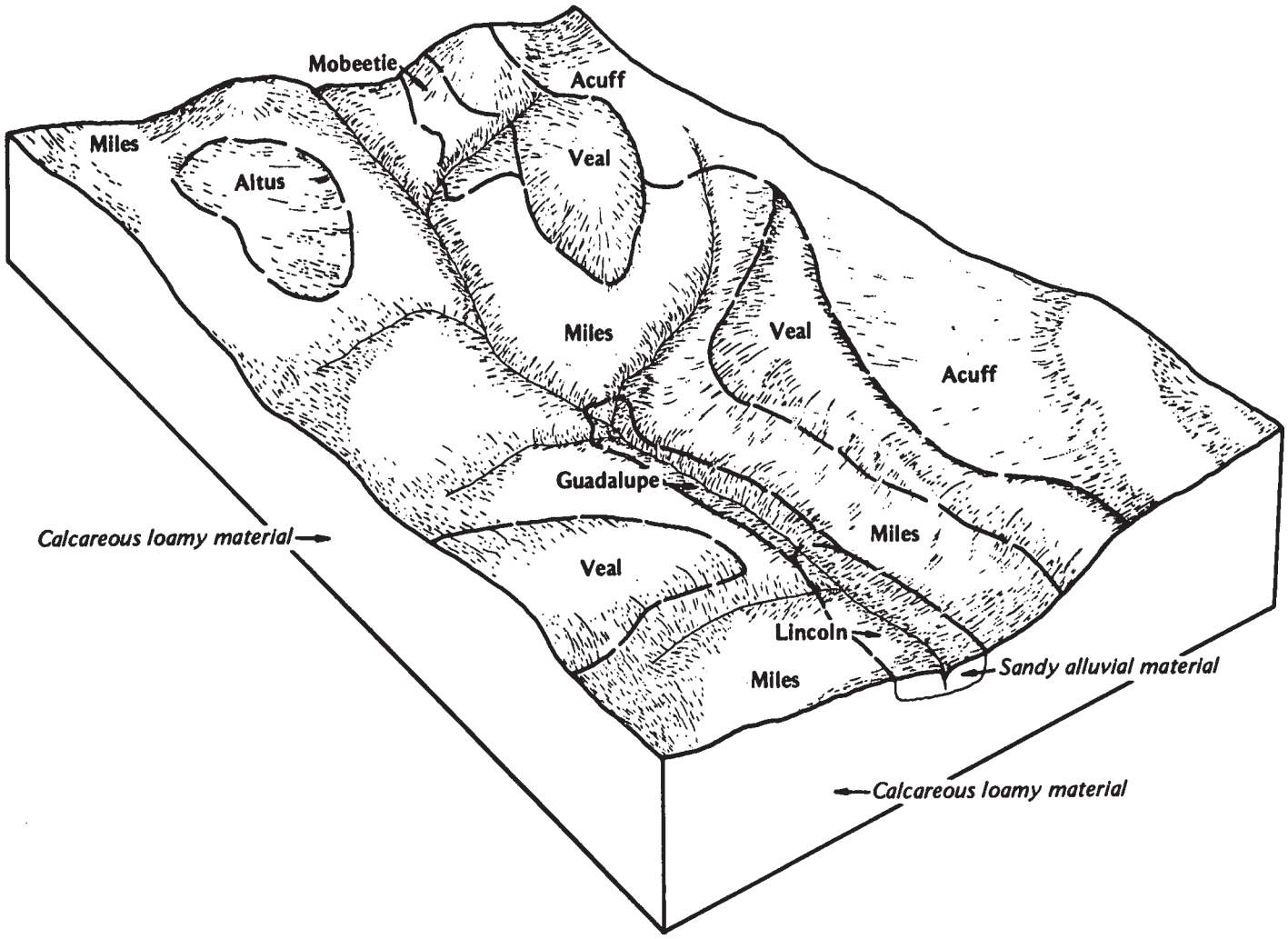


Figure 3.—Typical pattern of soils and parent material in the Miles-Veal-Acuff map unit.

Acuff soils are on uplands and have slopes of 0 to 5 percent. Typically, the surface layer is about 13 inches thick. It is dark grayish brown loam to a depth of 6 inches and dark brown sandy clay loam below that. The subsoil extends to a depth of 80 inches or more. Between depths of 13 and 24 inches, it is reddish brown clay loam; to a depth of 48 inches, it is yellowish red sandy clay loam; to a depth of 64 inches, it is light reddish brown sandy clay loam; and, to a depth of 80 inches, it is reddish yellow sandy clay loam. The soil material is friable throughout. It is neutral to a depth of 6 inches, mildly alkaline between depths of 6 and 13 inches, and moderately alkaline below that.

The minor soils in this map unit are the Altus, Estacado, Guadalupe, Lincoln, Mobeetie, Polar, and Springer soils. Altus soils are deep, nearly level, loamy soils on uplands. Estacado soils are deep, nearly level to gently sloping, loamy soils on uplands. Guadalupe soils are deep, nearly level, loamy soils on the bottom of drainageways and on outwash fans. Lincoln soils are deep, nearly level, sandy soils on bottom lands. Mobeetie soils are deep, gently sloping to strongly sloping, loamy soils on uplands. Polar soils are deep, strongly sloping to steep, loamy soils on convex, gravelly ridges. Springer soils are deep, nearly level to sloping, sandy soils on uplands.

This map unit is used as rangeland and for cultivated crops.

This unit has medium potential for cultivated crops. The main limitations are the low rainfall, the slope, and the hazards of soil blowing and water erosion. Wheat, cotton, and grain sorghum are the main crops. Water for irrigation is not available in many areas of this unit.

This unit has high potential for use as rangeland. The yield of short and mid grasses is good in favorable years.

This unit has high potential for most urban uses. The main limitations are low soil strength, corrosivity to uncoated steel, and the hazard of soil blowing. These limitations can be overcome through good design and careful installation.

This unit has high potential for recreation uses. The slope and the soil blowing hazard are limitations for some playgrounds.

4. Springer-Lincoln-Likes

Deep, nearly level to sloping, sandy soils; on uplands and bottom lands

This map unit makes up about 12 percent of the county (fig. 4). The slopes range from 0 to 8 percent. Springer soils make up about 33 percent of this unit, Lincoln soils 25 percent, Likes soils 14 percent, and minor soils 28 percent.

Springer soils are on uplands and have slopes of 0 to 8 percent. Typically, the surface layer is loose loamy fine sand about 16 inches thick. It is brown to a depth of 8 inches and reddish brown below that. The subsoil, to a depth of 28 inches, is very friable, yellowish red fine sandy loam; to a depth of 40 inches, it is very friable, reddish yellow fine sandy loam. The layer below that, which extends to a depth of 48 inches, is loose, reddish yellow loamy fine sand. To a depth of 60 inches, the soil material is very friable, yellowish red sandy clay loam, and, to a depth of 72 inches, it is very friable, yellowish red fine sandy loam. The soil is neutral to a depth of 16 inches and mildly alkaline below that.

Lincoln soils are on bottom lands and have slopes of 0 to 1 percent. Typically, the surface layer is brown loamy fine sand about 8 inches thick. The underlying material, to a depth of 25 inches, is light yellowish brown loamy fine sand; to a depth of 38 inches, it is pale brown fine sand; and to a depth of 60 inches, it is very pale brown sand. The soil is very friable and moderately alkaline throughout.

Likes soils are on uplands and have slopes of 1 to 8 percent. Typically, the surface layer is brown loamy fine

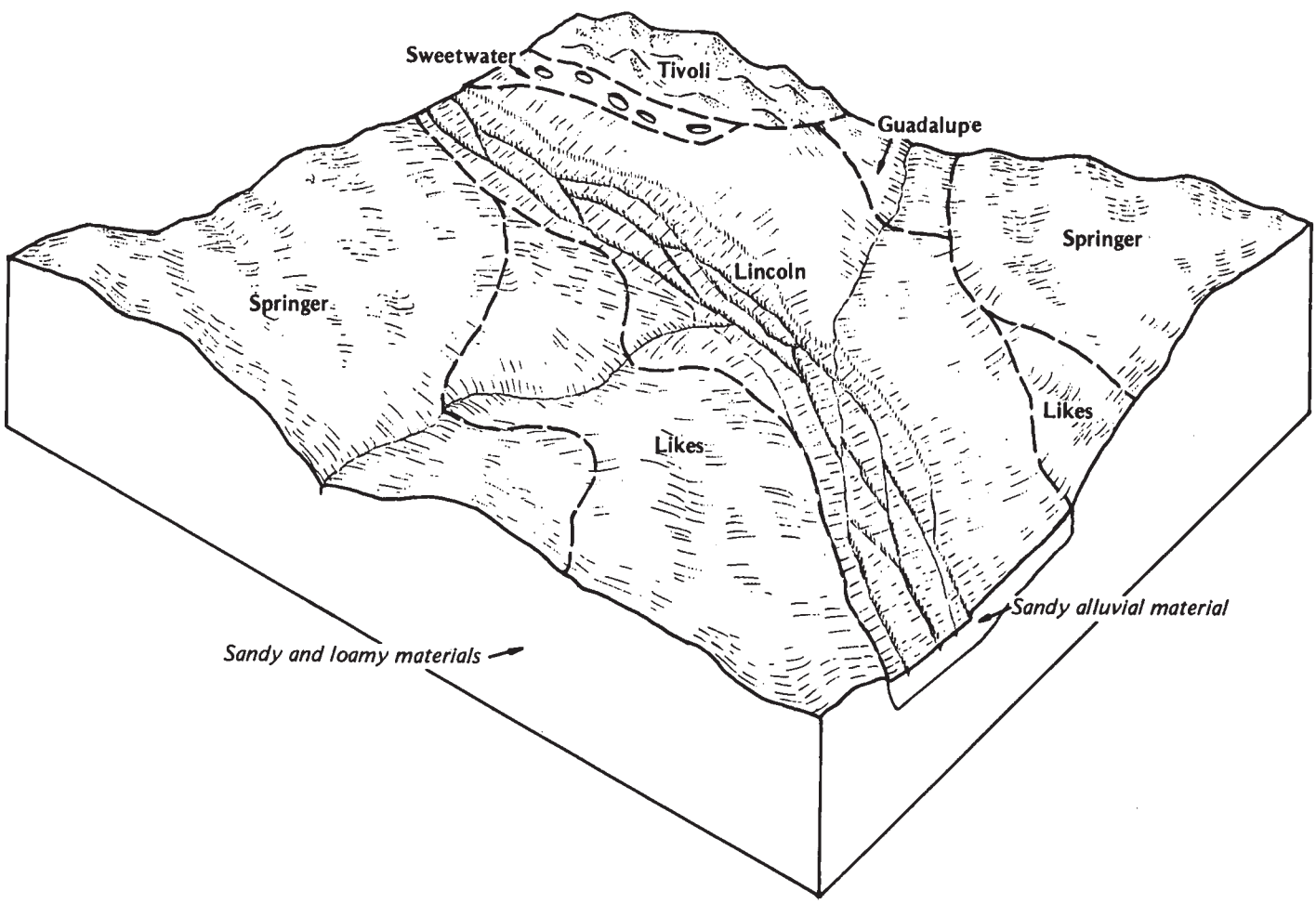


Figure 4.—Typical pattern of soils and parent material in the Springer-Lincoln-Likes map unit.

sand about 8 inches thick. The underlying material, to a depth of 28 inches, is brown loamy fine sand; to a depth of 66 inches, it is pink loamy fine sand. The soil is very friable and moderately alkaline throughout.

The minor soils in this map unit are the Guadalupe, Miles, Nobscot, Sweetwater, Tivoli, and Veal soils. Guadalupe soils are deep, nearly level, loamy soils on bottom lands. Miles soils are deep, nearly level to sloping, sandy soils on uplands. Nobscot soils are deep, gently sloping to sloping, sandy soils in broad, convex areas on uplands. Sweetwater soils are deep, nearly level to gently sloping, loamy soils on wet bottom lands. Tivoli soils are deep, gently sloping to steep, sandy soils on upland dunes. Veal soils are deep, gently sloping, loamy soils on uplands.

This map unit is used mainly as rangeland. In a few areas, the Springer soils are cultivated. The Lincoln and Likes soils are not suitable for cultivation.

This unit has low potential for cultivated crops because of the slopes, the low or medium available water capacity, and the hazard of soil blowing. The main crops are hay, pasture grasses, and sorghum.

This unit has medium potential for use as rangeland. The slopes, the soil blowing hazard, and the low or medium available water capacity limit the amount of forage that can be produced. The native range plants are mainly tall grasses. The yield of forage is good in favorable years.

This unit has low potential for most urban uses. The main limitations are slope, seepage in reservoir areas or sewage lagoons, and the hazard of flooding.

This unit has low potential for recreation uses, mainly because of the slopes, the soil blowing and flooding hazards, and the sandy texture of the surface layer.

5. Miles-Springer

Deep, nearly level to sloping, sandy soils; on uplands

This map unit makes up about 11 percent of the county (fig. 5). The slopes range from 0 to 8 percent.

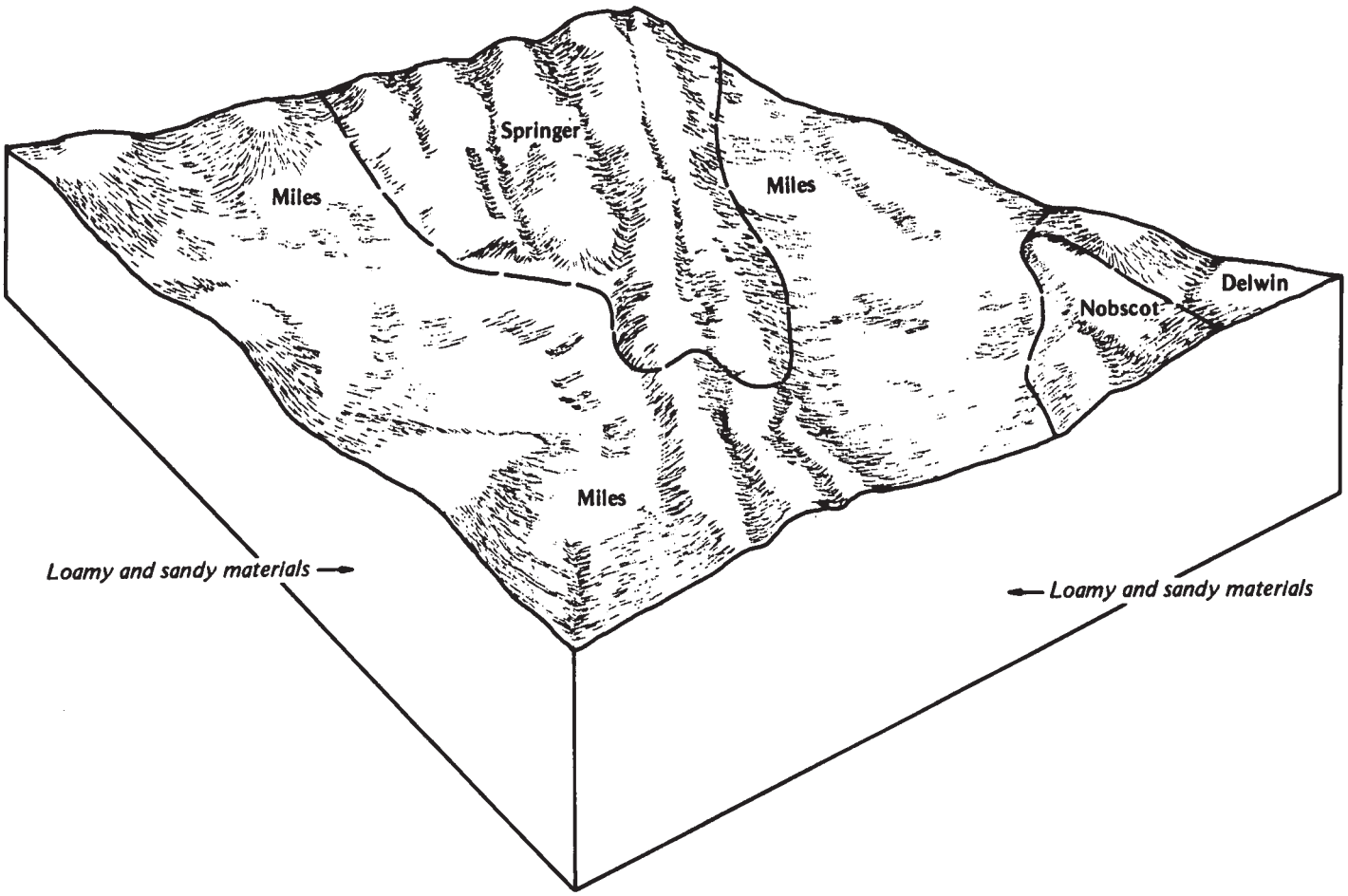


Figure 5.—Typical pattern of soils and parent material in the Miles-Springer map unit.

Miles soils make up about 55 percent of this unit, Springer soils 24 percent, and minor soils 21 percent.

Miles soils are on upland plains and have slopes of 0 to 8 percent. Typically, the surface layer is very friable, light reddish brown loamy fine sand about 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 7 and 17 inches, it is reddish brown sandy clay loam and loamy fine sand; to a depth of 64 inches, it is friable, reddish brown sandy clay loam; and, to a depth of 80 inches, it is friable, yellowish red sandy clay loam. The soil is neutral to a depth of 17 inches, mildly alkaline between depths of 17 and 64 inches, and moderately alkaline below that.

Springer soils are on uplands and have slopes of 0 to 8 percent. Typically, the surface layer is loose loamy fine sand about 16 inches thick. It is brown to a depth of 8 inches and reddish brown below that. The subsoil, to a depth of 28 inches, is very friable, yellowish red fine sandy loam; and, to a depth of 40 inches, it is very friable, reddish yellow fine sandy loam. The layer below that, which extends to a depth of 48 inches, is loose, reddish yellow loamy fine sand. To a depth of 60 inches, the soil material is very friable, yellowish red sandy clay loam; and, to a depth of 72 inches, it is very friable, yellowish red fine sandy loam. The soil is neutral to a depth of 16 inches and mildly alkaline below that.

The minor soils in this map unit are the Altus, Delwin, Likes, Lincoln, Nobscot, Tivoli, and Veal soils. Altus soils are deep, nearly level, loamy soils in slight depressions. Delwin soils are deep, nearly level to gently sloping, sandy soils on uplands. Likes soils are deep, gently sloping to sloping, sandy soils on uplands. Lincoln soils are deep, nearly level, sandy soils on bottom lands that are frequently flooded. Nobscot soils are deep, gently sloping to sloping, sandy soils on broad, convex uplands. Tivoli soils are deep, gently sloping to steep, sandy soils on upland dunes. Veal soils are deep, gently sloping, loamy upland soils.

This map unit is used as rangeland and cropland. Crops are grown mainly on the Miles soils.

This unit has medium potential for cultivated crops. The main limitations are the low rainfall and the hazard of soil blowing. Cotton and grain sorghum are the main crops.

This unit has high potential for use as rangeland. The native range plants are mainly tall grasses. The yield of forage is good in favorable years.

This unit has high potential for most urban uses. The main limitations are seepage in reservoir areas or sewage lagoons, low soil strength, and the hazard of soil blowing.

This unit has medium potential for recreation uses. The main limitations are the sandy surface layer and the slopes.

6. Pullman-Estacado-Olton

Deep, nearly level to gently sloping, loamy soils; on uplands

This map unit makes up about 3 percent of the county (fig. 6). The slopes range from 0 to 5 percent. Pullman soils make up about 60 percent of this unit, Estacado soils 15 percent, Olton soils 12 percent, and minor soils 13 percent.

Pullman soils are on uplands and have slopes of 0 to 3 percent. Typically, the surface layer is friable, dark grayish brown clay loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 6 and 26 inches, it is very firm, dark grayish brown clay; to a depth of 44 inches, it is very firm, brown clay; to a depth of 56 inches, it is firm, reddish brown clay loam; to a depth of 68 inches, it is friable, pink clay loam; and, to a depth of 80 inches, it is friable, yellowish red clay loam. The soil is mildly alkaline to a depth of 26 inches and moderately alkaline below that.

Estacado soils are on uplands and have slopes of 0 to 5 percent. Typically, the surface layer is dark grayish brown clay loam about 15 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 15 and 24 inches, it is light brown clay loam; to a depth of 80 inches, it is reddish yellow clay loam. The soil is friable and moderately alkaline throughout.

Olton soils are on uplands and have slopes of 0 to 3 percent. Typically, the surface layer is friable, dark brown clay loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 6 and 16 inches, it is firm, dark brown clay loam; to a depth of 38 inches, it is firm, reddish brown clay loam; to a depth of 47 inches, it is firm, yellowish red clay loam; to a depth of 70 inches, it is firm, pink clay loam; and, to a depth of 80 inches, it is friable, reddish yellow clay loam. The soil is neutral to a depth of about 25 inches and moderately alkaline below that.

The minor soils in this map unit are the Potter, Randall, and Spur soils. Potter soils are very shallow, gently sloping to sloping, loamy soils on uplands. Randall soils are deep, nearly level, clayey soils on the bottom of playas. Spur soils are deep, nearly level, loamy soils in drainageways and on alluvial fans.

This map unit is used mainly as cropland. In some areas, it is used as rangeland. About half of the cultivated land is irrigated using water from deep wells.

This unit has high potential for cultivated crops. The main limitations are the slow permeability, the low rainfall, and the hazard of soil blowing. Wheat and grain sorghum are the main crops. In some areas, corn and soybeans are grown under irrigation management.

This unit has medium potential for use as rangeland. The native range plants are mainly short and mid

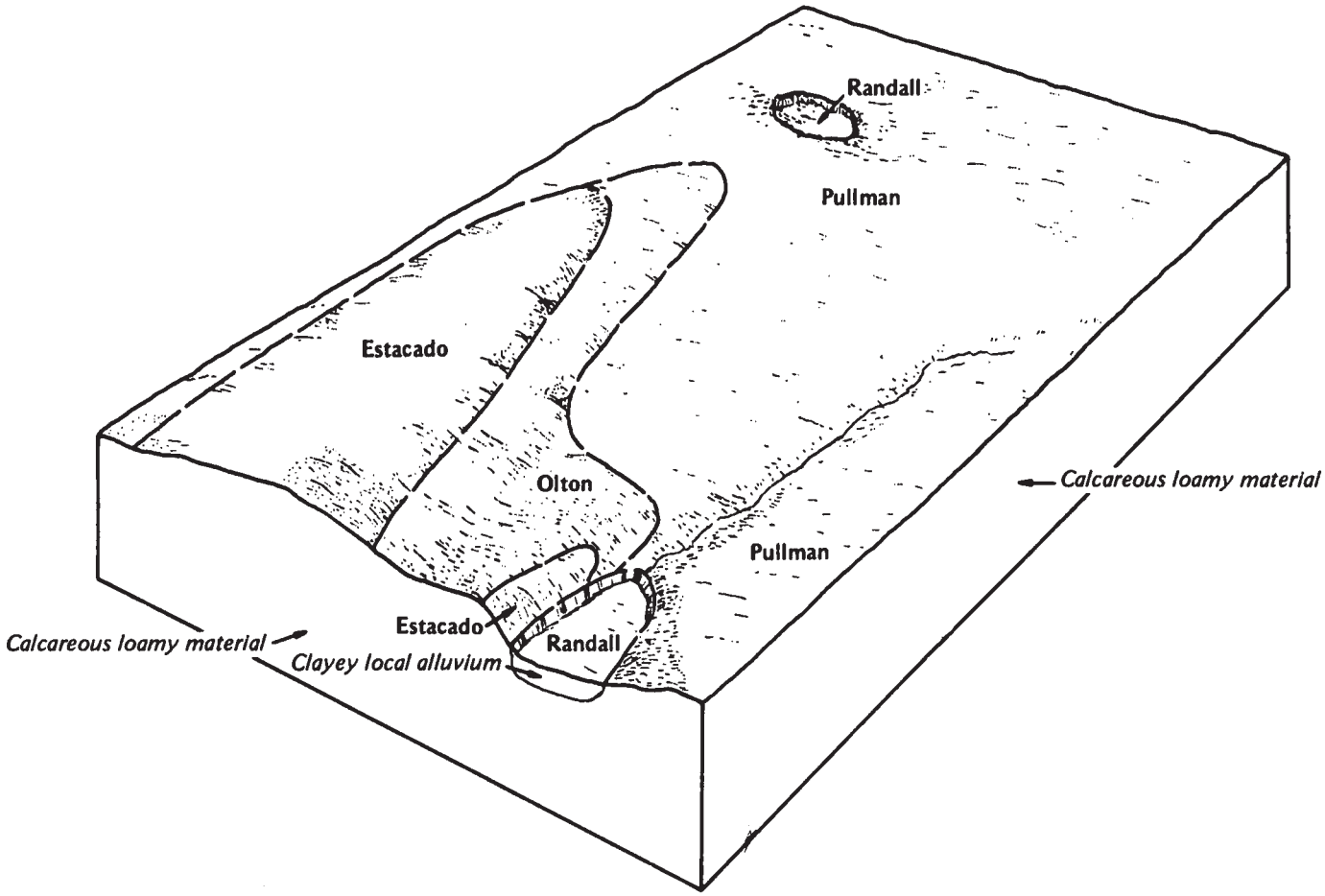


Figure 6.—Typical pattern of soils and parent material in the Pullman-Estacado-Olton map unit.

grasses. Because of the slow permeability and high clay content of the soils, the yield of forage is only moderate in favorable years.

This unit has medium potential for most urban uses. The main limitations are the shrinking and swelling of the soil, low soil strength, and corrosivity to uncoated steel.

This unit has medium potential for recreation uses. The clayey and dusty surface and slow permeability are limitations.

7. Olton-Acuff-Miles

Deep, nearly level to gently sloping, loamy soils; on uplands

This map unit makes up about 2 percent of the county (fig. 7). The slopes range from 0 to 5 percent. Olton soils make up about 30 percent of this unit, Acuff soils 25 percent, Miles soils 25 percent, and minor soils 20 percent.

Olton soils are on uplands and have slopes of 0 to 3 percent. Typically, the surface layer is friable, dark brown clay loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 6 and 16 inches, it is firm, dark brown clay loam; to a depth of 38 inches, it is firm, reddish brown clay loam; to a depth of 47 inches, it is firm, yellowish red clay loam; to a depth of 70 inches, it is firm, pink clay loam; and, to a depth of 80 inches, it is friable, reddish yellow clay loam. The soil is neutral to a depth of about 25 inches and moderately alkaline below that.

Acuff soils are on uplands and have slopes of 0 to 5 percent. Typically, the surface layer is about 13 inches thick. It is dark grayish brown loam to a depth of 6 inches and dark brown sandy clay loam below that. The subsoil extends to a depth of 80 inches or more. Between depths of 13 and 24 inches, it is reddish brown clay loam; to a depth of 48 inches, it is yellowish red sandy clay loam; to a depth of 64 inches, it is light reddish brown sandy clay loam; and, to a depth of 80 inches, it is reddish yellow sandy clay loam. The soil material is friable throughout. It is neutral to a depth of 6

inches, mildly alkaline between depths of 6 and 13 inches, and moderately alkaline below that.

Miles soils are on uplands and have slopes of 0 to 5 percent. Typically, the surface layer is very friable, brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 7 and 52 inches, it is friable, reddish brown sandy clay loam; to a depth of 72 inches, it is friable, yellowish red sandy clay loam; and, to a depth of 80 inches, it is very friable, reddish yellow sandy clay loam. The soil is neutral to a depth of about 28 inches, mildly alkaline between depths of 28 and 72 inches, and moderately alkaline below that.

The minor soils in this map unit are the Berda, Estacado, Randall, Springer, and Veal soils. Berda soils are deep, sloping, loamy soils on uplands. Estacado soils are deep, nearly level to gently sloping, loamy soils on uplands. Randall soils are deep, nearly level, clayey soils on the bottom of playas. Springer and Veal soils are deep, gently sloping, loamy soils on convex uplands.

This map unit is used as rangeland and for cultivated crops.

This unit has high potential for cultivated crops; however, the low rainfall and the insufficient supply of irrigation water limit the acreage that can be cultivated. Cotton, grain sorghum, and wheat are the main crops.

This unit has high potential for use as rangeland. The yield of short and mid grasses is good in favorable years.

This unit has high potential for most urban uses. The main limitations are the low soil strength and corrosivity to uncoated steel, but they can easily be overcome through good design and careful installation.

This unit has high potential for recreation uses. The slopes are a limitation for some playgrounds.

Broad land use considerations

The soils in the survey area vary widely in their potential for major land uses. Table 2 shows the extent of the

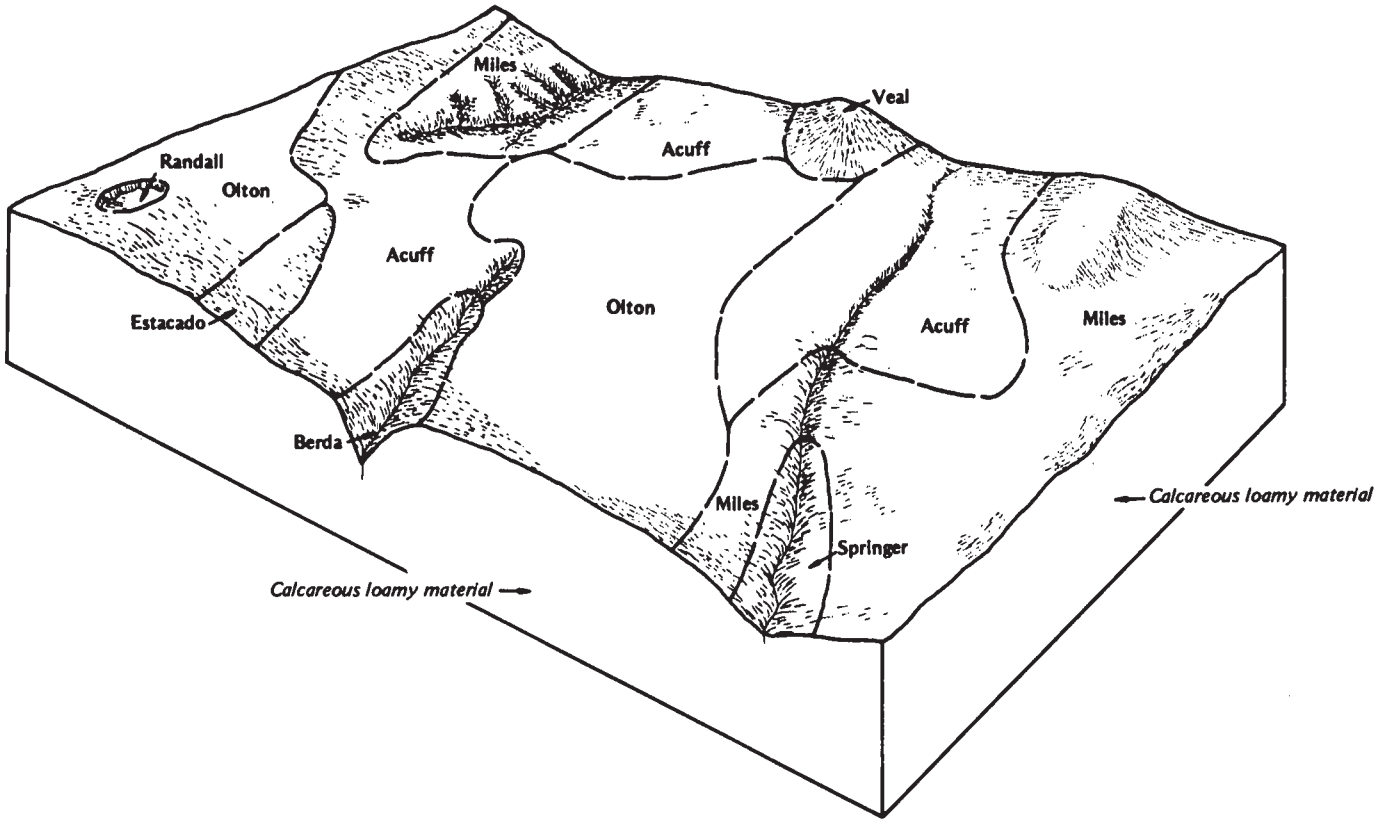


Figure 7.—Typical pattern of soils and parent material in the Olton-Acuff-Miles map unit.

map units shown on the general soil map. It lists the potential of each, in relation to that of the other map units, for major land uses and shows soil properties that limit use. Soil potential ratings are based on the practices commonly used in the survey area to overcome soil limitations. These ratings reflect the ease of overcoming the limitations. They also reflect the problems that will persist even if such practices are used.

Each map unit is rated for *cultivated crops, specialty crops, rangeland, urban uses,* and *recreation areas*. Cultivated crops are those grown extensively in the survey area. Specialty crops are the vegetables and fruits that generally require intensive management. Rangeland refers to land where the native plants are used for grazing livestock. Urban uses include residential, commercial, and industrial developments. Recreation areas are campsites, picnic areas, ballfields, and other areas that are subject to heavy foot traffic, as well as areas used for nature study and as wilderness.

About 79 percent of the acreage in Donley County is currently used as rangeland, about 15 percent is used for cultivated crops, and about 4 percent is pasture, hayland, or orchards. According to table 2, only about 30 percent of land in the county has high potential for use as rangeland, and about 70 percent has medium potential. Table 2 also shows that about 5 percent of the land has high potential for cultivated farm crops, about 28 percent has medium potential, and about 67 percent has low potential.

In recent years, the acreage used as rangeland has decreased slightly, and the acreage used as cropland, pastureland, and hayland has increased slightly. This change has been due, in part, to the development of irrigation water sources. The acreage used for urban development and recreation uses also has increased slightly.

The Pullman-Estacado-Olton and Olton-Acuff-Miles map units generally have high potential for cultivated farm crops and specialty crops. The soils in these units are deep and loamy and are well suited to cultivation. However, conservation practices are needed on these soils to prevent water erosion and soil blowing. The Miles-Veal-Acuff, Miles-Springer, and Olton-Acuff-Miles map units have high potential for use as rangeland. These deep, loamy or sandy soils also require conservation management to prevent water erosion and soil blowing.

The Miles-Veal-Acuff, Miles-Springer, and Olton-Acuff-Miles map units have high potential for urban uses. If the soils in these units are used for building site development, good designs and careful installation procedures are needed. The main limitations are the low strength and the corrosivity of the soils. The Miles-Veal-Acuff and Olton-Acuff-Miles map units have high potential for recreation uses. The more sloping soils in these units are limited for some playground uses.

The sandy soils in the Springer-Lincoln-Likes map unit have low potential for most uses. Soil blowing and slope are the main limitations.

Soil maps for detailed planning

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

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

A symbol identifying the soil precedes the map unit name in the soil descriptions. Each description includes general facts about the soil, a brief description of the soil profile, and a listing of the principal hazards and limitations to be considered in planning management.

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

Soils of one series can differ in texture of the surface layer or of the underlying material. They also can differ in slope, stoniness, salinity, wetness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Miles fine sandy loam, 1 to 3 percent slopes, is one of several phases in the Miles series.

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

A *soil association* is made up of two or more geographically associated soils that are shown as one unit on the maps. Because of present or anticipated soil uses in the survey area, it was not considered practical or necessary to map the soils separately. The pattern and relative proportion of the soils are somewhat similar. These units are broadly defined; they generally are larger and vary more in composition than other map units. Burson-Aspermont association, steep, is an example.

An *undifferentiated group* is made up of two or more soils that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils in a mapped area are not uniform. An area can

be made up of only one of the major soils, or it can be made up of all of them. Sweetwater soils is an undifferentiated group in this survey area.

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

Table 3 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

Soil descriptions

1—Acuff loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on uplands. The areas are irregular in shape and range from 10 to 100 acres.

The surface layer is about 12 inches thick. The upper part of the surface layer is friable, dark grayish brown loam about 8 inches thick, and the lower part is firm, dark grayish brown clay loam about 4 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 12 and 20 inches, it is firm, reddish brown clay loam; to a depth of 36 inches, it is friable, yellowish red sandy clay loam; to a depth of 48 inches, it is friable, reddish brown clay loam; to a depth of 65 inches, it is friable, pink sandy clay loam that is about 45 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is friable, reddish yellow sandy clay loam that is about 20 percent calcium carbonate, by volume. The soil is neutral to a depth of 12 inches, mildly alkaline between depths of 12 and 20 inches, and moderately alkaline below that.

Runoff is slow. Permeability is moderate, and the available water capacity is high. Tilth is good, and the soil can be worked within a wide range in moisture content. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Altus, Miles, Olton, and Veal soils. Also included are small areas of Acuff soils that have slopes of 1 to 3 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are grain sorghum and wheat. Cotton is grown in some areas.

This soil has high potential for nonirrigated and irrigated grain sorghum, wheat, and cotton. Soil blowing and water erosion can be controlled and moisture conserved by leaving crop residue on the surface, through timely and limited tillage, and by rotating crops. Leaving crop residue on the surface also helps to maintain the productivity of this soil. If the crop residue or cover crops cannot provide adequate protection, emergency tillage to roughen the soil surface is needed to help control soil blowing. If this soil is irrigated, an irrigation system that properly applies irrigation water should be used. Surface and sprinkler irrigation systems are suitable. Fertilizer will be needed if this soil is irrigated.

This soil has medium potential for native range plants. Its potential is limited because the amount of water available to plants during the growing season is low. The main native range plants are short grasses. Forage production is medium.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the moderate corrosivity to uncoated steel and low soil strength, but they can easily be overcome through good design and careful installation.

This soil has high potential for recreation uses.

Capability subclass IIIe, nonirrigated, and IIe, irrigated; Clay Loam range site.

2—Acuff loam, 1 to 3 percent slopes. This is a deep, gently sloping, well drained soil on uplands. The areas are irregular in shape and range from 5 to 200 acres.

The surface layer is about 13 inches thick. The upper part is friable, dark grayish brown loam about 6 inches thick, and the lower part is friable, dark brown sandy clay loam 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 13 and 24 inches, it is friable, reddish brown clay loam; to a depth of 48 inches, it is friable, yellowish red sandy clay loam; to a depth of 64 inches, it is friable, light reddish brown sandy clay loam that is about 40 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is friable, reddish yellow sandy clay loam. The soil is neutral to a depth of 6 inches, mildly alkaline between depths of 6 and 13 inches, and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Altus, Miles, Olton, and Veal soils. Also included are small areas of Acuff soils that have slopes of 0 to 1 percent or 3 to 5 percent. The included soils make up less than 30 percent of any one mapped area.

This soil is used mainly as cropland and rangeland. The main crops are grain sorghum, cotton, and wheat.

This soil has medium potential for nonirrigated and irrigated cotton, wheat, and grain sorghum. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. In dry years, emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces also help to control water erosion. Grassed waterways can be used as outlets for the terraces. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A sprinkler irrigation system is the most suitable. If a surface system is used, bench leveling will be necessary. Fertilizer will be needed if this soil is irrigated.

This soil has medium potential for native range plants. The low rainfall is the main limitation. The main native range plants are short grasses. Forage production is medium.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the moderate corrosivity to uncoated steel and the low soil strength, but they can easily be overcome through good design and careful installation

This soil has high potential for recreation uses. Slope is a limitation for some playgrounds.

Capability subclass IIIe, nonirrigated and irrigated; Clay Loam range site.

3—Acuff loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are irregular in shape and range from 5 to 100 acres.

The surface layer is friable, dark brown loam about 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 7 and 16 inches, it is firm, dark brown clay loam; to a depth of 28 inches, it is firm, reddish brown clay loam; to a depth of 48 inches, it is firm, yellowish red clay loam; to a depth of 70 inches, it is friable, reddish yellow clay loam that is about 6 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is friable, pink clay loam that is about 35 percent calcium carbonate, by volume. The soil is neutral to a depth of 7 inches and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is high. Tilth is good, and the soil can be worked within a wide range in moisture content. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Estacado, Miles, Olton, and Veal soils. Also included are small areas of Acuff soils that have slopes of 1 to 3 percent. These included soils make up less than 25 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are wheat, grain sorghum, and cotton.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and water erosion, to conserve moisture, and to maintain the productivity of this soil. In dry years, emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming, terraces, and grassed waterways help to control water erosion. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A sprinkler irrigation system is the most suitable. If a surface system is used, bench leveling will be necessary. Fertilizer will be needed if this soil is irrigated.

This soil has medium potential for native range plants. Its potential is limited because the amount of water available to plants during the growing season is low. The main native range plants are short grasses. Forage production is medium.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the moderate corrosivity to uncoated steel and the low soil strength, but they can easily be overcome through good design and careful installation.

This soil has high potential for recreation uses. The slope is a limitation for some playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Clay Loam range site.

4—Altus fine sandy loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on uplands. The areas are irregular to oval in shape and range from 10 to 200 acres. Local shifting of soil material by wind is evident in places.

The surface layer is very friable, dark grayish brown fine sandy loam about 12 inches thick. The subsoil extends to a depth of 65 inches or more. Between depths of 12 and 24 inches, it is friable, dark grayish brown sandy clay loam; to a depth of 35 inches, it is friable, brown sandy clay loam; to a depth of 50 inches, it is friable, reddish brown sandy clay loam, and to a depth of 65 inches, it is friable, brown sandy clay loam. The soil is mildly alkaline to a depth of 50 inches and moderately alkaline below that.

Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots.

Water erosion is a slight hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Acuff and Miles soils. Also included are small areas of Altus soils that have slopes of 1 to 3 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton and grain sorghum. Wheat is grown in some areas.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. Crop residue should be left on the surface or worked into the surface layer to conserve moisture and to help control soil blowing and water erosion. In dry years, emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Diversion terraces and grassed waterways can be used to control runoff from adjacent soils. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A surface or sprinkler irrigation system can be used. Fertilizer will be needed if this soil is irrigated.

This soil has high potential for native range plants. The yield of short and mid grasses is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the low soil strength for roads and the hazard of seepage in sewage lagoons.

This soil has high potential for recreation uses.

Capability subclass IIe, nonirrigated, and capability class I, irrigated; Sandy Loam range site.

5—Aspermont silty clay loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are irregular in shape and range from 5 to about 200 acres.

The surface layer is friable, reddish brown silty clay loam about 8 inches thick. The subsoil, to a depth of 22 inches, is friable, reddish brown silty clay loam; to a depth of 36 inches, it is friable, reddish yellow silty clay loam that is about 5 percent calcium carbonate, by volume. The substratum, to a depth of 60 inches, is firm, yellowish red silty clay loam. The soil is moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Carey, Clairemont, Obaro, and Quinlan soils. Also included are small areas of Aspermont soils that have slopes of 0 to 1 percent or 3 to 5 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. In a few areas, it is cultivated; wheat, cotton, and grain sorghum are the main crops.

This soil has medium potential for nonirrigated and irrigated wheat, cotton, and grain sorghum. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. In dry years, emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming, terraces, and grassed waterways are needed to help control water erosion. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system can be used. If a surface system is used, bench leveling will be necessary. Fertilizer will be needed if this soil is irrigated.

This soil has low potential for native range plants. Low rainfall is the main limitation.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the shrinking and swelling of the soil, the low soil strength, and the moderate corrosivity to uncoated steel. These limitations can easily be overcome through good design and careful installation.

This soil has high potential for recreation uses. The surface texture is too clayey for playgrounds.

Capability subclass IIIe, nonirrigated, and IIe, irrigated; Clay Loam range site.

6—Aspermont silty clay loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on uplands. Slopes are convex or concave. The areas are irregular in shape and range from 5 to 300 acres.

The surface layer is friable, reddish brown silty clay loam about 9 inches thick. The subsoil, to a depth of 25 inches, is friable, reddish brown silty clay loam; to a depth of 45 inches, it is friable, yellowish red silty clay loam. The substratum, to a depth of 70 inches, is firm, yellowish red silty clay loam. The soil is moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Carey, Clairemont, Obaro, and Quinlan soils. Also included are small areas of Aspermont soils that have slopes of 1 to 3 percent or more than 5 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. In a few areas it is cultivated; the main crops are grain sorghum and wheat. Cotton is grown in some areas.

This soil has low potential for nonirrigated and irrigated grain sorghum, cotton, and wheat. The main limitations are the low rainfall, the slope, and the hazard of water erosion. If this soil is cultivated, crop residue needs to be left on the surface or worked into the surface layer to conserve moisture and to help control water erosion and soil blowing. Emergency tillage is needed in dry years if the crop residue cannot provide adequate protection. Contour farming, terraces, and grassed waterways are necessary to help control runoff. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system can be used. If a surface system is used, bench leveling will be necessary. Fertilizer will be needed if this soil is irrigated.

This soil has low potential for native range plants mainly because of the low rainfall.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the shrinking and swelling of the soil, the low soil strength, and the moderate corrosivity to uncoated steel. These limitations can easily be overcome through good design and careful installation.

This soil has high potential for most recreation uses. The slope and the surface texture are limitations for playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Clay Loam range site.

7—Berda-Estacado-Potter association, rolling. The soils in this association are on uplands. The areas are dissected by erosional valleys and drainageways, and geologic erosion is active in some areas. The areas range from 10 to about 500 acres. Slopes range from 5 to 16 percent. The relief ranges from 30 to 100 feet. Berda soils make up about 25 percent of this association, Estacado soils 25 percent, Potter soils 15 percent, and minor soils and miscellaneous areas 35 percent.

Berda soils are well drained and are on hillsides, mainly below escarpments. The surface layer is very friable, grayish brown loam about 9 inches thick. The subsoil, to a depth of 17 inches, is friable, brown loam; to a depth of 45 inches, it is friable, light brown loam that is about 10 percent calcium carbonate, by volume. The substratum, to a depth of 60 inches, is friable, light brown loam that is about 5 percent calcium carbonate, by volume. The soil is moderately alkaline throughout.

Runoff is medium to rapid. Permeability is moderate, and the available water capacity is high. The root zone is deep. Water erosion and soil blowing are moderate hazards.

Estacado soils are well drained and are on ridges, on convex slopes, and in less sloping areas. The surface layer is friable, dark brown clay loam about 14 inches thick. The subsoil, to a depth of 22 inches, is friable, brown clay loam that is about 25 percent calcium carbonate, by volume; to a depth of 38 inches, it is friable, yellowish red clay loam that is about 10 percent calcium carbonate, by volume; to a depth of 52 inches, it is firm, yellowish red clay loam that is about 15 percent calcium carbonate, by volume; and, to a depth of 65 inches, it is friable, yellowish red clay loam that is about 30 percent calcium carbonate, by volume. The soil is moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. Water erosion and soil blowing are moderate hazards.

Potter soils are well drained and are in strongly convex areas and on ridges along escarpments. The surface layer is friable, light brown loam about 5 inches thick. The underlying material, to a depth of 10 inches, is friable, pink very gravelly loam that is about 50 percent calcium carbonate, by volume; and, to a depth of 40 inches, it is pink, fragmented, platy caliche that is about 80 percent calcium carbonate, by volume. The soil is moderately alkaline to a depth of 10 inches.

Runoff is rapid. Permeability is moderate, and the available water capacity is very low. The root zone is very shallow. Water erosion is a severe hazard.

Included in mapping are small areas of Bippus, Guadalupe, Likes, Mobeetie, Paloduro, and Spur soils. Also included are areas of Rock outcrop along escarpments and areas of Badland below the escarpments. Inclusions make up less than 50 percent of any one mapped area.

The soils in this association are not suitable for cultivation. They are used mainly as rangeland.

These soils have medium potential for native range plants. Because of the rapid runoff, the high to very low available water capacity, and the restricted root zone, forage production is only medium in favorable years. Stocking at the proper rate, controlling grazing, and managing brush are necessary in managing rangeland.

These soils have low potential for the development of wildlife habitat.

These soils have low potential for most urban or recreation uses. The main limitations are slope, the moderate corrosivity to uncoated steel, the low soil strength, and the hazard of seepage. These limitations are difficult to overcome.

The Berda soils are in capability subclass VIe and in Hardland Slopes range site; the Estacado soils are in capability subclass VIe and in Loamy range site; and the Potter soils are in capability subclass VIIs and in Very Shallow range site.

8—Berda-Potter-Rock outcrop association, steep. This association consists of steep, well drained soils and areas of Rock outcrop on uplands. The areas are dissected by deep erosional valleys and drainageways, and

geologic erosion is active (fig. 8). The areas range from 10 to about 200 acres. Slopes range from 20 to 45 percent. Relief ranges from 30 to 150 feet. This association is about 50 percent Berda soils, 20 percent Potter soils, 15 percent Rock outcrop, and 15 percent minor soils.

Berda soils are on hillsides and below escarpments. The surface layer is friable, brown clay loam about 11 inches thick. The subsoil, to a depth of 30 inches, is friable, light brown sandy clay loam. The substratum, to a depth of 60 inches, is friable, light brown sandy clay loam that is about 5 percent calcium carbonate, by volume. The soil is moderately alkaline throughout.

Runoff is very rapid. Permeability is moderate, and the available water capacity is high. The root zone is deep. Water erosion and soil blowing are moderate hazards.

Potter soils are in strongly convex areas and on ridges along escarpments. The surface layer is about 9 inches thick. The upper part is brown gravelly loam about 4 inches thick, and the lower part is light brown very gravelly loam about 5 inches thick. The underlying material, to a depth of 12 inches, is light brown, extremely gravelly loam that has soft calcium carbonate accumulations between the fragments of caliche; to a depth of 40 inches, it is light brown, weakly cemented caliche packsand. The soil is friable and moderately alkaline throughout.

Runoff is very rapid. Permeability is moderate. The available water capacity is very low. The root zone is very shallow. Water erosion is a severe hazard.

The areas of Rock outcrop are along escarpments of caliche caprock. They have little or no soil material and

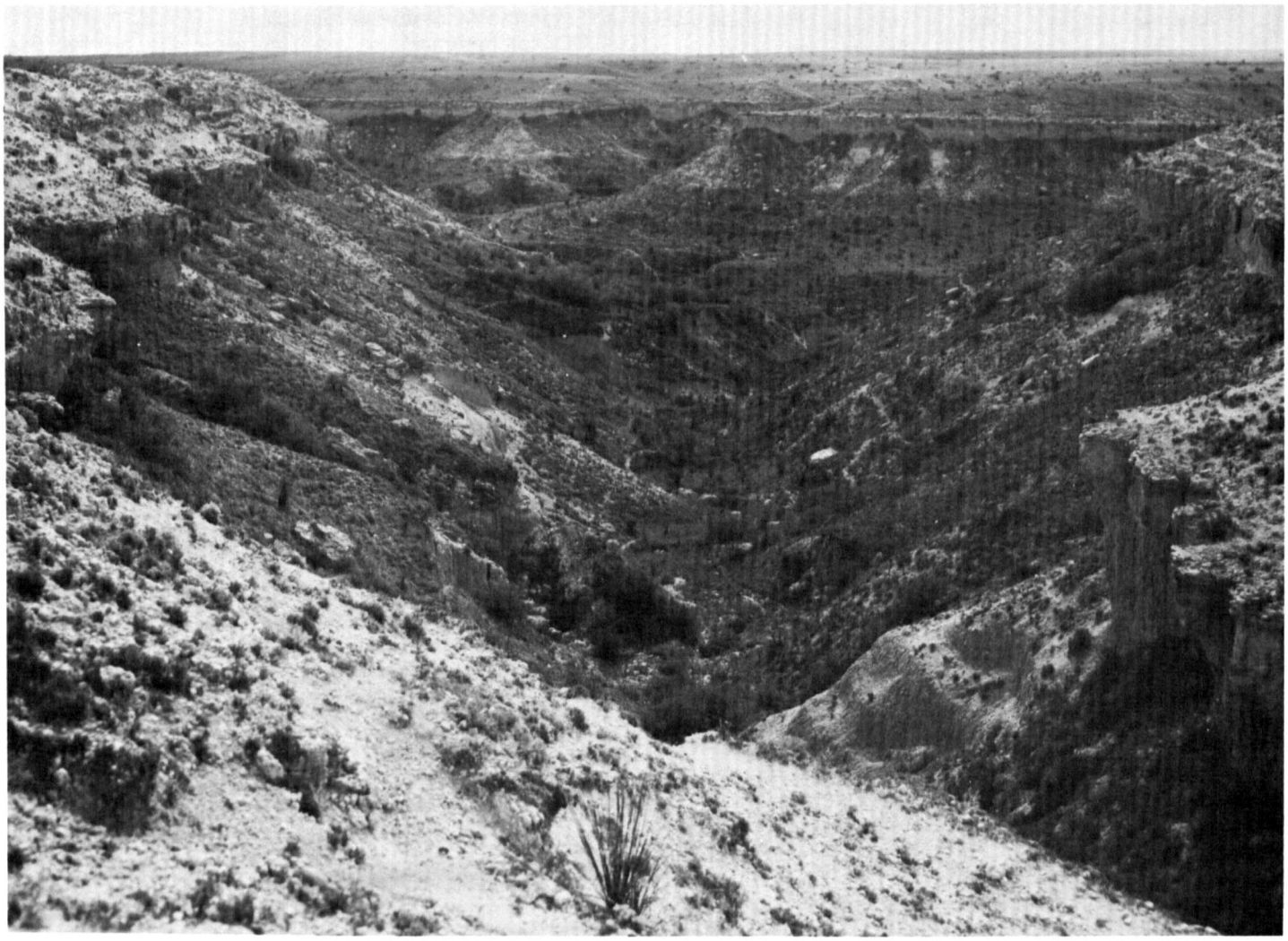


Figure 8.—An area of Berda-Potter-Rock outcrop association, steep.

are almost void of vegetation. Runoff is very rapid, and geologic erosion is active.

Included in mapping are small areas of Acuff, Bippus, Guadalupe, Likes, Lincoln, Miles, Mobeetie, Polar, Spur, and Veal soils. Slopes are mainly 20 to 45 percent but range from 3 to 60 percent. The included soils make up less than 30 percent of any one mapped area.

The soils in this association are used mainly as rangeland. They are not suitable for cultivation.

These soils have low potential for native range plants because of the very rapid runoff, the high to very low available water capacity, and the very shallow root zone. Forage production is low in favorable years. Proper stocking, controlled grazing, and brush management are necessary in managing rangeland.

These soils have low potential for the development of wildlife habitat.

These soils have low potential for most urban and recreation uses. The main limitations are the slope, the moderate corrosivity to uncoated steel, the rock outcrops, and the low soil strength. They are difficult to overcome.

The Berda soils are in capability subclass VIIe and in Rough Breaks range site; the Potter soils are in capability subclass VIIs and in Very Shallow range site; the Rock outcrop part is not assigned to a capability subclass or range site.

9—Bippus clay loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on valley floors and outwash fans. It occasionally receives runoff from adjacent upland soils. The areas are long and narrow and range from 10 to 200 acres.

The surface layer is dark grayish brown clay loam about 23 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 23 and 42 inches, it is brown clay loam; to a depth of 55 inches, it is yellowish brown clay loam that has a few threads and films of calcium carbonate; and to a depth of 80 inches, it is pale brown clay loam. The soil is friable throughout. It is mildly alkaline to a depth of 23 inches and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Guadalupe, Lincoln, Paloduro, and Spur soils and small areas of Bippus soils that have slopes of 1 to 3 percent. Also included are some narrow stream channels and U-shaped gullies. Inclusions make up less than 15 percent of any one mapped area.

This soil is used mainly as rangeland. It can be cultivated, but some areas are too small or too narrow for cultivation. Where this soil is cultivated, the main crops are wheat, cotton, and grain sorghum.

This soil has high potential for nonirrigated and irrigated cotton, wheat, and grain sorghum. Crop residue should be left on the surface or worked into the surface layer to help protect the soil from soil blowing and to conserve moisture. Contour farming and terraces are needed to control runoff. In some areas, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the terraces. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface system can be used. Fertilizer will be needed if this soil is irrigated.

This soil has high potential for native range plants. The yield of short and mid grasses is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has low potential for most urban uses mainly because of the moderate corrosivity to uncoated steel, the low soil strength, the shrinking and swelling of the soil, and the moderate permeability.

This soil has medium potential for recreation uses. The main limitations are the clay loam texture of the surface layer and the moderate permeability.

Capability subclass IIc, nonirrigated, and capability class I, irrigated; Draw range site.

10—Bippus clay loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on valley floors and outwash fans. It occasionally receives runoff from adjacent upland soils. The areas are elongated and range from 10 to 250 acres.

The surface layer is friable, dark grayish brown clay loam about 25 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 25 and 35 inches, it is firm, brown clay loam; to a depth of 45 inches, it is firm, pale brown clay loam that has threads and films of calcium carbonate; to a depth of 58 inches, it is very firm, light brown clay loam; and to a depth of 80 inches, the subsoil is friable, light brown sandy clay loam. The soil is mildly alkaline to a depth of 12 inches and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Altus, Guadalupe, Lincoln, Mobeetie, Paloduro, and Spur soils and small areas of Bippus soils that have slopes of 0 to 1 percent or 3 to 5 percent. Also included are a few U-shaped gullies extending headward up drainageways. Inclusions make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. It can be cultivated, but many areas are too small or too narrow for cultivation. Where this soil is cultivated, the main crops are cotton, grain sorghum, and wheat.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. Crop residue should be left on the surface or worked into the surface layer to conserve moisture and to help prevent water erosion and soil blowing. Contour farming and terraces are needed to reduce runoff. Diversion terraces and grassed waterways can be used to help control runoff from adjacent soils. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A surface or sprinkler irrigation system can be used. If a surface system is used, bench leveling will be necessary. Fertilizer will need to be applied if this soil is irrigated.

This soil has high potential for native range plants. The yield of short and mid grasses is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has low potential for urban uses mainly because of the low soil strength, the shrinking and swelling of the soil, and the moderate corrosivity to uncoated steel.

This soil has medium potential for recreation uses. The clay loam texture of the surface layer is the main limitation. The slope is a limitation for some playgrounds.

Capability subclass IIe, nonirrigated and irrigated; Draw range site.

11—Burson-Aspermont association, steep. The soils in this association are on uplands. The areas are dissected by erosional valleys and drainageways, and geologic erosion is active (fig. 9). The areas range from 10 to about 1,000 acres. Slopes range from 20 to 45 percent. The relief ranges from 30 to 100 feet. This association is about 40 percent Burson soils, 25 percent Aspermont soils, and 35 percent minor soils and miscellaneous areas.

Burson soils are well drained to excessively drained and are on hillsides and convex ridges and along escarpments. The surface layer is friable, yellowish red silt loam about 6 inches thick. The underlying material, to a depth of 60 inches, is yellowish red, weakly cemented siltstone redbeds. The soil material is moderately alkaline throughout.

Runoff is very rapid. Permeability is moderate, and the available water capacity is very low. The root zone is very shallow. Water erosion is a severe hazard, and soil blowing is a slight hazard.

Aspermont soils are well drained and are on hillsides and foot slopes and in less sloping areas. The surface layer is friable, red silty clay loam about 10 inches thick. The subsoil, to a depth of 24 inches, is friable, red silty clay loam; to a depth of 38 inches, it is friable, yellowish red silty clay loam that is about 5 percent calcium carbonate, by volume. The substratum, to a depth of 60 inches, is firm, yellowish red silty clay loam. The soil is moderately alkaline throughout.

Runoff is rapid. Permeability is moderate, and the available water capacity is high. The root zone is deep. Soil blowing is a moderate hazard, and water erosion is a severe hazard.

Included in mapping are small areas of Clairemont, Likes, Lincoln, Obaro, Polar, and Quinlan soils. Also included are areas of Rock outcrop along escarpments and areas of Badland below the escarpments. Inclusions make up less than 50 percent of any one mapped area.

The soils in this association are used mainly as rangeland. They are not suitable for cultivation.

These soils have low potential for native range plants because of the rapid runoff, the high to very low available water capacity, and the very shallow root zone of the Burson soils. Forage production is low in favorable years. Proper stocking, controlled grazing, and brush management are necessary in managing rangeland.

These soils have low potential for the development of wildlife habitat.

These soils have low potential for most urban and recreation uses mainly because of the slope, the moderate corrosivity to uncoated steel of the Aspermont soils, the low soil strength, and the shallowness to bedrock of the Burson soils. These limitations are difficult to overcome.

The Burson soils are in capability subclass VIIs, and the Aspermont soils are in capability subclass VIIe; Rough Breaks range site.

12—Carey loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on uplands. The areas are irregular in shape and range from 5 to 100 acres.

The surface layer is very friable, dark brown loam about 9 inches thick. The subsoil extends to a depth of about 80 inches. Between depths of 9 and 17 inches, it is friable, dark reddish gray silty clay loam; to a depth of 25 inches, it is friable, reddish brown silty clay loam; to a depth of 35 inches, it is friable, yellowish red silty clay loam that is about 10 percent calcium carbonate, by volume; to a depth of 48 inches, it is friable, light reddish brown silty clay loam that is about 30 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is friable, reddish yellow silt loam. The soil is mildly alkaline to a depth of 17 inches and moderately alkaline below that.

Runoff is slow. Permeability is moderate, and the available water capacity is high. Tilth is good, and the soil can be worked within a wide range in moisture content. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Acuff, Aspermont, Clairemont, Miles, and Quinlan soils. Also included are small areas of Carey soils that have slopes of 1 to 3

Figure 9.—An area of Burson-Aspermont association, steep.

percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. Cotton is the main crop. Grain sorghum and wheat are grown in some areas.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. Soil blowing and water erosion can be controlled and moisture conserved by leaving crop residue on the surface when crops are not grown, through timely and limited tillage, and by rotating crops. Leaving crop residue on the surface also helps to maintain the productivity of this soil. If the crop residue or cover crops cannot provide adequate protection, emergency tillage to roughen the soil surface is needed to help control soil blowing. Diversion terraces and grassed waterways can be used to intercept runoff. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A surface or sprinkler irrigation system is suitable. Fertilizer will be needed if this soil is irrigated.

This soil has medium potential for native range plants. Its potential is limited because the amount of water available to plants during the growing season is low. The main native range plants are short and mid grasses. Forage production is medium.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the moderate corrosivity to uncoated steel and the low soil strength, but they can easily be overcome through good design and careful installation.

This soil has high potential for recreation uses.

Capability subclass IIc, nonirrigated, and capability class I, irrigated; Loamy Prairie range site.

13—Carey loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are irregular in shape and range from 5 to 100 acres.

The surface layer is very friable, dark brown loam about 9 inches thick. The subsoil, to a depth of 18 inches, is friable, dark brown silty clay loam; to a depth of 38 inches, it is friable, reddish brown silty clay loam; to a depth of 55 inches, it is friable, yellowish red silty clay loam that is about 10 percent calcium carbonate, by volume; and to a depth of 70 inches, it is friable, reddish yellow silt loam. The substratum, to a depth of 80 inches, is very friable, yellowish red silt loam. The soil is mildly alkaline to a depth of 18 inches and moderately alkaline below that.

Runoff is medium. Permeability is moderate. The available water capacity is high. The root zone is deep. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Acuff, Aspermont, Bippus, Clairemont, Obaro, and Quinlan soils and small areas of Carey soils that have slopes of 0 to 1 percent. Also included are a few U-shaped gullies extending headward up drainageways. Inclusions make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are wheat, cotton, and grain sorghum.

This soil has high potential for nonirrigated and irrigated wheat, cotton, and grain sorghum. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Contour farming and terraces are needed to control runoff. In some areas, diversion terraces are needed to intercept runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A sprinkler system is the most suitable. If a surface system is used, bench leveling will be necessary. Fertilizer will need to be applied if this soil is irrigated.

This soil has medium potential for native range plants. Its potential is limited by the low rainfall and medium runoff. The yield of short and mid grasses is medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the moderate corrosivity to uncoated steel and the low soil strength. They can easily be overcome through good design and careful installation.

This soil has high potential for recreation uses. The slope is a limitation for some playgrounds.

Capability subclass IIe, nonirrigated and irrigated; Loamy Prairie range site.

14—Clairemont silt loam, occasionally flooded. This is a deep, well drained, nearly level soil on bottom lands. Slopes are 0 to 1 percent. The areas generally are less than 500 feet wide and are elongated along drainageways. This soil is flooded for a few hours about once in 1 to 5 years.

The surface layer is very friable, reddish brown silt loam about 9 inches thick. The underlying material, to a depth of 53 inches, is very friable, yellowish red loam. The layer between depths of 53 and 65 inches is a buried surface layer of friable, reddish brown silty clay loam that has thin strata of sandy and loamy material. The soil is moderately alkaline throughout. The underlying material has thin strata of varying textures.

Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Soil blowing is a slight hazard.

Included in mapping are small areas of Guadalupe, Lincoln, Spur, and Sweetwater soils. Also included are small areas of Clairemont soils that have a water table below a depth of 30 inches for a few months each year.

The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has high potential for nonirrigated cotton, grain sorghum, and wheat. The hazard of occasional flooding is the main limitation. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. In some areas, diversion terraces are needed to control the runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. If this soil is irrigated, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system is suitable. If a surface system is used, land leveling will be necessary in some areas. Fertilizer will need to be applied if this soil is irrigated.

This soil has high potential for native range plants. The occasional flooding supplies additional moisture. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has low potential for most urban uses mainly because of the hazard of flooding, the low soil strength, and the moderate corrosivity to uncoated steel.

This soil has medium potential for recreation uses. The flood hazard is the main limitation.

Capability subclass IIw, nonirrigated and irrigated; Loamy Bottomland range site.

15—Delwin fine sand, 0 to 3 percent slopes. This is a deep, well drained, nearly level to gently sloping soil on undulating uplands. The areas are irregular in shape and range from 5 to about 300 acres. Local shifting of soil material by wind is evident in places.

The surface layer is loose, very pale brown fine sand about 15 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 15 and 40 inches, it is friable, reddish brown sandy clay loam; to a depth of 65 inches, it is friable, reddish yellow sandy clay loam; and to a depth of 80 inches, it is very friable, reddish yellow fine sandy loam. The soil is slightly acid to a depth of 15 inches, and it is neutral below that.

Runoff is very slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Miles, Nobscot, Springer, and Tivoli soils. Also included in a few areas are soils that have a surface layer of fine sand more than 20 inches thick. In some areas, soil blowing has resulted in the accumulation of sand along fence rows and shin oak motts. The included soils make up less than 25 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton and grain sorghum. Alfalfa is grown in some areas (fig. 10).

This soil has medium potential for nonirrigated and irrigated cotton, wheat, or grain sorghum. Crop residue should be left on the surface or worked into the surface layer to help prevent soil blowing. Emergency tillage can be used to help control soil blowing if the crop residue cannot provide adequate protection. Deep plowing can increase the clay content in the surface layer. Diversion terraces and grassed waterways help to control excessive runoff. If this soil is cultivated, fertilizer will be needed. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler irrigation system is suitable.

This soil has high potential for native range plants. The native vegetation is mainly tall and mid grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the hazard of seepage and the moderate corrosivity to uncoated steel.

This soil has low potential for recreation uses. The fine sand texture of the surface layer is the main limitation.

Capability subclass IIIe, nonirrigated and irrigated; Sandy range site.

16—Estacado clay loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on upland plains. The areas are irregular in shape and range from 5 to 80 acres.

The surface layer is dark grayish brown clay loam about 15 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 15 and 24 inches, it is light brown clay loam that is about 10 percent calcium carbonate, by volume; between depths of 24 and 70 inches, it is reddish yellow clay loam that is about 25 percent calcium carbonate, by volume, within a depth of 54 inches and 20 percent below that; and to a depth of 80 inches, it is reddish yellow clay loam that is about 10 percent calcium carbonate, by volume. The soil is friable and moderately alkaline throughout.

Runoff is slow. Permeability is moderate, and the available water capacity is medium. Tilth is good. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Acuff, Pullman, and Olton soils. These soils make up less than 15 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, wheat, and grain sorghum.

Figure 10.—Irrigated cropland in an area of Delwin fine sand, 0 to 3 percent slopes. The crop is alfalfa.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. Crop residue needs to be left on the surface to help control soil blowing and water erosion, to conserve moisture, and to help maintain the productivity of this soil. If crops do not produce enough residue to protect the soil, emergency tillage to roughen the soil surface will be necessary to reduce soil blowing. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A surface or sprinkler irrigation system is suitable. Fertilizer will need to be applied if this soil is irrigated.

This soil has medium potential for native range plants. The low rainfall limits forage production. The main native range plants are short grasses, and forage production is medium.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the moderate corrosivity to uncoated steel and the low strength of the soil. They can easily be overcome through good design and careful installation.

This soil has medium potential for recreation uses. The clay loam texture of the surface layer is the main limitation.

Capability subclass IIIe, nonirrigated, and IIe, irrigated; Loamy range site.

17—Estacado clay loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on uplands (fig. 11). The areas are irregular to elongated in shape and range from 5 to 30 acres.

The surface layer is about 15 inches thick. The upper part is dark brown clay loam about 5 inches thick, and the lower part is dark grayish brown clay loam about 10 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 15 and 24 inches, it is brown clay loam; to a depth of 55 inches, it is pink clay loam that is about 35 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is reddish yellow clay loam that is about 15 percent calcium carbonate, by volume. The soil is friable and moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Acuff, Olton, Paloduro, Pullman, and Veal soils. Also included are small areas of Estacado soils that have slopes of 0 to 1 percent or 3 to 5 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, wheat, and grain sorghum.

This soil has medium potential for nonirrigated and irrigated wheat, grain sorghum, and cotton. Crop residue needs to be left on the surface or worked into the surface layer to help protect this soil against water erosion

Figure 11.—Profile of Estacado clay loam, 1 to 3 percent slopes.

and soil blowing and to help conserve moisture. In dry years, if the crop residue cannot provide adequate protection, emergency tillage will be needed to control soil blowing. Contour farming and terraces are needed on this soil. Grassed waterways can be used as outlets for the diversions and terraces where excess water is a problem. Cuts or excavations that exceed a depth of 20 inches can expose soil material that has concentrations of calcium carbonate. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system can be used. Bench leveling will be needed if a surface irrigation system is used. Fertilizer will be needed if this soil is irrigated.

This soil has medium potential for native range plants. Because of the low rainfall, the production of mid and short grasses is only medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the low soil strength and the moderate corrosivity to uncoated steel.

This soil has medium potential for recreation uses. The clay loam texture of the surface layer is a limitation. In places, the slope is a limitation for playgrounds.

Capability subclass IIIe, nonirrigated and irrigated; Loamy range site.

18—Estacado clay loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on uplands. The areas are irregular to elongated in shape and range from 5 to 40 acres.

The surface layer is friable, dark grayish brown clay loam about 10 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 10 and 15 inches, it is friable, brown clay loam; and to a depth of 80 inches, it is firm, reddish yellow clay loam. Between depths of 15 and 30 inches, the subsoil is about 25 percent calcium carbonate, by volume, and below that, it is about 10 percent calcium carbonate, by volume. The soil is moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Berda, Bippus, Olton, Paloduro, Spur, and Veal soils and small areas of Estacado soils that have slopes of 1 to 3 percent. Also included in some cultivated fields are areas where the soil has been damaged by sheet and rill erosion. The included soils make up less than 25 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are wheat and grain sorghum. Cotton is grown in some areas.

This soil has low potential for nonirrigated and irrigated wheat, cotton, and grain sorghum. Crop residue needs to be left on the surface or worked into the surface layer to help protect the soil against water erosion and soil blowing and to help conserve moisture. In dry years, emergency tillage will be needed to help control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed on this soil. In some areas, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Cuts or excavations that exceed a depth of 20 inches can expose soil material that has concentrations of calcium carbonate. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler irrigation system is the most suitable. Some bench leveling will be needed if a surface irrigation system is used. Fertilizer will need to be applied if this soil is irrigated.

This soil has medium potential for native range plants. Because of the low rainfall, the production of mid and short grasses is only medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the low soil strength and the moderate corrosivity to uncoated steel.

This soil has medium potential for recreation uses. The clay loam texture of the surface layer is a limitation. The slope is a limitation for some playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Loamy range site.

19—Guadalupe fine sandy loam, occasionally flooded. This is a deep, well drained, nearly level soil on bottom lands (fig. 12). Slopes are 0 to 1 percent. The areas generally are less than 1,000 feet wide and are elongated along drainageways. This soil is flooded for a few hours about once in 1 to 5 years.

The surface layer is brown fine sandy loam about 9 inches thick. The subsoil, to a depth of 24 inches, is very pale brown fine sandy loam; to a depth of 34 inches, it is light brown fine sandy loam. The substratum, to a depth of 50 inches, is very pale brown fine sandy loam; to a depth of 65 inches, it is very pale brown loamy fine sand that has distinct stratification. The soil is very friable and moderately alkaline throughout.

Runoff is slow. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Soil blowing is a moderate hazard.

Included in mapping are small areas of Bippus, Clairemont, Lincoln, Mobeetie, Paloduro, Spur, Sweetwater, and Tivoli soils. Also included are small areas that are

Figure 12.—An area of Guadalupe fine sandy loam, occasionally flooded, on bottom lands.

dissected by stream channels and a few soils that have a water table within a depth of 40 inches for a few months each year. These inclusions make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The hazards of occasional flooding and soil blowing are the main limitations. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. In some areas, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler irrigation system is the most suitable. If a surface system is used, land leveling generally is necessary. Fertilizer will need to be applied if this soil is irrigated.

This soil has high potential for native range plants. The occasional flooding supplies additional moisture. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has high potential for the development of wildlife habitat.

The soil has low potential for most urban uses mainly because of the hazards of flooding and seepage.

This soil has medium potential for recreation uses. The flooding hazard is the main limitation.

Capability subclass IIw, nonirrigated and irrigated; Sandy Bottomland range site.

20—Likes loamy fine sand, 1 to 8 percent slopes. This is a deep, excessively drained, gently sloping to sloping soil on undulating uplands. The areas are irregular in shape and range from 5 to 400 acres. In some areas, the soil has been blown out by the wind.

The surface layer is brown loamy fine sand about 8 inches thick. The underlying material, to a depth of 28 inches, is brown loamy fine sand; to a depth of 66 inches, it is pink loamy fine sand. The soil is very friable and moderately alkaline throughout.

Runoff is slow. Permeability is moderately rapid, and the available water capacity is low. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Bippus, Guadalupe, Lincoln, Mobeetie, Potter, Tivoli, and Veal soils. Also included are small areas of Likes soils that have a surface layer of fine sandy loam. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as rangeland. It is not suitable for cultivation.

This soil has medium potential for native range plants. The main limitations are the low rainfall and the severe hazard of soil blowing. The main native range plants are mid and tall grasses. Forage production is medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. Excessive seepage is the main limitation.

This soil has low potential for recreation uses mainly because of the sandy texture of the surface layer.

Capability subclass VIe, nonirrigated; Loamy Sand range site.

21—Lincoln loamy fine sand, frequently flooded. This is a deep, somewhat excessively drained, nearly level soil on bottom lands. Slopes are 0 to 1 percent. The areas are elongated and range from 5 to 1,000 acres. The frequency of flooding ranges from five times in one year to about once in 3 years. Some floods scour the surface of this soil, and others leave a thin deposit of alluvium. Soil blowing is a hazard in areas that are void of vegetation.

The surface layer is brown loamy fine sand about 8 inches thick. The underlying material, to a depth of 25 inches, is light yellowish brown loamy fine sand; to a depth of 38 inches, it is pale brown fine sand; and to a depth of 60 inches, it is very pale brown sand. The soil is very friable and moderately alkaline throughout.

Runoff is slow. Permeability is rapid, and the available water capacity is low. The root zone is deep, and the soil material is easily penetrated by plant roots. Soil blowing is a moderate hazard.

Included in mapping are small areas of Clairemont, Guadalupe, Likes, Spur, Sweetwater, and Tivoli soils. Also included are some soils that have a water table and mottles below a depth of 40 inches. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. It is not suitable for cultivation.

This soil has high potential for native range plants. The frequent flooding is the main limitation. The native range plants are mainly mid and tall grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

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

Capability subclass Vw, nonirrigated; Sandy Bottomland range site.

22—Miles loamy fine sand, 0 to 3 percent slopes. This is a deep, well drained, nearly level to gently sloping soil on gently undulating uplands. The areas are irregular in shape and range from 10 to several thousand acres in size. In most cultivated fields, the surface layer has been

thinned by soil blowing. In places in some fields, soil blowing has removed all of the surface layer. Also as a result of soil blowing, sand has accumulated along most field boundaries and fence rows. The accumulations are 10 to 30 feet wide and are as much as 3 feet deep. A few shallow washes are in natural watercourses on slopes of 2 to 3 percent.

The surface layer is very friable, neutral, light reddish brown loamy fine sand about 7 inches thick. The subsoil, to a depth of 17 inches, is friable, mildly alkaline, mixed reddish brown sandy clay loam and loamy fine sand; to a depth of 64 inches, it is friable, mildly alkaline, reddish brown sandy clay loam; and to a depth of 80 inches, it is friable, moderately alkaline, yellowish red sandy clay loam.

Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Altus, Delwin, Springer, and Veal soils. Also included are a few soils that have a surface layer more than 20 inches thick, soils that have a lime accumulation within a depth of 60 inches, soils that have a dark buried layer, and soils that have significantly less clay within a depth of 60 inches. Also included are small areas of Miles soils that have slopes of 3 to 5 percent and areas of Miles fine sandy loam. The included soils make up less than 15 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The low rainfall and the severe hazard of soil blowing are the main limitations. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Deep plowing is necessary to increase the clay content in the surface layer. In some areas, contour farming and terraces are needed to help control water erosion, and diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or drip irrigation system is suitable. Fertilizer will need to be applied if this soil is irrigated.

This soil has high potential for native range plants. The low rainfall is the main limitation. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the low soil strength and the hazard of seepage, and they can easily be overcome through good design and careful installation.

This soil has medium potential for recreation uses. The loamy fine sand texture of the surface layer is the main limitation. The slope is a limitation for some playgrounds.

Capability subclass IIIe, nonirrigated and irrigated; Loamy Sand range site.

23—Miles loamy fine sand, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on undulating uplands. The areas are irregular in shape and range from 5 to 100 acres. In most cultivated fields, the surface layer has been thinned by soil blowing and water erosion. Gullies have formed in some drainageways. In a few of these drainageways in old fields and on rangeland, the gullies are expanding.

The surface layer is very friable, light brown loamy fine sand about 12 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 12 and 20 inches, it is friable, reddish brown sandy clay loam; to a depth of 38 inches, it is friable, yellowish red sandy clay loam; to a depth of 55 inches, it is friable, light reddish brown sandy clay loam; and to a depth of 80 inches, it is friable, reddish yellow sandy clay loam. The soil is neutral to a depth of 12 inches, mildly alkaline between depths of 12 and 55 inches, and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Altus, Delwin, Likes, Lincoln, Nobscot, Polar, Quinlan, Springer, Tivoli, and Veal soils, small areas of Miles soils that have slopes of 0 to 3 percent or 5 to 8 percent, and small areas of Miles fine sandy loam. Also included are small areas of eroded soils and a few blowout pits. Inclusions make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. In some places, it is used for grain sorghum and wheat. It is not suited to cotton.

This soil has low potential for close-spaced, nonirrigated and irrigated grain sorghum and wheat. The main limitations are the low rainfall, the slope, and the hazards of soil blowing and water erosion. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage is needed to control soil blowing if the crop residue cannot provide adequate protection. Diversion terraces are needed in some areas to control water erosion and runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions. Fertilizer will be needed if this soil is used for crops. Under irrigation management, an irrigation system

that properly applies irrigation water is necessary. A sprinkler or drip irrigation system is suitable.

This soil has high potential for native range plants. The low rainfall and the slope are the main limitations. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the slope, the low soil strength, and the hazard of seepage, and they can be overcome through good design and careful installation.

This soil has medium potential for recreation uses. The slope and the loamy fine sand texture of the surface layer are the main limitations. The slope is a limitation for some playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Loamy Sand range site.

24—Miles loamy fine sand, 3 to 8 percent slopes, severely eroded. This is a deep, well drained, gently sloping to sloping soil on undulating uplands. The areas are irregular in shape and range from 5 to 50 acres.

On 35 to 65 percent of the acreage, the subsoil has been exposed through soil blowing and water erosion. On about 25 percent of the acreage, one-half of the surface layer has been removed. The surface texture on this acreage is sandy clay loam. The surface layer that remains has been winnowed by wind whipping and has lost most of the silt and clay particles. Its texture is mainly fine sand.

There are blowout pits in most of these areas. On the average, these pits are about 75 feet wide, 150 feet long, and 2 to 6 feet deep. The underlying sandy clay loam soil material is exposed in these pits. Sand dunes of fine sand and loamy fine sand several feet thick border these blowouts. The dunes are void of vegetation or have thin stands of native grass. The surface texture in areas of these blowouts is sandy clay loam, fine sandy loam, loamy fine sand, or fine sand.

On the side slopes of hills, the surface layer has been removed on about one-half of the acreage. The surface texture is sandy clay loam and fine sandy loam. There are many crossable gullies and a few uncrossable gullies in most of these areas. The uncrossable gullies generally are so deep that they have exposed the substratum material. Some have sheer sides and are as much as 8 feet deep and 10 feet wide.

Soil blowing and water erosion are still active throughout most of this map unit.

The surface layer is very friable, light brown loamy fine sand about 3 inches thick. The subsoil, to a depth of 12 inches, is friable, reddish brown sandy clay loam; to a depth of 38 inches, it is friable, yellowish red sandy clay loam; to a depth of 70 inches, it is very friable, reddish yellow fine sandy loam; and to a depth of 80 inches, the subsoil is friable, reddish yellow sandy clay loam. The soil is neutral to a depth of 38 inches and mildly alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Delwin, Quinlan, Springer, and Veal soils. Also included are small areas of Miles soils that have slopes of 1 to 3 percent and areas of Miles fine sandy loam. The included soils make up less than 15 percent of any one mapped area.

This soil is used mainly as rangeland. It is not suitable for use as cropland. Most of the acreage in this map unit was once used for crops but has been converted to rangeland.

This soil has high potential for native range plants. The low rainfall, the slope, and the eroded condition of the soil are the main limitations. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the slope, the eroded condition of the soil, the low soil strength, and the hazard of seepage. They can be overcome through good design and careful installation.

This soil has medium potential for recreation uses. The slope and the loamy fine sand texture of the surface layer are the main limitations. The slope is a limitation for playgrounds.

Capability subclass VIe, nonirrigated; Loamy Sand range site.

25—Miles fine sandy loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on slightly concave uplands. The areas are roughly oval and range from 5 to 100 acres in size. In most areas, this soil receives a small amount of water from adjacent soils. In most cultivated fields, soil blowing has removed a few inches of the surface layer.

The surface layer is very friable, brown fine sandy loam about 13 inches thick. The subsoil, to a depth of 20 inches, is friable, reddish brown sandy clay loam; to a depth of 35 inches, it is friable, yellowish red sandy clay loam; and to a depth of 80 inches, it is friable, reddish yellow sandy clay loam. The soil is neutral to a depth of 35 inches, and it is mildly alkaline below that.

Runoff is slow. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Acuff and Altus

soils. Also included are a few soils that have a browner subsoil, soils that have significantly less clay within a depth of 60 inches, and a few soils that have a dark buried horizon below a depth of 40 inches. Also included are small areas of Miles soils that have slopes of 1 to 3 percent and small areas of Miles loamy fine sand. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton and grain sorghum. Wheat is grown in some areas.

This soil has high potential for nonirrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall and the hazard of soil blowing. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage is needed to control soil blowing if the crop residue cannot provide adequate protection. In some areas, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions. Fertilizer is needed if this soil is used for crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler, drip, or surface irrigation system is suitable. If surface irrigation is used, land leveling will be needed in some areas.

This soil has medium potential for native range plants. The low rainfall is the main limitation. The main native range plants on this soil are mid and tall grasses. Forage production is medium in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The low soil strength and the hazard of seepage are the main limitations, but they can easily be overcome through good design and careful installation.

This soil has high potential for recreation uses.

Capability subclass IIe, nonirrigated and irrigated; Sandy Loam range site.

26—Miles fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on gently undulating uplands. The areas are irregular in shape and range from 5 to 300 acres. In most cultivated fields, soil blowing and water erosion have removed a few inches of the surface layer.

The surface layer is very friable, brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 7 and 52 inches, it is friable, reddish brown sandy clay loam; to a depth of 72 inches, it is friable, yellowish red sandy clay loam; and to a depth of 80 inches, it is very friable, reddish yellow sandy clay loam. The soil is neutral to a depth of 28 inches, mildly alkaline between depths of 28 and 52 inches, and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Acuff, Altus, Polar, and Veal soils. Also included are a few soils that have significantly less clay or are grayer in color below a depth of 60 inches, soils that have a dark buried horizon, soils that have lime accumulations within a depth of 60 inches, and soils that have a browner subsoil. Also included are small areas of Miles soils that have slopes of 0 to 1 percent or 3 to 5 percent and small areas of Miles loamy fine sand. The included soils make up less than 25 percent of any one mapped area.

This soil is used as cropland and rangeland (fig. 13). The main crops are cotton, grain sorghum, and wheat.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the slope, and the hazards of soil blowing and water erosion. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed in some areas to help control water erosion. Diversion terraces are needed in places to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Fertilizer is needed if this soil is used for crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler, drip, or surface irrigation system is suitable. If a surface system is used, bench leveling will be necessary.

This soil has medium potential for native range plants. The low rainfall is the main limitation. The main native range plants are mid and tall grasses. Forage production is medium in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the slope, the low soil strength, and the hazard of seepage. They can easily be overcome through good design and careful installation.

This soil has high potential for recreation uses. The slope is a limitation for some playgrounds.

Capability subclass IIIe, nonirrigated, and IIe, irrigated; Sandy Loam range site.

27—Miles fine sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on gently undulating uplands. The areas are irregular in shape and range from 5 to 100 acres. In most cultivated fields, the soil is slightly eroded. Soil blowing and water erosion have removed a few inches of the surface layer, and there are a few rills and shallow gullies in most fields. In some areas, the original surface layer of this soil has been lost.

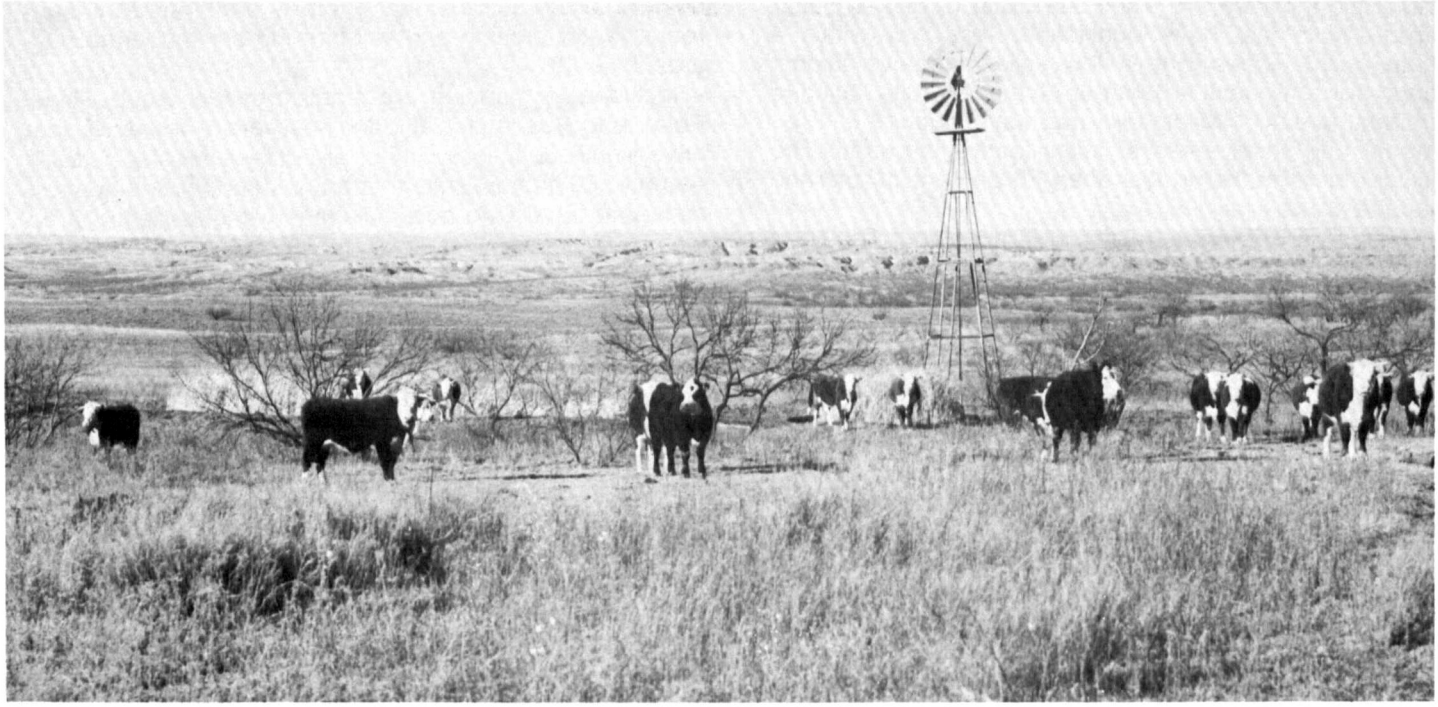


Figure 13.—Rangeland in an area of Miles fine sandy loam, 1 to 3 percent slopes. This soil is in the Sandy Loam range site.

The surface layer is very friable, brown fine sandy loam about 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 7 and 35 inches, it is friable, reddish brown sandy clay loam; and to a depth of 80 inches, it is friable, reddish yellow sandy clay loam. The soil is neutral to a depth of 20 inches, moderately alkaline between depths of 20 and 35 inches, mildly alkaline between depths of 35 and 55 inches, and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Acuff, Aspermont, Mobeetie, Springer, and Veal soils. Also included are a few soils that have significantly less clay or are grayer in color below a depth of 60 inches, soils that have a lime accumulation within a depth of 60 inches, and a few soils that have a browner subsoil. Also included are small areas of Miles soils that have slopes of 1 to 3 percent or 5 to 8 percent and small areas of Miles loamy fine sand. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the slope, and the hazards of soil blowing and water erosion. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to help control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed to help control water erosion. Diversion terraces are needed in some areas to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Fertilizer is needed in some areas for nonirrigated crops and is essential for irrigated crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or drip irrigation system is suitable.

This soil has medium potential for native range plants. The low rainfall and the loss of water through runoff are the main limitations. The main native range plants are mid and tall grasses. Forage production is medium in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the slope, the low soil strength, and the hazard of seepage. They can be overcome through good design and careful installation.

This soil has high potential for recreation uses. The slope is a limitation for some playgrounds.

Capability subclass IIIe, nonirrigated and irrigated; Sandy Loam range site.

28—Miles fine sandy loam, 3 to 5 percent slopes, eroded. This is a deep, well drained, gently sloping soil

on gently undulating uplands. The areas are irregular in shape and range from 5 to 50 acres.

On about 25 percent of the acreage, this soil has been slightly eroded by wind and water. On about 17 percent of the acreage, the original surface layer has been lost through erosion, and the surface texture is sandy clay loam. On about 50 percent of the acreage, most of the original surface layer has been lost, and the surface texture is sandy clay loam or fine sandy loam.

Gullies that extend into the subsoil are about 80 feet apart across the slopes. Of these gullies, about one out of four is uncrossable by farm equipment. Accumulations of fine sand and loamy fine sand as much as 2 feet deep are in the natural drainageways at the base of these slopes. They are as much as 1 foot deep along fence rows and field borders.

The surface layer is very friable, brown fine sandy loam about 3 inches thick. The subsoil extends to a depth of 70 inches or more. Between depths of 3 and 15 inches, it is friable, yellowish red sandy clay loam; to a depth of 25 inches, it is friable, reddish brown sandy clay loam; to a depth of 36 inches, it is friable, reddish yellow sandy clay loam; to a depth of 52 inches, it is friable, pink sandy clay loam that is about 4 percent calcium carbonate, by volume; and to a depth of 70 inches, the subsoil is friable, reddish yellow sandy clay loam that is about 2 percent calcium carbonate, by volume. The soil is neutral to a depth of 15 inches, mildly alkaline between depths of 15 and 36 inches, and moderately alkaline below that.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Acuff, Mobeetie, Springer, and Veal soils, small areas of Miles soils that have slopes of 1 to 3 percent or 5 to 8 percent, and small areas of Miles loamy fine sand. Also included are a few areas of native rangeland where the soil is not eroded. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat. All of this map unit was once used as cropland, but in some areas the soil has been converted to use as rangeland or pasture.

This soil has low potential for nonirrigated and irrigated cotton, grain sorghum, and wheat, mainly because of the low rainfall, the slope, the hazards of soil blowing and water erosion, and the eroded condition of the soil. If this soil is used for crops, crop residue needs to be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage is necessary to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed to help control water erosion. In some areas, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Fertilizer is needed if this soil is used for crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or drip irrigation system is suitable.

This soil has medium potential for native range plants. The low rainfall and the eroded condition of the soil are the main limitations. The main native range plants are mid and tall grasses. Forage production is medium in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the slope, the low soil strength, and the hazard of seepage. They can be overcome through good design and careful installation.

This soil has high potential for recreation uses. The slope is a limitation for playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Sandy Loam range site.

29—Mobeetie fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on slightly convex and concave foot slopes on uplands. The areas are irregular in shape and range from 5 to 80 acres. Local shifting of the soil by wind is evident in some cultivated areas.

The surface layer is brown fine sandy loam about 12 inches thick. The subsoil, to a depth of 26 inches, is yellowish brown fine sandy loam; to a depth of 40 inches, it is light yellowish brown fine sandy loam that is about 3 percent calcium carbonate, by volume. The substratum, to a depth of 60 inches, is very pale brown fine sandy loam that has a few threads and films of calcium carbonate. The soil is very friable and moderately alkaline throughout.

Runoff is medium. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Berda, Bippus, Guadalupe, Likes, Lincoln, Miles, Paloduro, Polar, Spur, and Veal soils. Also included are small areas of Mobeetie soils that have slopes of 3 to 5 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is mainly used as rangeland. In some areas, it is used as cropland, and the main crops are grain sorghum and wheat.

This soil has low potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the high calcium carbonate content, the slope, and the hazard of soil blowing. Crop residue needs to be left on the surface or worked into the surface layer to help control water erosion and soil blowing

and to conserve moisture. Emergency tillage is necessary to control soil blowing if the crop residue cannot provide adequate protection. Contour farming is needed to help control water erosion. In some areas, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions. Fertilizer is needed if this soil is used for crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or drip irrigation system is suitable.

This soil has high potential for native range plants. The low rainfall is the main limitation. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The hazard of seepage is the main limitation.

This soil has high potential for recreation uses. The slope is a limitation for some playgrounds.

Capability subclass IIIe, nonirrigated and irrigated; Mixedland Slopes range site.

30—Mobeetie fine sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on slightly concave uplands. The areas are elongated and range from 5 to 150 acres. Local shifting of the soil by wind is evident in some cultivated areas.

The surface layer is brown fine sandy loam about 14 inches thick. The subsoil, to a depth of 36 inches, is yellowish brown fine sandy loam; to a depth of 55 inches, it is light yellowish brown fine sandy loam that is about 5 percent calcium carbonate, by volume. The substratum, to a depth of 65 inches, is very pale brown fine sandy loam that is about 3 percent calcium carbonate, by volume. The soil is very friable and moderately alkaline throughout.

Runoff is medium. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Berda, Bippus, Guadalupe, Likes, Lincoln, Miles, Paloduro, Polar, Springer, Spur, and Veal soils. Also included are small areas of Mobeetie soils that have slopes of 1 to 3 percent or 5 to 8 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. It is cultivated in some areas, and grain sorghum and wheat are the main crops.

This soil has low potential for nonirrigated and irrigated grain sorghum and wheat because of the low rainfall, the high content of calcium carbonate, the slope, and the hazards of water erosion and soil blowing. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. In some areas, contour farming and terraces are needed to help control water erosion, and diversion terraces are needed in some areas to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Fertilizer is needed if this soil is used for crops. Under irrigation management, an irrigation system that properly applies irrigation water also is necessary. A sprinkler or drip irrigation system is suitable.

This soil has high potential for native range plants. The low rainfall is the main limitation. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The hazard of seepage is the main limitation.

This soil has high potential for recreation uses. The slope is a limitation for playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Mixedland Slopes range site.

31—Mobeetie fine sandy loam, 5 to 12 percent slopes. This is a deep, well drained, sloping to strongly sloping soil on slightly concave uplands. The areas are elongated and range from 5 to 200 acres. There are U-shaped gullies in some drainageways.

The surface layer is grayish brown fine sandy loam about 15 inches thick. The subsoil, to a depth of 35 inches, is brown fine sandy loam; to a depth of 54 inches, it is very pale brown fine sandy loam that is about 5 percent calcium carbonate, by volume. The substratum, to a depth of 80 inches, is very pale brown fine sandy loam that is about 4 percent calcium carbonate, by volume. The soil is very friable and moderately alkaline throughout.

Runoff is medium to rapid. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Included in mapping are small areas of Berda, Guadalupe, Likes, Lincoln, Miles, Paloduro, Polar, Potter, Springer, Spur, and Veal soils. Also included are small areas of Mobeetie soils that have slopes of 3 to 5 percent or more than 12 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used as rangeland. It is not suitable for use as cropland.

This soil has high potential for native range plants. The low rainfall and the loss of water through runoff are the main limitations. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The slope and the hazard of seepage are the main limitations.

This soil has medium potential for recreation uses. The slope is the main limitation.

Capability subclass VIe, nonirrigated; Mixedland Slopes range site.

32—Mobeetie-Badland association, steep. This association consists of Mobeetie soils and areas of Badland on uplands (fig. 14). The areas are dissected by drainage channels, and geologic erosion of the soft caliche material is active. The areas range from 5 to about 100 acres. Slopes range from 20 to 45 percent. The relief ranges from 30 to 100 feet. Mobeetie soils make up about 35 percent of this association, Badland 60 percent, and minor soils 5 percent.

Mobeetie soils are well drained and are on mesalike benches between the areas of Badland. The surface layer is brown fine sandy loam about 10 inches thick. The subsoil, to a depth of about 23 inches, is brown fine sandy loam; to a depth of 40 inches, it is pale brown fine sandy loam that is about 5 percent calcium carbonate, by volume. The substratum, to a depth of 60 inches, is light yellowish brown fine sandy loam that is about 2 percent calcium carbonate, by volume.

Runoff is very rapid. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Badland consists of areas of nearly barren, steep land where runoff is very rapid and geologic erosion is active. The erosion of the soft caliche material washes large amounts of silt from these areas. The vegetation in these areas is of poor vigor.

Included in this association are small areas of Acuff, Berda, Likes, Lincoln, Miles, Polar, Potter, Spur, and Veal soils. Also included are areas where the soils have slopes of less than 20 percent or more than 45 percent. The included soils make up less than 10 percent of any one mapped area.

This association is used mainly as rangeland and for

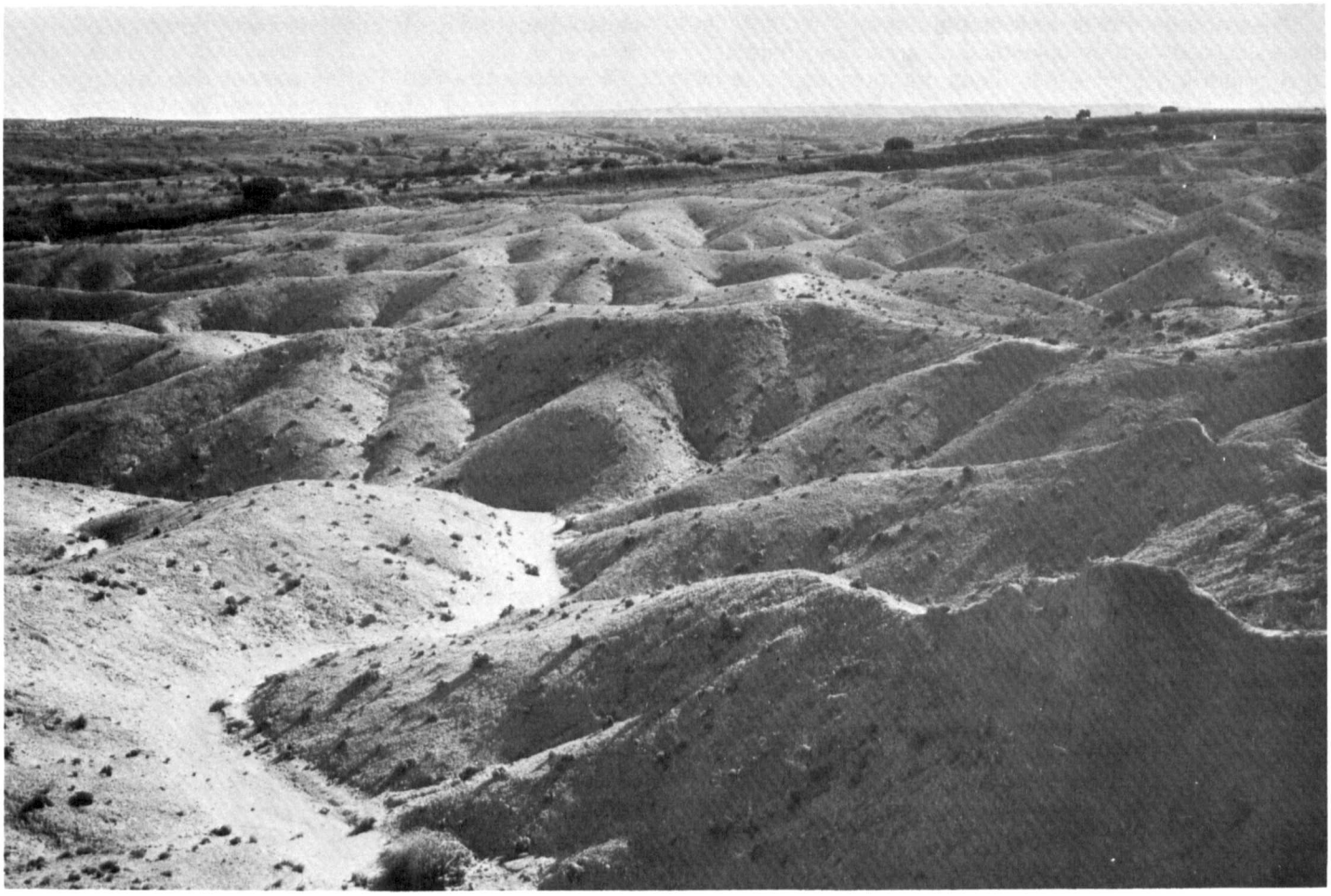


Figure 14.—An area of Mobeetie-Badland association, steep.

wildlife habitat and esthetic purposes. It is not suitable for cultivation.

This association has low potential for native range plants. The main limitations are the very rapid runoff, the high amount of sediment produced, the slope, the severe erosion hazard, and the difficulty of managing the deep Mobeetie soil together with the areas of Badland. Forage production is low in favorable years. For this map unit, rangeland management requires proper stocking, controlled grazing, and an attempt to establish vegetation in areas of Badland so that erosion and runoff can be reduced.

This map unit has low potential for the development of wildlife habitat.

This unit has low potential for most urban and recreation uses. The main limitations are the slope, the instability of the land due to the continuing erosion, and the very rapid runoff. They are difficult to overcome. Recreation uses are limited to hiking trails. The area has esthetic value.

The Mobeetie soils are in capability subclass VIIe and in Mixedland Slopes range site. Badland is in capability subclass VIIIs; it was not placed in a range site.

33—Mobeetie-Polar association, hilly. The soils in this association are on uplands. The areas are characterized by gravelly knobs and ridges that are separated by narrow valleys and drainageways. The areas range from 10 to about 1,000 acres. Slopes range from 10 to 30 percent. The relief ranges from 20 to 100 feet. Mobeetie soils make up about 47 percent of this association, Polar soils 38 percent, and minor soils 15 percent.

Mobeetie soils are well drained and are on hillsides and in valley-fill areas below gravelly knobs and ridges. The surface layer is brown fine sandy loam about 14 inches thick. The subsoil, to a depth of 48 inches, is brown fine sandy loam. The substratum, to a depth of 60 inches, is light brown fine sandy loam. Throughout the profile, the soil is very friable and moderately alkaline and is about 5 percent quartz pebbles. Below a depth of 34 inches, the undersides of the pebbles are coated with calcium carbonate.

Runoff is rapid. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Polar soils are excessively drained and are on strongly convex gravelly knobs and ridges. The surface layer is brown, very gravelly sandy loam about 7 inches thick. The underlying material, to a depth of 18 inches, is light brown, very gravelly sandy loam that is about 20 percent calcium carbonate, by volume; to a depth of 50 inches, it is light brown, very gravelly sandy loam that is about 3 percent calcium carbonate, by volume. Throughout the profile, the soil is very friable and moderately alkaline and is about 40 percent quartz pebbles.

Runoff is rapid to very rapid. Permeability is moderately rapid, and the available water capacity is low. The root zone is deep. Water erosion is a severe hazard.

Included in mapping are small areas of Acuff, Berda, Likes, Lincoln, Miles, Potter, Spur, and Veal soils and a few outcrops of bedrock and redbed material. Also included are areas where the slopes are less than 10 percent or more than 30 percent. Inclusions make up less than 25 percent of any one mapped area.

The soils in this association are used mainly as rangeland. They are not suitable for cultivation. Some areas are mined for gravel.

These soils have medium potential for native range plants. The very rapid to rapid runoff and the medium to low available water capacity are limitations. Forage production is medium in favorable years. Proper stocking, controlled grazing, and brush management are necessary in managing rangeland.

These soils have low potential for the development of wildlife habitat.

These soils have low potential for most urban and recreation uses. The slope, the small stones on the surface, and the hazard of seepage are the main limitations. These limitations are difficult to overcome.

The Mobeetie soils are in capability subclass VIIe and in Mixedland Slopes range site; the Polar soils are in capability subclass VIs and in Gravelly range site.

34—Mobeetie-Veal-Potter association, rolling. The soils in this association are on uplands. The areas are dissected by erosional valleys and drainageways, and geologic erosion is active. The areas range from 10 to about 1,000 acres. Slopes range from 5 to 16 percent. The relief ranges from 30 to 100 feet. Mobeetie soils make up about 50 percent of this association, Veal soils 20 percent, Potter soils 20 percent, and minor soils 10 percent.

Mobeetie soils are well drained and are on hillside benches and foot slopes below caprock escarpments. The surface layer is grayish brown fine sandy loam about 7 inches thick. The subsoil, to a depth of 20 inches, is pale brown fine sandy loam; to a depth of 35 inches, it is very pale brown fine sandy loam that is about 5 percent calcium carbonate, by volume. The substratum, to a depth of 60 inches, is very pale brown fine sandy loam. The soil is very friable and moderately alkaline throughout.

Runoff is rapid. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Veal soils are well drained and are on convex ridges and hillsides. The surface layer is very friable, pale brown loam about 8 inches thick. The subsoil extends to a depth of about 60 inches. Between depths of 8 and 14 inches, it is very pale brown loam that is about 20 percent calcium carbonate, by volume; to a depth of 24 inches, it is friable, very pale brown loam that is about 40 percent calcium carbonate, by volume; and to a depth of 60 inches, it is friable, very pale brown loam that is about

50 percent calcium carbonate, by volume. The soil is moderately alkaline throughout.

Runoff is rapid. Permeability is moderate, and the available water capacity is medium. The root zone is deep. Water erosion is a severe hazard, and soil blowing is a moderate hazard.

Potter soils are well drained and are on strongly convex slopes and ridges. The surface layer is about 9 inches thick. The upper part is friable, light brownish gray loam about 5 inches thick, and the lower part is friable, pale brown gravelly loam about 4 inches thick. The underlying material, between depths of 9 and 60 inches, is pinkish white, platy caliche intermingled with pinkish calcareous earths. The soil is moderately alkaline to a depth of 9 inches.

Runoff is rapid. Permeability is moderate, and the available water capacity is very low. The root zone is very shallow. Water erosion is a severe hazard.

Included in mapping are small areas of Acuff, Berda, Guadalupe, Likes, Lincoln, Miles, Paloduro, Polar, and Spur soils. Also included are a few areas of Rock outcrop, outcrops of redbed material, and Badland. In some areas, the slopes are less than 5 percent or more than 16 percent. Inclusions make up less than 20 percent of any one mapped area.

The soils in this association are used mainly as rangeland. They are not suitable for cultivation.

These soils have medium potential for native range plants. The rapid runoff, medium to very low available water capacity, slope, and restricted root zone are limitations. Forage production is medium in favorable years. Proper stocking, controlled grazing, and brush management are necessary in managing rangeland.

These soils have low potential for the development of wildlife habitat.

These soils have low potential for most urban and recreation uses. The slope, the hazard of seepage, the moderate corrosivity to uncoated steel, and the low soil strength are the main limitations. These limitations are difficult to overcome.

The Mobeetie soils are in capability subclass VIe and in Mixedland Slopes range site; the Veal soils are in capability subclass VIe and in Loamy range site; and the Potter soils are in capability subclass VIIs and in Very Shallow range site.

35—Nobscot fine sand, 1 to 8 percent slopes. This is a deep, well drained, gently sloping to sloping soil on undulating uplands. The areas are irregular in shape and range from 20 to 500 acres. In most areas where this soil has been used for crops, the wind has sorted and shifted the sand in the surface layer. As a result of this soil blowing, sand has accumulated along fence rows and field borders in most old fields. The accumulations are as much as 4 feet high and 60 feet wide.

The surface layer is about 27 inches thick. The upper part is loose, grayish brown fine sand about 6 inches thick, and the lower part is loose, pink fine sand about 21 inches thick. The subsoil, to a depth of 36 inches, is very friable, yellowish red sandy loam that has a few thin bands of more clayey material; to a depth of 62 inches, it is very friable, reddish yellow fine sandy loam that has a few thin bands of more clayey material and pockets of clean sand grains. The substratum, to a depth of 80 inches, is loose, reddish yellow loamy fine sand that has a few pockets of clean sand grains. The soil is slightly acid to a depth of about 27 inches and neutral below that.

Runoff is very slow. Permeability is moderately rapid, and the available water capacity is low. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Altus, Delwin, Miles, Lincoln, Springer, Tivoli, and Veal soils. Also included are small areas of Nobscot soils that have slopes of more than 8 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. It generally is not suitable for cultivation because of the low rainfall, the low available water capacity, and the severe hazard of soil blowing.

This soil has high potential for native range plants. The low rainfall and the severe hazard of soil blowing are the main limitations. The main native range plants are mid and tall grasses. Shinnery oak is common on the rangeland. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has low potential for most urban uses. The slope and the moderately rapid permeability are the main limitations.

This soil has low potential for recreation uses. The main limitations are the fine sand texture of the surface layer and the slope.

Capability subclass VIe, nonirrigated; Sandy range site.

36—Obaro-Quinlan association, rolling. The soils in this association are on ridges and side slopes of interstream divides on uplands (fig. 15). Slopes range from 5 to 16 percent. The areas are oblong and range from 10 to 2,000 acres. The average size of the areas is about 100 acres. Obaro soils make up about 50 percent of this association, Quinlan soils 25 percent, and minor soils 25 percent.

Obaro soils are well drained and are on concave and convex side slopes, on benches, on foot slopes below ridges, and along escarpments. The surface layer is reddish brown silty clay loam about 8 inches thick. The subsoil, to a depth of 15 inches, is reddish brown silty clay loam; to a depth of 32 inches, it is yellowish red silty clay loam. The substratum, to a depth of 60 inches, is red, weakly cemented, calcareous siltstone. The soil is friable and moderately alkaline to a depth of about 32 inches.

Runoff is medium to rapid, depending on the slope. Permeability is moderate, and the available water capac-

Figure 15.—An area of Obaro-Quinlan association, rolling.

ity is low. The root zone is moderately deep, and the soil material is easily penetrated by plant roots. Soil blowing is a morderate hazard, and water erosion is a severe hazard.

Quinlan soils are well drained and are on the steeper ridges and convex slopes on uplands. The surface layer is very friable, yellowish red loam about 7 inches thick. The subsoil, to a depth of 12 inches, is friable, yellowish red loam that has a few siltstone fragments. The substratum, to a depth of 60 inches, is red, weakly cemented, calcareous siltstone. The soil is moderately alkaline to a depth of 12 inches.

Runoff is rapid. Permeability is moderate, and the available water capacity is very low. The root zone is shallow. Soil blowing is a slight hazard, and water erosion is a severe hazard.

Included in mapping are Acuff, Aspermont, Burson, Guadalupe, Clairemont, Likes, Lincoln, Miles, and Spur soils. Also included are some gullies that are downcutting and extending headward in drainageways. Some areas of gently sloping soils and areas where slopes are more than 16 percent also are included in mapping. Inclusions range from about 1 to 5 acres in size.

The soils in this association are used mainly as rangeland. They are not suitable for cultivation.

These soils have medium potential for native range plants, which are mainly mid and short grasses. Forage production is medium in favorable years.

These soils have medium potential for the development of wildlife habitat.

These soils have medium potential for most urban uses. Shallowness to rippable rock and the slope are the main limitations.

These soils have medium potential for recreation uses. The main limitations are the slope and the silty clay loam texture of the surface layer.

Capability subclass VIe; Loamy Prairie range site.

37—Olton clay loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on slightly convex uplands. The areas are irregular in shape and range from 10 to 300 acres.

The surface layer is friable, dark brown clay loam about 6 inches thick. The subsoil extends to a depth of about 80 inches. Between depths of 6 and 16 inches, it is firm, dark brown clay loam; to a depth of 38 inches, it is firm, reddish brown clay loam; to a depth of 47 inches, it is firm, yellowish red clay loam; to a depth of 70

inches, it is friable, pink clay loam that is about 35 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is friable, reddish yellow clay loam that is about 10 percent calcium carbonate, by volume. The soil is neutral to a depth of 25 inches and moderately alkaline below that.

Runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Acuff, Altus, Estacado, Pullman, and Randall soils. Also included are a few soils that have a dark grayish brown surface layer, soils that have a silty clay loam surface layer or subsoil, soils that are dark colored to a depth of more than 20 inches, soils that have significantly less clay within a depth of 60 inches, and soils that do not have a distinct layer of lime accumulation within a depth of 60 inches. Also included are small areas of Olton soils that have slopes of 1 to 3 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall and the hazard of soil blowing. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed in some areas to help control water erosion. In places, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system is suitable. If a surface system is used, land leveling will be necessary in some areas. Fertilizer will be needed if this soil is irrigated.

This soil has low potential for native range plants. The low rainfall and the moderately slow rate of water infiltration are the main limitations. The main native range plants are short and mid grasses. Forage production is low in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has low potential for most urban uses. The main limitations are the shrinking and swelling of the soil, the low soil strength, and the moderate corrosivity to uncoated steel. They are difficult to overcome.

This soil has medium potential for recreation uses. The clay loam texture of the surface layer and the moderately slow permeability are the main limitations.

Capability subclass IIIe, nonirrigated, and IIe, irrigated; Clay Loam range site.

38—Olton clay loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on slightly convex uplands. The areas are irregular in shape and range from 5 to 100 acres. In most cultivated fields, soil blowing and water erosion have removed a few inches of the surface layer. Heavy rains can cause a few shallow rills to form, especially on slopes of 2 to 3 percent.

The surface layer is friable, brown clay loam about 7 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 7 and 18 inches, it is firm, brown clay loam; to a depth of 30 inches, it is firm, reddish brown clay loam; to a depth of 55 inches, it is firm, yellowish red clay loam; to a depth of 66 inches, it is firm, light reddish brown clay loam that is about 35 percent calcium carbonate, by volume; to a depth of 78 inches, it is friable, reddish yellow clay loam that is about 10 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is friable, reddish yellow clay loam that is about 40 percent calcium carbonate, by volume. The soil is neutral to a depth of about 18 inches and moderately alkaline below that.

Runoff is slow. Permeability is moderately slow, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Acuff, Bippus, Estacado, Miles, Pullman, Randall, Spur, and Veal soils. Also included are a few soils that have a light-colored surface layer, soils that do not have a distinct layer of lime accumulation within a depth of 60 inches, and soils that have significantly less clay at or below a depth of 60 inches. Also included are small areas of Olton soils that have slopes of 3 to 5 percent or 0 to 1 percent. The included soils make up less than 15 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the slope, and the hazard of water erosion. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed to help control water erosion. In places, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system is suitable. If a surface system is used, bench leveling will be necessary. Fertilizer will need to be applied if this soil is irrigated.

This soil has low potential for native range plants. The low rainfall and the moderately slow rate of water infiltra-

tion are the main limitations. The main native range plants are short grasses. Forage production is low in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has low potential for most urban uses. The main limitations are the shrinking and swelling of the soil, the low soil strength, and the moderate corrosivity to uncoated steel. They are difficult to overcome.

This soil has medium potential for recreation uses. The clay loam texture of the surface layer and the moderately slow permeability are the main limitations. The slope is a limitation for some playgrounds.

Capability subclass IIIe, nonirrigated and irrigated; Clay Loam range site.

39—Paloduro loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on slightly concave foot slopes on uplands. The areas are irregular in shape and range from 5 to 100 acres. In some areas, U-shaped gullies have been formed by the downcutting of valleys and the headward extension of drainageways.

The surface layer is friable, dark grayish brown loam about 15 inches thick. The subsoil extends to a depth of 60 inches. Between depths of 15 and 22 inches, it is friable, brown clay loam; to a depth of 38 inches, it is friable, brown clay loam that is about 2 percent calcium carbonate, by volume; to a depth of 60 inches, it is firm, grayish brown clay loam that is about 5 percent calcium carbonate, by volume. The soil is moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Berda, Bippus, Estacado, Mobeetie, Potter, and Veal soils. Also included are small areas of Paloduro soils that have slopes of 1 to 3 percent or 5 to 8 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. It is cultivated in some areas, and grain sorghum and wheat are the main crops.

This soil has low potential for nonirrigated and irrigated grain sorghum and wheat. The main limitations are the low rainfall, the slope, and the hazard of water erosion. Crop residue needs to be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed to help control water erosion. In places, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for diversions and terraces. Fertilizer is needed if this soil is used for crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler, surface, or drip irrigation system is suitable. If a surface system is used, bench leveling will be necessary.

This soil has medium potential for native range plants. The low rainfall and the loss of water through runoff are the main limitations. The main native range plants are short and mid grasses. Forage production is medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The main limitations are the slope, the moderate corrosivity to uncoated steel, and the hazard of seepage. They can be overcome through good design and careful installation.

This soil has medium potential for recreation uses. The slope and the clay loam texture of the surface layer of some Paloduro soils are the main limitations. The slope is a limitation primarily for playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Hardland Slopes range site.

40—Paloduro loam, 5 to 8 percent slopes. This is a deep, well drained, sloping soil on slightly concave foot slopes on uplands. The areas are irregular in shape and range from 5 to 100 acres. In some areas, U-shaped gullies have been formed by the downcutting of valleys and the headward extension of drainageways.

The surface layer is dark brown loam about 12 inches thick. The subsoil extends to a depth of 60 inches. Between depths of 12 and 35 inches, it is light yellowish brown loam; to a depth of 45 inches, it is very pale brown loam that is about 10 percent calcium carbonate, by volume; and to a depth of 60 inches, it is pink loam that has common threads, films, and concretions of calcium carbonate. The soil is friable and moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Berda, Bippus, Estacado, Likes, Mobeetie, Potter, and Veal soils and a few areas of soils that have caliche rock below a depth of 40 inches. Also included are small areas of Paloduro soils that have slopes of 3 to 5 percent. The included soils make up less than 20 percent of any one mapped area.

This soil is used mainly as rangeland. It is not suitable for cultivation.

This soil has medium potential for native range plants. The low rainfall and the loss of water through runoff are the main limitations. The main native range plants are short and mid grasses. Forage production is medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the slope, the moderate corrosivity to uncoated steel, and the hazard of seepage.

This soil has medium potential for recreation uses. The main limitation is the slope.

Capability subclass VIe, nonirrigated; Hardland Slopes range site.

41—Potter loam, 1 to 8 percent slopes. This is a very shallow to shallow, well drained, gently sloping to sloping soil on convex upland ridges. The areas are elongated and range from 5 to 100 acres.

The surface layer is about 11 inches thick. It is brown loam in the upper 5 inches and light brownish gray loam in the lower 6 inches. The underlying material, to a depth of 15 inches, is light gray loam that has many soft masses and weakly cemented concretions of calcium carbonate; to a depth of 60 inches, it is pinkish white, loamy caliche material consisting of calcareous earths and caliche fragments. The soil is friable and moderately alkaline to a depth of 15 inches. The surface layer has a few hard fragments of caliche.

Runoff is medium. Permeability is moderate, and the available water capacity is very low. The root zone is very shallow to shallow. Water erosion is a moderate hazard.

Included in mapping are small areas of Berda, Estacado, Mobeetie, Paloduro, and Veal soils. Also included are small areas of Rock outcrop. Inclusions make up less than 25 percent of any one mapped area.

This soil is used mainly as rangeland. It is not suitable for cultivation. In some areas, it is mined for caliche.

This soil has low potential for native range plants. The shallow to very shallow root zone is the main limitation. The main native range plants are short and mid grasses. Forage production is low in favorable years.

This soil has low potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the moderate corrosivity to uncoated steel and the hazard of seepage. They can be overcome through good design and careful installation.

This soil has medium potential for recreation uses. The small stones on the surface are the main limitation. The slope is a limitation for some playgrounds.

Capability subclass VIIs, nonirrigated; Very Shallow range site.

42—Pullman clay loam, 0 to 1 percent slopes. This is a deep, well drained, nearly level soil on uplands. Slopes are plane. The areas have smooth boundaries and range from 20 to 1,000 acres.

The surface layer is friable, dark grayish brown clay loam about 6 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 6 and 26 inches, it is very firm, dark grayish brown clay; to a depth of 44 inches, it is very firm, brown clay; to a depth of 56 inches, it is firm, reddish brown clay loam; to a depth of 68 inches, it is friable, pink clay loam that is about 35 percent calcium carbonate, by volume; and to a depth of 80 inches, the subsoil is friable, yellowish red clay loam that is about 20 percent calcium carbonate, by volume. The soil is mildly alkaline to a depth of 26 inches and moderately alkaline below that.

Runoff is slow. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but it is difficult for plant roots to penetrate the clay subsoil. Water erosion and soil blowing are slight hazards.

Included in mapping are small areas of Estacado, Olton, and Randall soils. Also included are a few soils that are calcareous at a depth below 30 inches or soils that have significantly less clay at a depth of 60 inches. Small areas of Pullman soils that have slopes of 1 to 3 percent also are included in mapping. The included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the very slow permeability, the clay subsoil, and the surface crusting. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. If the crop residue cannot provide adequate protection, emergency tillage will be needed to control soil blowing. Contour farming and terraces are needed in some areas to help conserve water. In places, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system is suitable. If a surface system is used, land leveling will be necessary on some slopes. Fertilizer needs to be applied if this soil is irrigated.

This soil has low potential for native range plants. The low rainfall and the slow rate of water infiltration are the limitations. The main native range plants are short grasses. Forage production is low in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has low potential for most urban uses. The main limitations are the shrinking and swelling of the soil, the low soil strength, the high corrosivity to uncoated steel, and the very slow permeability. They are difficult to overcome.

This soil has medium potential for recreation uses. The very slow permeability and the clay loam texture of the surface layer are the main limitations.

Capability subclass IIIe, nonirrigated, and IIs, irrigated; Clay Loam range site.

43—Pullman clay loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on slightly convex or concave slopes on uplands. The areas are elongated and range from 5 to 80 acres.

The surface layer is friable, dark grayish brown clay loam about 8 inches thick. The subsoil extends to a depth of 80 inches or more. Between depths of 8 and 29 inches, it is very firm, dark grayish brown clay; to a depth of 50 inches, it is very firm, brown clay; to a depth of 65 inches, it is firm, light brown clay loam that is about 30 percent calcium carbonate, by volume; and to a depth of 80 inches, it is firm, reddish yellow clay loam that is about 20 percent calcium carbonate, by volume. The soil is mildly alkaline to a depth of 29 inches and moderately alkaline below that.

Runoff is medium. Permeability is very slow, and the available water capacity is medium. The root zone is deep, but it is difficult for plant roots to penetrate the clay subsoil. Water erosion is a moderate hazard, and soil blowing is a slight hazard.

Included in mapping are small areas of Estacado, Olton, and Randall soils. Also included are small areas of Pullman soils that have slopes of 0 to 1 percent. These included soils make up less than 25 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the slope, the surface crusting, the hazard of water erosion, the very slow permeability, and the clay subsoil. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. If the crop residue cannot provide adequate protection, emergency tillage will be needed to control soil blowing. Contour farming and terraces are needed to help control water erosion. In places, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A surface or sprinkler irrigation system is suitable. If a surface system is used, bench leveling will be necessary. Fertilizer needs to be applied if this soil is irrigated.

This soil has low potential for native range plants. The low rainfall and the slow rate of water infiltration are the main limitations. The main native range plants are short grasses. Forage production is low in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has low potential for most urban uses. The main limitations are the shrinking and swelling of the soil, the low soil strength, the high corrosivity to uncoated steel, and the very slow permeability. They are difficult to overcome.

This soil has medium potential for recreation uses. The very slow permeability and the clay loam texture of the surface layer are the main limitations.

Capability subclass IIIe, nonirrigated and irrigated; Clay Loam range site.

44—Randall clay. This is a deep, somewhat poorly drained, nearly level soil on the bottom of depressions and shallow playas. Slopes are 0 to 1 percent. The areas are circular to oval and range from 5 to 100 acres. The plains surrounding the areas of this soil are 2 to 50 feet higher in elevation. In areas where this soil has not been disturbed, the surface is characterized by gilgai microrelief consisting of microknolls and microdepressions. The microknolls are 6 to 20 inches higher than the bottom of the microdepressions. They are 2 to 10 feet wide and 3 to 20 feet apart. This gilgai microrelief is destroyed after the soil has been cultivated for a few years.

The surface layer is firm, dark gray clay about 15 inches thick. The underlying material, to a depth of 48 inches, is very firm, gray clay that has many slickensides; to a depth of 75 inches, it is very firm, gray clay that has a few slickensides. Throughout the profile, the soil is moderately alkaline and has many shiny faces of peds.

Runoff ponds on this soil. After a rain, the runoff from surrounding soils accumulates on this soil to a depth of a few inches to several feet and remains for a few days to several months. Permeability is very slow, and the available water capacity is high. When the soil dries, wide deep cracks form at the surface. Water infiltration is rapid when the soil is cracked but is very slow when the soil is wet and the cracks are sealed. The root zone is deep, but the clay generally impedes the movement of air, water, and roots. Water erosion is a slight hazard, and soil blowing is a moderate hazard.

Included in mapping and making up less than 5 percent of any one mapped area are small areas of gently sloping soils around the lakeshore.

This soil is used mainly as rangeland. In a few areas it is used for crops; however, this soil is not suitable for cultivation unless it is drained or protected against the runoff from surrounding soils.

This soil has low potential for use as cropland mainly because crops are susceptible to severe damage by ponded water. If this soil is used for crops, crop residue should be left on the surface or worked into the surface layer to help prevent soil blowing and to conserve moisture. In dry years, emergency tillage will be needed to help control soil blowing if the crop residue cannot provide adequate protection.

This soil has medium potential for native range plants. It is alternately droughty and wet. Forage production is medium.

This soil has medium potential for the development of wildlife habitat. When they are ponded, the playas are used by migrating waterfowl.

This soil has low potential for most urban uses. The main limitations are the hazard of flooding, the shrinking and swelling of this soil, the low soil strength, and the high corrosivity to uncoated steel.

This soil has low potential for recreation uses, mainly because of the hazard of flooding and the clay texture of the surface layer.

Capability subclass VIw, nonirrigated; Lakebed range site.

45—Springer loamy fine sand, 0 to 3 percent slopes. This is a deep, well drained, nearly level to gently sloping soil on gently undulating uplands. The areas are irregular in shape and range from 5 to 100 acres. In most cultivated fields, the plow layer has been thinned by soil blowing, and most of the silt and clay particles have been removed. In some fields, there are small blowouts that have exposed the subsoil. Mounds of sand 1 to 2 feet high and about 30 feet wide have accumulated along the fence rows and field borders of most fields.

The surface layer is loose, brown loamy fine sand about 14 inches thick. The subsoil, to a depth of 32 inches, is very friable, reddish brown fine sandy loam; to a depth of 48 inches, it is very friable, yellowish red fine sandy loam. Below that, to a depth of 80 inches, the soil material is friable, yellowish red sandy clay loam. The soil is neutral to a depth of 32 inches and mildly alkaline below that.

Runoff is slow. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Altus, Delwin, Likes, Lincoln, Miles, Mobeetie, Nobscot, and Veal soils. Also included are small playas, areas of eroded soils, soils that are loamy fine sand to a depth of more than 20 inches, gravelly knobs, and a few soils that have redbeds or dark layers below a depth of 40 inches. Also included are small areas of Springer soils that have slopes of 3 to 5 percent and small areas of Springer fine sandy loam. Inclusions make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are grain sorghum and wheat. Cotton is grown in some areas.

This soil has medium potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall and the severe hazard of soil blowing. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Diversion terraces are needed in some areas to control runoff from adjacent soils and to control water erosion. Grassed waterways can be used as outlets for the diversions. Fertilizer is needed if this soil is cultivated. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. Sprinkler or drip irrigation systems are the most suitable.

This soil has high potential for native range plants. The low rainfall and the hazard of soil blowing are the main limitations. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The hazards of soil blowing and seepage are the main limitations.

This soil has medium potential for recreation uses. The loamy fine sand texture of the surface layer is the main limitation. The slope is a limitation for some playgrounds.

Capability subclass IIIe, nonirrigated and irrigated; Loamy Sand range site.

46—Springer loamy fine sand, 3 to 8 percent slopes. This is a deep, well drained, gently sloping to sloping soil on undulating uplands.

The areas are irregular in shape and range from 10 to 500 acres. In most cultivated areas, this soil is slightly eroded as a result of soil blowing.

The surface layer is loose loamy fine sand about 16 inches thick. It is brown in the upper 8 inches and reddish brown in the lower 8 inches. The subsoil, to a depth of 28 inches, is very friable, yellowish red fine sandy loam; to a depth of 40 inches, it is very friable, reddish yellow fine sandy loam. The layer below that, to a depth of 48 inches, is loose, reddish yellow loamy fine sand. Between depths of 48 and 60 inches, the soil material is very friable, yellowish red sandy clay loam; and to a depth of 72 inches, it is very friable, yellowish red fine sandy loam. The soil is neutral to a depth of 16 inches and mildly alkaline below that.

Runoff is slow. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a moderate hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Likes, Lincoln, Miles, Nobscot, Quinlan, Tivoli, and Veal soils. Also included are soils that have a surface layer more than 20 inches thick, areas of eroded soils, and small playas in depressions. Also included are small areas of Springer soils that have slopes of more than 8 percent or less than 3 percent and small areas of Springer fine sandy loam. The included soils make up less than 25 percent of any one mapped area.

This soil is used mainly as rangeland. In some areas it is cultivated, and grain sorghum and wheat are the main crops. This soil is not suitable for cotton.

This soil has low potential for nonirrigated and irrigated, close-spaced grain sorghum and wheat. The main limitations are the low rainfall, the slope, and the severe hazard of soil blowing. Minimum tillage should be used, and crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Diversion terraces are needed in some areas to control runoff from adjacent soils and to reduce water erosion. Grassed waterways can be used as outlets for the diversions. Fertilizer is needed if this soil is cultivated. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or drip irrigation system is suitable.

This soil has high potential for native range plants. The low rainfall and the hazard of soil blowing are the main limitations. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The slope and the hazards of soil blowing and seepage are the main limitations.

This soil has medium potential for recreation uses. The slope and the loamy fine sand texture of the surface layer are the main limitations.

Capability subclass IVe, nonirrigated and irrigated; Loamy Sand range site.

47—Springer loamy fine sand, 3 to 8 percent slopes, severely eroded. This is a deep, well drained, gently sloping to sloping soil on uplands. The landscape is undulating. The areas are irregular in shape and range from 5 to 80 acres. As a result of soil blowing, sand has accumulated along fence rows and field borders. The accumulations are as much as 4 feet deep and 60 feet wide.

On about 60 percent of the acreage, the surface layer has been lost through erosion, and the subsoil is exposed. On more than 50 percent of this acreage, about half of the subsoil material has also been lost. There are many crossable gullies and a few uncrossable gullies in most of these areas. The crossable gullies are about 100 to 150 feet apart, and the uncrossable gullies are 400 to 600 feet apart. The uncrossable gullies generally extend into the underlying material. They are as much as 8 feet deep and 10 feet wide. In these areas, the surface texture is mainly fine sandy loam. In places, it is fine sand and loamy fine sand.

On about 30 percent of the acreage, the soil is slightly eroded. In these areas, 25 to 75 percent of the original surface layer has been lost through erosion. The remaining surface layer is winnowed and is mainly fine sand. In places, it is loamy fine sand.

On about 10 percent of the acreage, the land is characterized by blowouts. On the average, these blowouts are 75 feet wide, 150 feet long, and 6 feet deep. In most areas they extend into the underlying material. Sand dunes several feet thick are along the sides of these blowouts. In most of these areas, the vegetation consists only of thin stands of native grasses. The surface texture is fine sand or loamy fine sand.

Soil blowing and water erosion are still active throughout most of this map unit.

The surface layer is loose, light brown loamy fine sand about 2 inches thick. The subsoil, to a depth of 35 inches, is very friable, brown fine sandy loam; to a depth of 50 inches, it is loose, reddish yellow loamy fine sand. The next layer, to a depth of 58 inches, is loose, brown loamy fine sand. Below that, to a depth of 65 inches, the soil material is very friable, yellowish red fine sandy loam, and to a depth of 80 inches, it is very friable, reddish yellow fine sandy loam. The surface layer is neutral. Below that, the soil is mildly alkaline.

Runoff is slow. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are severe hazards.

Included in mapping are small areas of Delwin, Likes, Lincoln, Miles, Nobscot, Quinlan, and Veal soils. Also included are small areas of Springer fine sandy loam. The included soils make up less than 10 percent of any one mapped area.

This soil is used mainly as rangeland. It is not suited to crops.

This soil has high potential for native range plants. The main limitations are the low rainfall, the hazard of soil blowing, and the eroded condition of the soil. The main native range plants are mid and tall grasses. Forage production is high in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The hazards of soil blowing and seepage and the eroded condition of the soil are the main limitations.

This soil has medium potential for recreation uses. The slope and the loamy fine sand texture of the surface layer are the main limitations.

Capability subclass VIe, nonirrigated; Loamy Sand range site.

48—Springer fine sandy loam, 5 to 8 percent slopes. This is a deep, well drained, sloping soil on slightly convex and gently rolling uplands. The areas are irregular in shape and range from 5 to 100 acres. Local shifting of the soil by wind is evident in cropland areas.

The surface layer is very friable, brown fine sandy loam about 9 inches thick. The subsoil, to a depth of 18 inches, is very friable, reddish brown fine sandy loam. Between depths of 18 and 68 inches, the soil material is

very friable, yellowish red fine sandy loam; and to a depth of 75 inches, it is loose, reddish yellow loamy fine sand. The soil is mildly alkaline to a depth of 68 inches and moderately alkaline below that.

Runoff is medium. Permeability is moderately rapid, and the available water capacity is medium. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Acuff, Guadalupe, Likes, Lincoln, Miles, Mobeetie, Paloduro, and Veal soils. Also included are a few soils that have a lime accumulation or a dark layer below a depth of 40 inches, small areas of Springer loamy fine sand, and small areas of Springer soils that have slopes of 3 to 5 percent or 8 to 12 percent. The included soils make up less than 25 percent of any one mapped area.

This soil is used mainly as rangeland. The main crops are grain sorghum and wheat. This soil is not suitable for cotton.

This soil has low potential for nonirrigated and irrigated, close-spaced grain sorghum and wheat. The main limitations are the low rainfall, the slope, and the hazards of soil blowing and water erosion. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed to help control water erosion. Diversion terraces are needed in some areas to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Fertilizer is needed if this soil is cultivated. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or drip irrigation system is suitable.

This soil has medium potential for native range plants. The low rainfall and the slope are the main limitations. The main native range plants are mid and tall grasses. Forage production is medium in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has high potential for most urban uses. The slope and the hazard of seepage are the main limitations.

This soil has high potential for recreation uses. The slope is a limitation for playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Sandy Loam range site.

49—Spur clay loam, occasionally flooded. This is a deep, well drained, nearly level soil on bottom lands. Slopes are 0 to 1 percent. The areas generally are less than 800 feet wide and are elongated along drainageways. This soil is flooded for a few hours about once in 1 to 5 years.

The surface layer is dark brown clay loam about 18 inches thick. The subsoil, to a depth of 36 inches, is brown clay loam that has a few threads and films of calcium carbonate. The substratum, to a depth of 45 inches, is grayish brown loam that has a few threads and films of calcium carbonate; to a depth of 60 inches, it is dark grayish brown loam. The soil is friable and moderately alkaline throughout.

Runoff is slow. Permeability is moderate, and the available water capacity is high. The root zone is deep, and the soil material is easily penetrated by plant roots. Soil blowing is a slight hazard.

Included in mapping are small areas of Bippus, Clairemont, Guadalupe, Lincoln, and Sweetwater soils. Also included are small areas of Spur soils that have a water table and mottles within a depth of 60 inches. These included soils make up less than 20 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has high potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The occasional flooding is the main limitation. Crop residue should be left on the surface or worked into the surface layer to help control soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Diversion terraces are needed in some areas to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler or surface irrigation system is suitable. If a surface system is used, land leveling will be necessary on some slopes. Fertilizer needs to be applied if this soil is irrigated.

This soil has high potential for native range plants. The occasional flooding supplies additional moisture. The main native range plants are short and mid grasses. Forage production is high in favorable years.

This soil has high potential for the development of wildlife habitat.

This soil has low potential for most urban uses. The main limitations are the hazard of flooding, the shrinking and swelling of the soil, the low soil strength, the moderate corrosivity to uncoated steel, and the hazard of seepage.

This soil has low potential for recreation uses. The hazard of flooding and the clay loam texture of the surface layer are the main limitations.

Capability subclass IIw, nonirrigated and irrigated; Draw range site.

50—Sweetwater soils. These are deep, poorly drained, nearly level to gently sloping soils on wet bottom lands. The slopes are slightly concave and range from 0 to 3 percent. The areas are elongated and range from 5 to 60 acres.

The surface layer of these soils varies in texture from place to place; it is sandy clay loam, fine sandy loam, or clay loam. Typically, it is friable clay loam that has some yellowish brown mottles and is 26 inches thick. The surface layer is dark gray in the upper 16 inches and grayish brown below that. The underlying material, to a depth of 60 inches, is very pale brown loamy fine sand that has a few yellowish brown mottles. The soil is moderately alkaline throughout.

Runoff is slow. It is ponded during periods of flooding. Permeability is moderately slow, and the available water capacity is medium. The root zone is somewhat restricted by the high water table.

Included in mapping are small areas of Clairemont, Guadalupe, Likes, Lincoln, Spur, and Tivoli soils. Also included are small areas of Sweetwater soils that have slopes of 3 to 5 percent. These included soils make up less than 20 percent of any one mapped area.

These soils are used mainly as hayland and rangeland. They are not suitable for crops because of the wetness caused by the high water table.

These soils have high potential for native range plants. The main native range plants are mid and tall grasses. Forage production is high.

These soils have medium potential for the development of wildlife habitat.

These soils have low potential for most urban uses. Wetness, flooding, and the high corrosivity to uncoated steel are the main limitations.

These soils have low potential for recreation uses. Wetness and flooding are the main limitations.

Capability subclass Vw, nonirrigated; Wet Bottomland range site.

51—Tivoli fine sand. This is a deep, excessively drained, gently sloping to steep soil on uplands. Slopes are complex and range from 3 to 30 percent. The topography is characterized by dunes. The areas are oblong and range from 5 to 150 acres. Local shifting of the soil by wind is evident in places.

The surface layer is very friable, neutral, pale brown fine sand about 6 inches thick. The underlying material, to a depth of 60 inches, is loose, mildly alkaline, reddish yellow fine sand.

Runoff is very slow. Permeability is rapid, and the available water capacity is very low. The root zone is deep, and the soil material is easily penetrated by plant roots. Water erosion is a slight hazard, and soil blowing is a severe hazard.

Included in mapping are small areas of Likes, Miles, Mobeetie, Nobscot, Springer, and Veal soils. Also included are a few areas of blowouts. Inclusions make up less than 20 percent of any one mapped area.

This soil is used as rangeland. It is not suitable for cultivation mainly because of the severe hazard of soil blowing.

This soil has medium potential for native range plants. The low rainfall and the sandy texture of the surface layer are the main limitations. The main native range plants are mid and tall grasses. Forage production is medium in favorable years.

This soil has low potential for the development of wildlife habitat.

This soil has low potential for most urban uses. The rapid permeability and the sandy texture of the surface layer are the main limitations.

This soil has low potential for recreation uses. The slope and the sandy texture of the surface layer are the main limitations.

Capability subclass VIIe, nonirrigated; Sand Hills range site.

52—Veal fine sandy loam, 1 to 3 percent slopes. This is a deep, well drained, gently sloping soil on slightly convex uplands. The areas are irregular in shape and range from 5 to 80 acres. In most areas of cropland, this soil is slightly eroded.

The surface layer is very friable, brown fine sandy loam about 8 inches thick. The subsoil, to a depth of 14 inches, is friable, brown fine sandy loam; to a depth of 28 inches, it is friable, very pale brown sandy clay loam that is about 60 percent calcium carbonate, by volume; and to a depth of 50 inches, it is friable, pink sandy clay loam that is about 60 percent calcium carbonate, by volume. The substratum, to a depth of 80 inches, is friable, pink loam that is about 15 percent calcium carbonate, by volume. The soil is moderately alkaline throughout.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Estacado, Miles, Mobeetie, Potter, and Springer soils. Also included are small areas of Veal soils that have slopes of 0 to 1 percent or 3 to 5 percent. These included soils make up less than 25 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has low potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the slope, the hazards of soil blowing and water erosion, and the high calcium carbonate content. Crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed in some areas to help control water erosion. In places, diversion terraces are needed to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Fertilizer is needed if this soil is used

for crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler, surface, or drip irrigation system is suitable. If a surface system is used, bench leveling will be necessary.

This soil has medium potential for native range plants. The low rainfall and the high calcium carbonate content are the main limitations. The main native range plants are short and mid grasses. Forage production is medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the low soil strength, the moderate corrosivity to uncoated steel, and the hazard of seepage. They can be overcome through good design and careful installation.

This soil has high potential for recreation uses. The slope is a limitation for some playgrounds.

Capability subclass IVe, nonirrigated, and IIIe, irrigated; Loamy range site.

53—Veal fine sandy loam, 3 to 5 percent slopes. This is a deep, well drained, gently sloping soil on slightly convex uplands. The areas are irregular in shape and range from 5 to 100 acres. In most cultivated areas, this soil is slightly eroded.

The surface layer is very friable, grayish brown fine sandy loam about 6 inches thick. The subsoil, to a depth of 12 inches, is friable, brown sandy clay loam; to a depth of 26 inches, it is friable, pinkish gray sandy clay loam that is about 60 percent calcium carbonate, by volume; and to a depth of 45 inches, it is friable, pink sandy clay loam that is about 60 percent calcium carbonate, by volume, between depths of 26 and 35 inches and about 20 percent below a depth of 35 inches. The substratum, to a depth of 80 inches, is friable, pink sandy clay loam that is about 10 percent calcium carbonate, by volume.

Runoff is medium. Permeability is moderate, and the available water capacity is medium. The root zone is deep. Water erosion and soil blowing are moderate hazards.

Included in mapping are small areas of Acuff, Estacado, Miles, Mobeetie, and Potter soils. Also included are small areas of Veal soils that have slopes of 1 to 3 percent or 5 to 8 percent. These included soils make up less than 25 percent of any one mapped area.

This soil is used as cropland and rangeland. The main crops are cotton, grain sorghum, and wheat.

This soil has low potential for nonirrigated and irrigated cotton, grain sorghum, and wheat. The main limitations are the low rainfall, the slope, the hazards of soil blowing and water erosion, and the high calcium carbonate content of this soil. If this soil is used for crops, crop residue should be left on the surface or worked into the surface layer to help control water erosion and soil blowing and to conserve moisture. Emergency tillage will be needed to control soil blowing if the crop residue cannot provide adequate protection. Contour farming and terraces are needed to help control water erosion. Diversion terraces are needed in some areas to control runoff from adjacent soils. Grassed waterways can be used as outlets for the diversions and terraces. Fertilizer needs to be applied if this soil is used for crops. Under irrigation management, an irrigation system that properly applies irrigation water is necessary. A sprinkler, drip, or surface irrigation system is suitable. If a surface system is used, bench leveling will be necessary.

This soil has medium potential for native range plants. The low rainfall and the high calcium carbonate content of this soil are the main limitations. The main native range plants are short and mid grasses. Forage production is medium in favorable years.

This soil has medium potential for the development of wildlife habitat.

This soil has medium potential for most urban uses. The main limitations are the slope, the low soil strength, the moderate corrosivity to uncoated steel, and the hazard of seepage.

This soil has high potential for recreation uses. The slope is a limitation for some playgrounds.

Capability subclass IVe, nonirrigated and irrigated; Loamy range site.

Use and management of the soils

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

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

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

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

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

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

Crops

Allen H. King, conservation agronomist, Soil Conservation Service, helped prepare this section.

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

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

In 1967, according to the Conservation Needs Inventory (*3*), about 109,897 acres in the survey area was cropland. The main limitation to the use of the soils in Donley County for cultivated crops is low rainfall. The potential for increased food production in the county is high, but because rainfall and irrigation water are inadequate in many areas, the soils are restricted to use as rangeland. Other management concerns on cropland are the hazards of water erosion and soil blowing.

Water erosion is a hazard on the loamy, gently sloping Acuff, Aspermont, Carey, Estacado, Miles, Mobeetie, Olton, Paloduro, Pullman, Springer, and Veal soils. If these soils are not protected, they can be damaged by runoff. Maintaining a vegetative cover and other practices, including contour farming, terraces, and grassed waterways, can help to minimize water erosion on these soils.

Soil blowing is a severe hazard on the sandy Delwin, Miles, and Springer soils. It is a moderate hazard on the loamy Altus, Estacado, Miles, Mobeetie, Springer, and Veal soils and on the clayey Randall soils. Soil blowing can damage these soils in a few hours if winds are strong and the soils are dry and bare of vegetation or surface mulch. Maintaining a vegetative cover, surface mulch, or a rough surface through proper tillage can minimize soil blowing on these soils.

If the surface layer is lost through water erosion or soil blowing, the natural environment is damaged in two ways. First, productivity is reduced as the surface layer is eroded and subsoil material is incorporated into the plow layer. Loss of the surface layer is especially damaging to soils that have a clay loam subsoil, such as Olton soils, and to soils that have a layer that restricts the root zone, such as Veal soils, which have a layer of caliche. Second, water erosion on farmland results in sedimentation in streams. Controlling water erosion minimizes the pollution of streams by sediment and improves the quality of water for municipal use, for recreation uses, and for fish and other wildlife. Soil blowing pollutes the air and causes productive soil material to be deposited in drifts along fence rows, in bar ditches, and across roads.

Erosion-control practices provide a protective surface cover, reduce runoff, and increase water infiltration. A cropping system that maintains a vegetative cover on the soil helps to reduce soil erosion so that the productivity of the soils is not reduced.

Minimum tillage and leaving crop residue on the surface or incorporating it into the surface layer help to increase water infiltration and reduce runoff and erosion. These practices can be adapted to most soils in the survey area. They are most difficult to adapt to soils that have a clay loam surface layer, for example, Estacado, Olton, and Pullman soils.

Deep plowing increases the clay content in the surface layer of the sandy Delwin and Miles soils. Increasing the clay content in the surface layer of these soils helps to reduce soil blowing.

Emergency tillage can help to control soil blowing where crop residue cannot provide adequate protection. Emergency tillage roughens the soil surface so it is more resistant to soil blowing. It can be used effectively on Acuff, Altus, Aspermont, Bippus, Carey, Clairemont, Delwin, Estacado, Guadalupe, Miles, Mobeetie, Olton, Paloduro, Pullman, Randall, Springer, Spur, and Veal soils.

Contour farming is best adapted to soils that have smooth, uniform slopes. In most areas, the gently sloping Acuff, Aspermont, Bippus, Carey, Estacado, Miles, Mobeetie, Olton, Paloduro, Pullman, and Veal soils are suitable for contour farming.

Grassed waterways are protected outlets that can minimize soil erosion caused by concentrated runoff water. They can also be used as outlets for terraces or diversions.

Terraces and diversions reduce the length of slopes and thus reduce runoff and erosion. Deep, well drained soils that have regular slopes are the best suited to terraces and diversions. Acuff, Aspermont, Carey, Estacado, Miles, Mobeetie, Olton, Paloduro, and Springer soils are suitable for terraces. The other soils in the survey area are less suitable for terraces and diversions because they have irregular slopes; a clayey subsoil that would be exposed in terrace channels, for example, Pullman soils; or a high concentration of calcium carbonate within a depth of 30 inches, for example, Veal soils.

Information on the design of erosion-control practices for each kind of soil in Donley County is available at the local office of the Soil Conservation Service.

Soil drainage is a management need only on the poorly drained Sweetwater soils, which make up about 1,260 acres of the survey area, and on the somewhat poorly drained Randall soils, which make up about 1,920 acres.

Soil fertility is naturally medium to low in most of the cultivated upland soils in the survey area. Fertilizer should be added on the basis of soil tests, the need of the crop, and the expected level of yield. The Cooperative Extension Service can help in determining the kind and amount of fertilizer to apply. None of the soils in Donley County require lime.

Soil tilth is an important factor in the germination of seeds and in the infiltration of water into the soil. Soils that have good tilth are granular and porous. Most of the cultivated soils in the survey area are loamy and can be plowed in fall. However, some of the gently sloping loamy soils can be damaged by water erosion if they are plowed in fall. Tilth is a problem on the Olton, Pullman, and Randall soils. If these soils are plowed when wet, they tend to be very cloddy when dry, and a good seedbed is difficult to prepare. Plowing these soils in fall generally results in good tilth in spring. Soil blowing is a hazard if these soils are left bare.

Field crops that are suited to the soils and climate in the survey area include cotton, grain sorghum, and wheat. Cotton and grain sorghum are row crops (fig. 16). Wheat is a close-grown crop.

Specialty crops grown in Donley County include some vegetables and orchard crops. Deep soils that have good natural drainage and that warm up early in spring are especially well suited to vegetables. The production of specialty crops is limited mainly by the low rainfall or by an inadequate supply of irrigation water. Some of the special field crops grown in the survey area are alfalfa, barley, cantelopes, corn, cucumbers, guar, rye, soybeans, sugar beets, sunflowers, and watermelons.

The latest information and suggestions on growing field crops or specialty crops can be obtained at the local offices of the Cooperative Extension Service and the Soil Conservation Service.

Irrigation

In 1974, about 18,663 acres in Donley County was under irrigation. The largest area of irrigated land is in the vicinity of Jericho. Smaller areas are located in the western and central parts of the county.

All the irrigation water is pumped from deep wells, most of which are 150 to 600 feet deep. The amount of water produced by these wells ranges from 200 to 1,200 gallons per minute.

Surface and sprinkler irrigation systems are used in Donley County. In some places, land leveling or smooth-

Figure 16.—Grain sorghum and cotton in rotation on Miles loamy fine sand, 0 to 3 percent slopes.

ing is necessary before a surface irrigation system can be installed. Row irrigation is the main system used on the nearly level clayey and loamy soils (fig. 17). Irrigation runoff can be utilized by collecting it in a tailwater pit and then pumping it back into the irrigation distribution system (fig. 18). Sprinkler irrigation is used on the gently sloping loamy soils and on the nearly level to gently sloping sandy soils. If a surface system is used on the gently sloping loamy soils, bench leveling will be necessary.

The yield of irrigated crops is 2 to 3 times higher than that of nonirrigated crops.

Yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 4. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

For yields of irrigated crops, it is assumed that the irrigation system is adapted to the soils and to the crops grown, that good quality irrigation water is uniformly applied as needed, and that tillage is kept to a minimum.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed.

Figure 17.—Row irrigation on Pullman clay loam, 0 to 1 percent slopes.

Figure 18.—This tailwater pit collects runoff from row irrigation on Pullman clay loam, 0 to 1 percent slopes.

The productivity of a given soil compared with that of other soils, however, is not likely to change.

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

Land capability classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor does it consider possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland and for engineering purposes.

In the capability system, soils are generally grouped at two levels: capability class and subclass. Only class and subclass are used in this survey. These levels are defined 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. The classes are defined as follows:

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

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

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

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, IIe. The letter *e* shows that the main 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 very cold or very dry.

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

The acreage of soils in each capability class and subclass is shown in table 5. The capability classification of each map unit is given in the section "Soil maps for detailed planning."

Rangeland

John W. Wright, range conservationist, Soil Conservation Service, helped prepare this section.

In 1967, according to the Conservation Needs Inventory (*3*), about 437,005 acres in the survey area was rangeland. Rangeland is used for the production of native vegetation for grazing by domestic livestock and wildlife. The acreage in rangeland and the number of ranches in the survey area have gradually decreased over the years. At present, there are about 500 ranches and farms that produce livestock in Donley County.

Most of the soils in the county produce a mixture of plants that are suitable for grazing by cattle and horses. Stocker-type calves are grazed on supplemental small-grain pastures. Deer and other wildlife are increasing in number and value, but at present they graze only a small part of the forage produced on rangeland.

In areas that have similar climate and topography, differences in the kind and amount of vegetation produced on rangeland are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

Table 6 shows, for some soils in the survey area, the range site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. Only those soils that are used as or are suited to rangeland are listed. Explanation of the column headings in table 6 follows.

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

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

Dry weight is the total annual yield per acre reduced to a common percent of air-dry moisture.

Characteristic vegetation—the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil—is listed by common name. Under *composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

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

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, conservation of water, and control of erosion. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

The deeper soils in valleys and on plains can produce tall, mid, or short grasses and some forbs and woody plants. The more clayey, nearly level to gently sloping soils on plains produce a grassland of drought-resistant short grasses and forbs and a few shrubs. Buffalograss and invading mesquite trees have increased greatly on these soils (fig. 19). The very shallow soils along caliche caprocks and on redbed hills produce a few browse plants as well as grasses and forbs. Redberry juniper

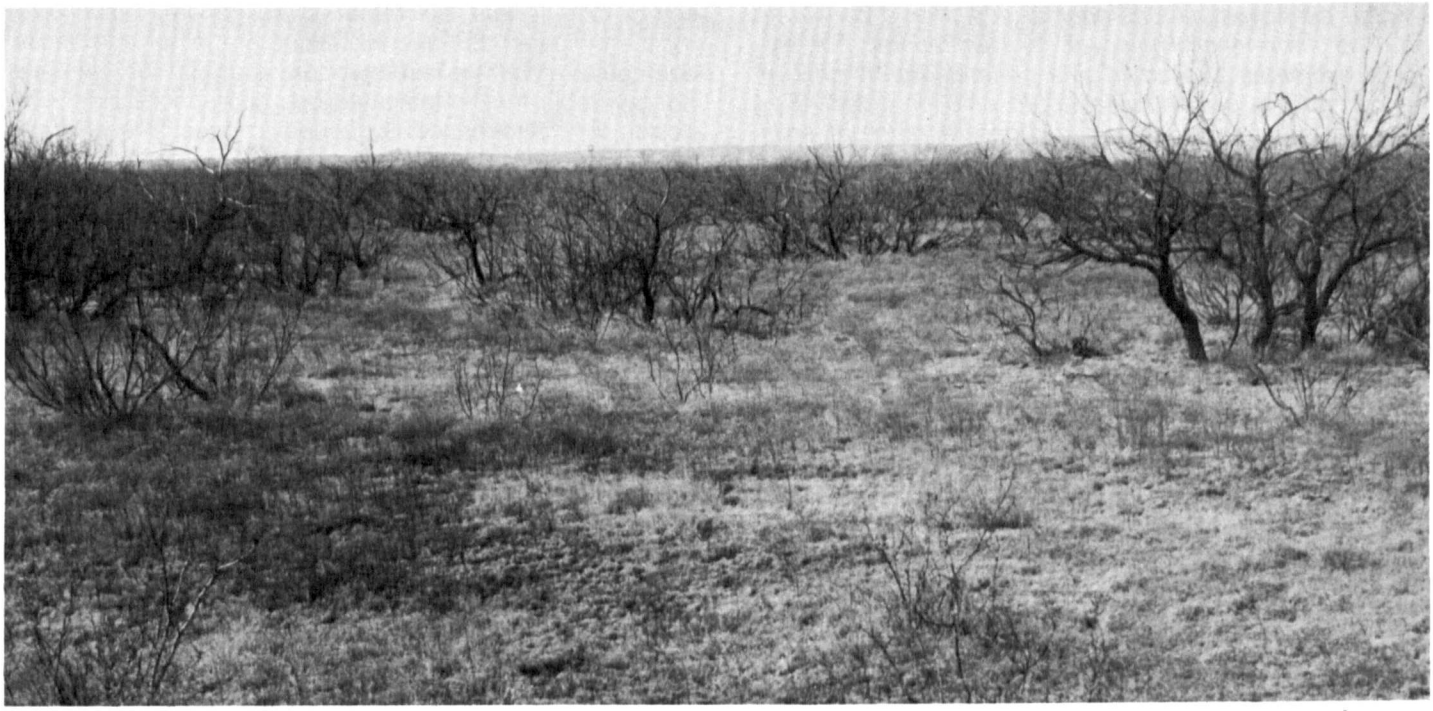


Figure 19.—Mesquite trees have invaded this area of rangeland. The soil is Olton clay loam, 0 to 1 percent slopes. This soil is in the Clay Loam range site.

has increased in these rough areas, which are suited to grazing by wildlife.

Growth of native vegetation is greatest during May and June, when rainfall and temperatures are the most favorable. Another major period of growth usually occurs during September and October. The soils on most range sites produce some cool-season grasses, but the fertile bottom-land soils produce more than most. However, cool-season grasses usually are of insignificant value for year-long forage.

Windbreaks and environmental plantings

Windbreaks protect livestock, buildings, and yards from wind and snow. They also protect fruit trees and gardens, and they furnish habitat for wildlife. Several rows of low- and high-growing broadleaf and coniferous trees and shrubs provide the most protection.

Field windbreaks are narrow plantings made at right angles to the prevailing wind and at specific intervals across the field. The interval depends on the erodibility of the soil. Field windbreaks protect cropland and crops from wind, hold snow on the fields, and provide food and cover for wildlife.

Environmental plantings help to beautify and screen houses and other buildings and to abate noise. The plants, mostly evergreen shrubs and trees, are closely spaced. To insure plant survival, a healthy planting stock of suitable species should be planted properly on a well prepared site and maintained in good condition.

Table 7 shows the height that locally grown trees and shrubs are expected to reach in 20 years on various soils. The estimates in table 7 are based on measurements and observation of established plantings that have been given adequate care. They can be used as a guide in planning windbreaks and screens. Additional information on planning windbreaks and screens and planting and caring for trees and shrubs can be obtained from local offices of the Soil Conservation Service or the Cooperative Extension Service or from a nursery.

Engineering

James L. Hailey, agricultural engineer, Soil Conservation Service, helped prepare this section.

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

Information in this section is intended for land use planning, for evaluating land use alternatives, and for

planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

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

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

This information can be used to (1) evaluate the potential of areas for residential, commercial, industrial, and recreation uses; (2) make preliminary estimates of construction conditions; (3) evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; (4) evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; (5) plan detailed onsite investigations of soils and geology; (6) locate potential sources of gravel, sand, earthfill, and topsoil; (7) plan drainage systems, irrigation systems, ponds, terraces, and other structures for soil and water conservation; and (8) predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

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

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

Building site development

Table 8 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Sanitary facilities

Table 9 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are gener-

ally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 9 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 9 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, depth to bedrock or to a cemented pan, flooding, large stones, and content of organic matter.

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

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

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

The ratings in table 9 are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or to a cemented pan, a high water table, slope, and flooding affect both types of landfill. Texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

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

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

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

Construction materials

Table 10 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

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

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

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

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

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 10, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

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

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

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

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

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

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

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

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water management

Table 11 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are

not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

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

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

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

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

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

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

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

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

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Large stones, wetness, slope, and depth to bedrock or to a cemented pan affect the construction of grassed waterways. A hazard of wind erosion, low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

Recreation

The soils of the survey area are rated in table 12 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 12, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 12 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 9 and interpretations for dwellings without basements and for local roads and streets in table 8.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils

have mild slopes and are not wet or subject to flooding during the period of use. The surface has few or no stones or boulders, absorbs rainfall readily but remains firm, and is not dusty when dry. Strong slopes and stones or boulders can greatly increase the cost of constructing campsites.

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

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

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

Wildlife habitat

Willard Richter, biologist, Soil Conservation Service, helped prepare this section.

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, by maintaining the existing plant cover, or by promoting the natural establishment of desirable plants.

In table 13, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

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

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

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

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

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, surface stoniness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, beggarweed, Indiangrass, croton, and paspalum.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are mountainmahogany, grape, skunkbush, wild plum, and shin oak.

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

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

areas, beaver ponds, and other wildlife ponds.

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

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants. The wildlife attracted to these areas include bobwhite and scaled quail, badger, cottontail and jackrabbit, pronghorn antelope, and red fox.

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

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. Wildlife attracted to rangeland include white-tailed deer, desert mule deer, buffalo, coyote, lesser prairie chicken, and wild turkey.

Soil properties

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

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

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

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

Engineering properties

Table 14 gives estimates of the engineering classification and of the range of properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

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

Texture is given in the standard terms used by the U.S. Department of Agriculture (*4*). These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

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

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

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

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

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

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

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

Physical and chemical properties

Table 15 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

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

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

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

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

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

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

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water (*5*). Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

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

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

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

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

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

4L. Calcareous loamy soils that are less than 35 percent clay and more than 5 percent finely divided calcium carbonate. These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.

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

5. Loamy soils that are less than 18 percent clay and less than 5 percent finely divided calcium carbonate and sandy clay loams and sandy clays that are less than 5 percent finely divided calcium carbonate. These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

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

7. Silty clay loams that are less than 35 percent clay and less than 5 percent finely divided calcium carbonate.

These soils are very slightly erodible. Crops can easily be grown.

8. Stony or gravelly soils and other soils not subject to wind erosion.

Soil and water features

Table 16 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic groups are:

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

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

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

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

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall or snowmelt is not considered flooding.

Table 16 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

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

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

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 16 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 16.

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

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Depth to bedrock is given if bedrock is within a depth of 5 feet. The depth is based on many soil borings and on observations during soil mapping. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavations.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil bound-

aries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

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

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

Classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*6*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 17, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

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

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Ustoll (*Ust*, meaning burnt, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Paleustolls (*Pale*, meaning horizons that have more than normal development, plus *ustoll*, the suborder of the Mollisols that have a ustic moisture regime).

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

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

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series. An example is the Acuff series, a member of the fine-loamy, mixed, thermic family of Aridic Paleustolls.

Soil series and morphology

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

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

The map units of each soil series are described in the section "Soil maps for detailed planning."

Acuff series

The Acuff series consists of deep, loamy soils on uplands. Acuff soils formed in calcareous, loamy sediment. Slopes range from 0 to 5 percent.

Typical pedon of Acuff loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 287 and Farm Road 2162 in Clarendon, this pedon is located 0.7 mile southwest and 1 mile west on Farm Road 2162, 1.85 miles west on county road, and 250 feet south, in a field:

Ap—0 to 6 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; weak medium granular structure; slightly hard, friable, slightly sticky; many fine roots; neutral; clear smooth boundary.

A1—6 to 13 inches; dark brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) moist; moderate fine subangular blocky structure; hard, friable; mildly alkaline; clear smooth boundary.

B21t—13 to 24 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moder-

ate medium subangular blocky structure; very hard, friable; patchy clay films on faces of peds; noncalcareous; moderately alkaline; gradual smooth boundary.

B22t—24 to 38 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, friable; patchy clay films on faces of peds; few very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B23t—38 to 48 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate medium subangular blocky structure; very hard, friable; patchy clay films on faces of peds; few films, threads, and concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

B24tca—48 to 64 inches; light reddish brown (5YR 6/4) sandy clay loam, reddish brown (5YR 5/4) moist; moderate fine and medium subangular blocky structure; hard, friable; about 40 percent, by volume, soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B25t—64 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; few patchy clay films on faces of peds; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. The mollic epipedon is 11 to 20 inches thick and commonly comprises all of the A horizon and the upper part of the B2t horizon. It is reddish brown, brown, dark brown, or dark grayish brown. Layers that have secondary calcium carbonate are at a depth of 15 to 34 inches.

The A horizon is 6 to 14 inches thick. It is neutral or mildly alkaline.

The B2t horizon is sandy clay loam or clay loam that is 25 to 35 percent clay. It is mildly alkaline or moderately alkaline. The part of the B2t horizon that is below the mollic epipedon and above the calcic horizon is reddish brown, red, yellowish red, reddish yellow, or brown.

The B2tca horizon is pink, light reddish brown, or reddish yellow. The content of calcium carbonate is 15 to 60 percent, by volume.

Altus series

The Altus series consists of deep, loamy soils on uplands. Altus soils formed in calcareous, loamy sediment. Slopes are 0 to 1 percent.

Typical pedon of Altus fine sandy loam, 0 to 1 percent slopes; from the intersection of U.S. Highway 287 and Texas Highway 203 in Hedley, this pedon is located 0.6 mile northeast on Texas Highway 203 and 100 feet east, in a field:

Ap—0 to 12 inches; dark grayish brown (10YR 4/2) fine sandy loam, very dark grayish brown (10YR 3/2) moist; moderate medium granular structure; slightly hard, very friable; neutral; clear smooth boundary.

B21t—12 to 24 inches; dark grayish brown (10YR 4/2) sandy clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium subangular blocky structure; very hard, friable; many very fine pores; few patchy clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—24 to 35 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; moderate medium subangular blocky structure; very hard, friable; few patchy clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B23t—35 to 50 inches; reddish brown (5YR 5/3) sandy clay loam, reddish brown (5YR 4/3) moist; moderate fine and medium subangular blocky structure; very hard, friable; few patchy clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B3—50 to 65 inches; brown (7.5YR 5/4) sandy clay loam, dark brown (7.5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. The mollic epipedon is 20 to more than 40 inches thick and commonly comprises all of the A horizon and the upper part of the B2t horizon. It is dark brown, grayish brown, or dark grayish brown. Layers that have secondary calcium carbonate are at a depth of 17 to 50 inches.

The A horizon is 7 to 22 inches thick.

The B2t horizon is sandy clay loam that is 18 to 28 percent clay. It is mildly alkaline or moderately alkaline. The part of the B2t horizon that is below the mollic epipedon is reddish brown or brown.

Aspermont series

The Aspermont series consists of deep, loamy soils on uplands. Aspermont soils formed in loamy redbed sediment. Slopes range from 1 to 45 percent.

Typical pedon of Aspermont silty clay loam, 3 to 5 percent slopes; from the intersection of Farm Road 2162 and U.S. Highway 287 in Clarendon, this pedon is located 4.1 miles east on U.S. Highway 287, about 10 miles north and east on Farm Road 1260 to the north end of bridge over the Salt Fork of the Red River, 0.4 mile northwest on Farm Road 1260, and 60 feet north in rangeland:

A1—0 to 9 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate fine granular structure; hard, friable; many roots; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21—9 to 25 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; common roots; many very fine pores; common worm casts; few threads and films of calcium carbonate on faces of peds; few very fine fragments of caliche; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—25 to 45 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; moderate medium and fine subangular blocky structure; hard, friable; many very fine pores; few worm casts; about 8 percent, by volume, threads, films, coatings, and very fine soft masses of calcium carbonate; calcareous; moderately alkaline; diffuse smooth boundary.

C—45 to 70 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; massive; hard, firm; common threads, films, and very fine soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 25 to more than 50 inches thick. Layers that have secondary carbonates are at a depth of 12 to 32 inches.

The A horizon is 6 to 10 inches thick. It is reddish brown, red, brown, or light reddish brown loam, clay loam, or silty clay loam. It is moderately alkaline throughout.

The B2 horizon is 20 to 40 inches thick. It is reddish brown, red, reddish yellow, yellowish red, light reddish brown, or brown. Its texture is loam, clay loam, or silty clay loam. The B22ca horizon is 5 to 20 percent calcium carbonate, by volume.

The C horizon is red, reddish brown, or yellowish red.

Berda series

The Berda series consists of deep, loamy soils on uplands. Berda soils formed in calcareous, loamy sediment of slope alluvium and colluvial valley fill. Slopes range from 5 to 45 percent.

Typical pedon of Berda loam, in an area of Berda-Estacado-Potter association, rolling; from Jericho, this pedon is located about 5 miles east to the intersection of county roads at the northeast corner of the Rockledge oil tank industrial property, 0.15 mile southeast on county road, 0.4 mile east and 0.2 mile south on a major ranch access road, 0.25 mile southwest on trail, and 100 feet south in rangeland:

A1—0 to 9 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; hard, very friable; common worm casts; few very fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21—9 to 17 inches; brown (7.5YR 5/3) loam, dark brown (7.5YR 4/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; common very fine pores; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22ca—17 to 45 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; few worm casts; about 10 percent threads, films, soft masses, and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; clear wavy boundary.

C—45 to 60 inches; light brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; hard, friable; about 5 percent threads, films, soft masses, and concretions of calcium carbonate, by volume; calcareous; moderately alkaline.

The solum is 40 to more than 60 inches thick.

The A horizon is 6 to 12 inches thick. It is brown, light brown, grayish brown, or light brownish gray clay loam, loam, or fine sandy loam.

The B21 and B22ca horizons are brown, light brown, pale brown, light yellowish brown, or pink. They are loam, sandy clay loam, or clay loam, and the clay content is 18 to 35 percent. The B22ca horizon is 1 to about 20 percent calcium carbonate.

The C horizon is brown, light brown, pale brown, very pale brown, or pink. It is clay loam, loam, or sandy clay loam.

Bippus series

The Bippus series consists of deep, loamy soils on uplands. Bippus soils formed in calcareous, loamy sediment on outwash fans and valley sides. Slopes are 0 to 3 percent.

Typical pedon of Bippus clay loam, 1 to 3 percent slopes; from the intersection of U.S. Highway 287 and Texas Highway 70 in Clarendon, this pedon is located 8 miles north on Texas Highway 70, 2.5 miles east on county road, 5.5 miles north on ranch road to the Griffin North Ranch buildings, 0.65 mile north on ranch road on the east side of Barton Creek, and 60 feet west in rangeland:

A11—0 to 12 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate medium prismatic structure parting to weak fine subangular blocky; hard, friable; many fine roots; many very fine pores; many worm casts; mildly alkaline; clear smooth boundary.

A12—12 to 25 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; very hard, friable; many fine and very fine pores; many worm casts; few threads and films of calcium carbonate on faces

of peds; calcareous; moderately alkaline; gradual smooth boundary.

B21—25 to 35 inches; brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; very hard, firm, slightly sticky; many fine and very fine pores; common worm casts; common threads and films of calcium carbonate on faces of peds; calcareous; moderately alkaline; gradual smooth boundary.

B22—35 to 45 inches; pale brown (10YR 6/3) clay loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; very hard, firm, slightly sticky; many very fine pores; common worm casts; common threads and films of calcium carbonate on faces of peds; few quartz pebbles as much as 3 centimeters in diameter that have very thin coatings of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

B23—45 to 58 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; moderate fine subangular blocky structure; very hard, very firm, sticky; common very fine pores; about 4 percent, by volume, very fine soft masses, concretions, films, and threads of calcium carbonate; calcareous; moderately alkaline; abrupt smooth boundary.

B3—58 to 80 inches; light brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 5/4) moist; weak fine subangular blocky structure; very hard, friable; few very fine pores; common concretions of cemented quartz and caliche pebbles that are as much as 5 centimeters in diameter; some quartz pebbles have a very thin coating of calcium carbonate; calcareous; moderately alkaline.

The solum is more than 50 inches thick. The mollic epipedon is 20 to 40 inches thick. It is dark grayish brown or dark brown.

The A horizon is 20 to 30 inches thick. It is mildly alkaline or moderately alkaline.

The B2 horizon is clay loam, sandy clay loam, or loam that is 20 to 35 percent clay in the control section. The part of the B2 horizon that is below the mollic epipedon is pale brown, brown, or light brown.

Burson series

The Burson series consists of very shallow, loamy soils on uplands. Burson soils formed in calcareous, loamy redbed sediment. Slopes range from 20 to 45 percent.

Typical pedon of Burson silt loam, in an area of Burson-Aspermont association, steep; from the intersection of U.S. Highway 287 and Farm Road 2162 in Clarendon, this pedon is located about 12 miles southwest on Farm Road 2162 and on county road to bridge over Halls Creek on the J.A. Ranch, 1.6 miles northeast on the county road, and 300 feet north in rangeland:

A1—0 to 6 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/6) moist; weak fine granular structure; slightly hard, very friable; common roots; calcareous; moderately alkaline; gradual smooth boundary.

C—6 to 60 inches; yellowish red (5YR 5/6) weakly cemented siltstone redbeds, yellowish red (5YR 4/6) moist; few roots in upper part; calcareous; moderately alkaline.

The solum is 3 to 12 inches thick. Reaction is moderately alkaline.

The A horizon is red, yellowish red, or reddish brown. It is loam, silt loam, very fine sandy loam, or silty clay loam that is 15 to 35 percent clay.

The C horizon is weakly cemented siltstone or very fine grained sandstone interbedded with strata of soft loamy or silty material. It is red, yellowish red, or reddish brown.

Carey series

The Carey series consists of deep, loamy soils on uplands. These soils formed in calcareous, loamy redbed sediment. Slopes are 0 to 3 percent.

Typical pedon of Carey loam, 1 to 3 percent slopes; from the intersection of the Gray-Donley county line and Texas Highway 273, this pedon is located 4.2 miles south on Texas Highway 273, 0.27 mile east along fence, and 100 feet north in rangeland:

A1—0 to 9 inches; dark brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; moderate fine granular structure; slightly hard, very friable; many very fine pores; many worm casts; neutral; clear smooth boundary.

B21t—9 to 18 inches; dark brown (7.5YR 4/2) silty clay loam, dark brown (7.5YR 3/2) moist; moderate fine and very fine subangular blocky structure; hard, friable; many very fine pores; many worm casts; few very thin clay films on faces of peds; mildly alkaline; clear smooth boundary.

B22t—18 to 26 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate medium and fine subangular blocky structure; hard, friable; many very fine pores; common worm casts; patchy clay films on faces of peds; calcareous; moderately alkaline; gradual smooth boundary.

B23t—26 to 38 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine and very fine subangular blocky structure; hard, friable; common very fine pores; few worm casts; few clay films on faces of peds; common films and

threads of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B24tca—38 to 55 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; weak medium subangular blocky structure; hard, friable; common very fine pores; few clay films on faces of peds; about 10 percent, by volume, medium to very fine soft masses and weakly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B3—55 to 70 inches; reddish yellow (5YR 6/6) silt loam, yellowish red (5YR 5/6) moist; weak medium subangular blocky structure; hard, friable; common medium to very fine pores; common soft masses and coatings of calcium carbonate; calcareous; moderately alkaline; diffuse smooth boundary.

C—70 to 80 inches; yellowish red (5YR 5/6) silt loam, yellowish red (5YR 4/8) moist; massive; slightly hard, very friable; about 10 percent, by volume, threads, films, and soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to more than 70 inches thick. The mollic epipedon is 10 to 19 inches thick and commonly comprises all of the A horizon and the upper part of the B2t horizon. It is reddish brown, dark reddish brown, brown, dark brown, dark grayish brown, or dark reddish gray. Layers that have secondary calcium carbonate are at a depth of 11 to 30 inches.

The A horizon is 7 to 15 inches thick. It is neutral or mildly alkaline.

The B2t horizon has a clay content of 20 to 32 percent. The part of the B2t horizon that is below the mollic epipedon and above the calcic horizon is reddish brown or yellowish red.

The B2tca horizon is light reddish brown, reddish brown, yellowish red, or reddish yellow. It is 4 to 20 percent calcium carbonate, by volume.

The B3 and C horizons are reddish brown, red, yellowish red, or reddish yellow. They are silt loam or loam.

Clairemont series

The Clairemont series consists of deep, loamy soils on bottom lands. Clairemont soils formed in calcareous, loamy alluvial sediment. Slopes are 0 to 1 percent.

Typical pedon of Clairemont silt loam, occasionally flooded; from the intersection of the Gray-Donley county line and Texas Highway 273, this pedon is located 9.8 miles south-southeast on Texas Highway 273, and 25 feet south in a pasture:

A1—0 to 9 inches; reddish brown (5YR 5/4) silt loam, reddish brown (5YR 4/4) moist; moderate fine and medium granular and weak fine subangular blocky structure; hard, very friable; common very fine roots; calcareous; moderately alkaline; gradual wavy boundary.

C1—9 to 40 inches; yellowish red (5YR 5/8) loam, yellowish red (5YR 4/8) moist; massive; hard, very friable; few threads and films of calcium carbonate; about 20 percent clay; thin strata of very fine sandy loam, silt loam, and silty clay loam; calcareous; moderately alkaline; clear wavy boundary.

C2—40 to 53 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; massive; slightly hard, very friable; few threads and films of calcium carbonate; few very thin strata of very fine sandy loam, silt loam, and silty clay loam; calcareous; moderately alkaline; abrupt wavy boundary.

Ab—53 to 65 inches; reddish brown (5YR 5/3) silty clay loam, reddish brown (5YR 4/3) moist; massive; hard, friable; common threads, films, and soft masses of calcium carbonate; many thin strata of loamy sand to silt loam; calcareous; moderately alkaline.

The A horizon is 6 to 14 inches thick. It is brown, reddish brown, or yellowish red.

The C horizon is reddish brown, light reddish brown, yellowish red, light brown, or reddish yellow. It is loam, silt loam, or silty clay loam. The average clay content in the 10- to 40-inch control section is 18 to 35 percent. In some pedons, a buried A horizon is below a depth of 20 inches.

Delwin series

The Delwin series consists of deep, sandy soils on uplands. Delwin soils formed in loamy sediment. Slopes are 0 to 3 percent.

Typical pedon of Delwin fine sand, 0 to 3 percent slopes; from the intersection of U.S. Highway 287 and Texas Highway 203 in Hedley, this pedon is located 2.5 miles northeast on Texas Highway 203, 3.7 miles north on Texas Highway 273, 1.4 miles east on county road and then on a trail, and 50 feet south in an orchard:

Ap—0 to 15 inches; very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) moist; weak medium granular structure; loose; slightly acid; clear smooth boundary.

B21t—15 to 30 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; very hard, friable; sand grains are coated and bridged with clay; few patchy clay films on faces of peds; neutral; gradual smooth boundary.

B22t—30 to 40 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate medium prismatic structure parting to weak fine subangular blocky; very hard, friable; sand grains are

coated and bridged with clay; dark clay films on faces of prisms; few fine quartz pebbles; neutral; diffuse smooth boundary.

B23t—40 to 65 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; moderate medium and fine subangular blocky structure; hard, friable; sand grains are coated and bridged with clay; neutral; gradual smooth boundary.

B3—65 to 80 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak fine subangular blocky structure; slightly hard, very friable; neutral.

The solum is more than 70 inches thick. The depth to secondary carbonates is more than 65 inches. In some pedons, the soil is sandy clay loam throughout, and in others it is fine sandy loam over sandy clay loam.

The A horizon is 5 to 18 inches thick. It is brown, light brown, or very pale brown.

The B21t and B22t horizons generally extend to a depth of about 40 inches. They are brown, reddish brown, or yellowish red. The clay content is 20 to 35 percent. Where the B2t horizon extends to a depth of more than 40 inches, it is red or reddish yellow.

The B3 horizon is red or reddish yellow. It generally has lamellae of sandy clay loam alternated with fine sandy loam.

Estacado series

The Estacado series consists of deep, loamy soils on uplands. Estacado soils formed in calcareous, loamy sediment. Slopes range from 0 to 16 percent.

Typical pedon of Estacado clay loam, 0 to 1 percent slopes; from the intersection of Interstate Highway 40 and Texas Highway 70 in Pampa, this pedon is located 2 miles west on Interstate Highway 40; 1 mile south, 1 mile west, 0.5 mile north, 1 mile west, and 0.25 mile north on county road; and 60 feet east in a field:

Ap—0 to 7 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; weak very fine granular structure; hard, friable; calcareous; moderately alkaline; abrupt smooth boundary.

A1—7 to 15 inches; dark grayish brown (10YR 4/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate very fine subangular blocky structure; hard, friable; many very fine pores; many worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B21tca—15 to 24 inches; light brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; many very fine pores; many worm casts; few patchy clay films on faces of peds; about 10 percent threads, films, soft masses, and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; gradual smooth boundary.

B22tca—24 to 54 inches; reddish yellow (7.5YR 6/6) clay loam, strong brown (7.5YR 5/6) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; hard, friable; many very fine pores; few worm casts; few patchy clay films on faces of peds; about 25 percent medium to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; gradual smooth boundary.

B23tca—54 to 70 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate medium blocky structure; hard, friable; many very fine pores; few patchy clay films on faces of peds; about 20 percent coarse to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; clear smooth boundary.

B24tca—70 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak medium blocky structure; hard, friable; few very fine pores; few patchy clay films on faces of peds; few very fine black concretions; about 10 percent medium to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. The soil is moderately alkaline throughout.

The A horizon is a mollic epipedon. It is 8 to 15 inches thick. It is brown, dark brown, grayish brown, or dark grayish brown clay loam or loam.

The B2tca horizon is brown, light brown, or reddish yellow. It is 15 to 40 percent calcium carbonate, by volume. The clay content is 18 to 28 percent.

Guadalupe series

The Guadalupe series consists of deep, loamy soils on bottom lands. Guadalupe soils formed in calcareous, loamy alluvial sediment. Slopes are 0 to 1 percent.

Typical pedon of Guadalupe fine sandy loam, occasionally flooded; from the intersection of the Gray-Donley county line and Texas Highway 273, this pedon is located 1.5 miles south on Texas Highway 273, 0.4 mile west-southwest on dirt road, and 50 feet south in rangeland:

A1—0 to 9 inches; brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; moderate medium granular structure; slightly hard, very friable; few worm casts; few very fine concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21—9 to 24 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; moderate fine subangular blocky structure; slightly hard, very friable; few worm casts; few fine concre-

tions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B22—24 to 34 inches; light brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few threads and films of calcium carbonate on faces of peds; few very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C1—34 to 50 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; few very fine concretions of calcium carbonate; few thin strata of loam, silt loam, and loamy fine sand; calcareous; moderately alkaline; gradual smooth boundary.

C2—50 to 65 inches; very pale brown (10YR 7/4) loamy fine sand, light yellowish brown (10YR 6/4) moist; few fine faint yellowish brown mottles; single grained; loose; few threads, films, and fine and very fine soft masses and concretions of calcium carbonate; distinct stratification; calcareous; moderately alkaline.

The solum is 30 to 50 inches thick.

The A horizon is 6 to 22 inches thick. It is brown or grayish brown. This horizon generally is calcareous, but in a few pedons it is noncalcareous.

The B2 horizon is brown, grayish brown, light brown, very pale brown, or light brownish gray. It is fine sandy loam, loam, or loamy fine sand that is 5 to 18 percent clay.

The C horizon is brown, light brown, light yellowish brown, or very pale brown. It is fine sandy loam or loamy fine sand and has strata of loam, sandy clay loam, silt loam, or sand. In some pedons, buried dark layers are in the C horizon.

Likes series

The Likes series consists of deep, sandy soils on uplands. Likes soils formed in calcareous, sandy sediment that has been modified by the wind. Slopes range from 1 to 8 percent.

Typical pedon of Likes loamy fine sand, 1 to 8 percent slopes; from the intersection of Farm Road 2162 and U.S. Highway 287 in Clarendon, this pedon is located 4.1 miles east on U.S. Highway 287, about 10.25 miles north and east on Farm Road 1260, and 80 feet southwest in rangeland:

A1—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark yellowish brown (10YR 3/4) moist; weak granular structure; soft, very friable; common fine and very fine roots; calcareous; moderately alkaline; clear smooth boundary.

C1—8 to 28 inches; brown (7.5YR 5/3) loamy fine sand, dark brown (7.5YR 4/3) moist; single grained; loose, very friable; common very fine roots; calcareous; moderately alkaline; clear smooth boundary.

C2—28 to 66 inches; pink (7.5YR 7/4) loamy fine sand, light brown (7.5YR 6/4) moist; single grained; loose, very friable; few very fine roots; few threads and films of calcium carbonate; calcareous; moderately alkaline.

The A and C horizons are more than 60 inches thick. Free carbonates are within a depth of 40 inches.

The A horizon is 5 to 14 inches thick. It is brown or grayish brown. The A horizon generally is calcareous but is noncalcareous in a few pedons.

The C horizon is brown, light brown, very pale brown, pink, yellowish brown, or light yellowish brown. It is loamy fine sand or fine sand. Within a depth of 40 inches, the C horizon generally is calcareous, but it is noncalcareous in a few pedons. In some pedons, the C horizon has a few quartzite or caliche pebbles or a few lumps of weakly cemented sandstone.

Lincoln series

The Lincoln series consists of deep, sandy soils on bottom lands. Lincoln soils formed in calcareous, sandy alluvial sediment. Slopes are 0 to 1 percent.

Typical pedon of Lincoln loamy fine sand, frequently flooded; from the intersection of the Gray-Donley county line and Texas Highway 273, this pedon is located 13.8 miles south on Texas Highway 273 and 30 feet west in rangeland:

A1—0 to 8 inches; brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) moist; weak fine granular structure; soft, very friable; calcareous; moderately alkaline; gradual smooth boundary.

C1—8 to 25 inches; light yellowish brown (10YR 6/4) loamy fine sand, yellowish brown (10YR 5/4) moist; single grained; soft, very friable; few strata, 2 centimeters thick, of loam, fine sandy loam, and silty clay loam; calcareous; moderately alkaline; abrupt wavy boundary.

C2—25 to 38 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; single grained; loose, very friable; few strata, 2 centimeters thick, of fine sandy loam to clay loam; calcareous; moderately alkaline; abrupt wavy boundary.

C3—38 to 60 inches; very pale brown (10YR 7/4) sand, light yellowish brown (10YR 6/4) moist; single grained; loose, very friable; stratified sand and gravel riverwash; calcareous; moderately alkaline.

In some pedons, the soil is as much as 10 percent, by volume, particles larger than 2 millimeters. In some pedons, the water table is below a depth of 60 inches.

The A horizon is 6 to 14 inches thick. It is brown, pale brown, or pink. It generally is calcareous but is noncalcareous in a few pedons.

The C horizon is light brown, pale brown, white, pink, very pale brown, or light yellowish brown. It is loamy fine sand or fine sand.

Miles series

The Miles series consists of deep, loamy and sandy soils on uplands. Miles soils formed in old loamy alluvial sediment that has been modified by wind and water. Slopes range from 0 to 8 percent.

Typical pedon of Miles fine sandy loam, 1 to 3 percent slopes; from the intersection of Farm Road 2162 and U.S. Highway 287 in Clarendon, this pedon is located 4.1 miles east on U.S. Highway 287, 5.8 miles south on Farm Road 1260, 150 feet south on county road, and 60 feet west in a pasture:

Ap—0 to 7 inches; brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak very fine granular structure; slightly hard, very friable; neutral; abrupt smooth boundary.

B1—7 to 12 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate very coarse prismatic structure parting to weak fine subangular blocky; very hard, friable; many fine and very fine pores; many worm casts; few patchy clay films on faces of peds; neutral; clear smooth boundary.

B21t—12 to 28 inches; reddish brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; moderate very coarse prismatic structure parting to weak fine subangular blocky; very hard, friable; common fine and very fine pores; common worm casts; few very thin clay films on faces of peds; few quartz pebbles up to 1 inch in diameter; neutral; gradual smooth boundary.

B22t—28 to 52 inches; reddish brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; moderate coarse prismatic structure parting to weak fine subangular blocky; very hard, friable; common fine and very fine pores; few worm casts; few patchy clay films on faces of peds; few quartz pebbles up to 1 inch in diameter; mildly alkaline; gradual smooth boundary.

B23t—52 to 72 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure; hard, friable; common very fine pores; few patchy clay films on faces of peds; few threads and films of calcium carbonate; few quartz pebbles up to 1 inch in diameter; calcareous; moderately alkaline; diffuse smooth boundary.

B3ca—72 to 80 inches; reddish yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 5/6) moist; weak coarse prismatic structure; hard, very friable; common very fine pores; few patchy clay films on faces of peds; about 2 percent, by volume, threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. The depth to secondary carbonates is 36 to more than 60 inches.

The A horizon is 7 to 20 inches thick. It is thinner in eroded areas. It is brown, light brown, or light reddish brown fine sandy loam or loamy fine sand. It is neutral or mildly alkaline.

Where present, the B1 horizon is 4 to 8 inches thick. It is brown or reddish brown loam or sandy clay loam.

The B2t horizon is reddish brown, light reddish brown, or yellowish red. It is dominantly sandy clay loam that is 20 to 35 percent clay. In some pedons, a layer of fine sandy loam is within a depth of 60 inches and is underlain by a layer of sandy clay loam.

In some pedons, a B3 or B3ca horizon is below a depth of 65 inches. It is pink, reddish yellow, or very pale brown. The calcium carbonate content of calcic horizons is as high as 25 percent, by volume.

In a few pedons, a C horizon is below a depth of 65 inches. It is fine sandy loam or loamy fine sand.

Mobeetie series

The Mobeetie series consists of deep, loamy soils on uplands. These soils formed in calcareous, sandy slope alluvium that has been modified by water and wind. Slopes range from 1 to 45 percent.

Typical pedon of Mobeetie fine sandy loam, in an area of Mobeetie-Veal-Potter association, rolling; from the intersection of U.S. Highway 287 and Farm Road 2162 in Clarendon, this pedon is located 6 miles southwest on Farm Road 2162, 1.5 miles southwest on county road, 0.7 mile south on trail to the west end of a stock tank dam, and 500 feet west in rangeland:

A1—0 to 7 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate medium subangular blocky structure; slightly hard, very friable; common fine and very fine pores; common worm casts; few very fine fragments of caliche; calcareous; moderately alkaline; gradual smooth boundary.

B2—7 to 20 inches; pale brown (10YR 6/3) fine sandy loam, brown (10YR 5/3) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; many fine and very fine pores; many worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—20 to 35 inches; very pale brown (10YR 7/3) fine sandy loam, pale brown (10YR 6/3) moist; weak coarse prismatic structure parting to weak fine su-

bangular blocky; slightly hard, very friable; common fine and very fine pores; about 5 percent threads, films, and very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; diffuse smooth boundary.

C—35 to 60 inches; very pale brown (10YR 7/4) fine sandy loam, light yellowish brown (10YR 6/4) moist; massive; slightly hard, very friable; few threads, films, and very fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 24 to 60 inches thick. The depth to carbonates is 0 to 10 inches. In the control section, the soil is fine sandy loam or loam that is 12 to 18 percent clay. In most pedons, there are caliche fragments as much as 2 or 3 inches in diameter. The content of caliche fragments ranges from a few to 5 percent or more.

The A horizon is 6 to 16 inches thick. It is brown, grayish brown, or pinkish gray fine sandy loam or loam.

The B2 horizon is 10 to 22 inches thick. It is brown, light brown, pale brown, grayish brown, or yellowish brown.

The B3ca and C horizons are light brown, light yellowish brown, very pale brown, or pink. The B3ca horizon is 1 to about 12 percent calcium carbonate. In some pedons, there are strata of loamy fine sand below a depth of 40 inches.

Nobscot series

The Nobscot series consists of deep, sandy soils on uplands. Nobscot soils formed in sandy and loamy sediment that has been modified by the wind. Slopes range from 1 to 8 percent.

Typical pedon of Nobscot fine sand, 1 to 8 percent slopes; from the intersection of U.S. Highway 287 and Texas Highway 203 in Hedley, this pedon is located 2.5 miles northeast on Texas Highway 203, 3.7 miles north on Texas Highway 273, 0.8 mile east on county road, and 100 feet south in a field:

A1—0 to 6 inches; grayish brown (10YR 5/2) fine sand, dark grayish brown (10YR 4/2) moist; weak fine granular structure; loose; common very fine roots; slightly acid; clear smooth boundary.

A2—6 to 27 inches; pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) moist; weak fine granular structure; loose; common very fine roots; slightly acid; gradual wavy boundary.

B2t—27 to 36 inches; yellowish red (5YR 5/6) sandy loam, yellowish red (5YR 4/6) moist; few 1/4- to 1/2-inch thick bands of reddish brown (2.5YR 5/4) sandy clay loam, reddish brown (2.5YR 4/4) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few very fine roots; slightly acid; gradual wavy boundary.

B3—36 to 62 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak fine and medium subangular blocky structure; slightly hard, very friable; few thin bands, less than 1/4 inch thick, of reddish brown sandy clay loam; few pockets of clean sand grains; neutral; gradual wavy boundary.

C—62 to 80 inches; reddish yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; single grained; loose; common pockets of clean sand grains; neutral.

The solum is 55 to more than 80 inches thick.

The A horizon is 20 to 40 inches thick. The A1 horizon is brown or grayish brown. It is slightly acid or neutral. The A2 horizon is pink or light yellowish brown. It is slightly acid or neutral.

The B2t horizon is reddish yellow or yellowish red. It is 8 to 30 inches thick. In most pedons, this horizon has 1/8- to 1-inch thick bands of more clayey fine sandy loam or sandy clay loam. These bands are 2 to 6 inches apart.

The B3 horizon is dominantly reddish yellow. It is 25 to 40 inches thick. It has 1/8- to 1/2-inch thick bands of sandy clay loam or more clayey fine sandy loam. These bands are 4 to 12 inches apart. There are pockets of clean sand grains in most pedons. The B3 horizon is slightly acid or neutral.

The C horizon is loamy fine sand or fine sand. It generally has a few thin bands of more clayey material and a few pockets of clean sand grains. It is slightly acid or neutral.

Obaro series

The Obaro series consists of moderately deep, loamy soils on uplands. Obaro soils formed in loamy, calcareous redbeds of weathered sandstone or siltstone. Slopes range from 5 to 16 percent.

Typical pedon of Obaro silty clay loam, in an area of Obaro-Quinlan association, rolling; from the intersection of the Gray-Donley county line and Texas Highway 273, this pedon is located 4.2 miles south on Texas Highway 273, 700 feet east along a fence, 1.05 miles northeast along a dirt road, and 30 feet south in rangeland:

A1—0 to 8 inches; reddish brown (5YR 4/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate very fine subangular blocky structure; hard, friable; common roots; common worm casts; calcareous; moderately alkaline; gradual smooth boundary.

B2—8 to 15 inches; reddish brown (5YR 5/4) silty clay loam, reddish brown (5YR 4/4) moist; moderate fine subangular blocky structure; hard, friable; many very fine pores; few threads, films, and very fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—15 to 32 inches; yellowish red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; hard, friable; many very fine pores; about 10 percent threads, films, soft masses, and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; gradual wavy boundary.

C—32 to 60 inches; red (2.5YR 5/6) weakly cemented, calcareous siltstone, red (2.5YR 4/6) moist; few bluish green splotches.

The solum is 21 to about 48 inches thick. It is moderately alkaline throughout. The A and B horizons are loam, silt loam, or silty clay loam. The clay content ranges from 18 to 35 percent but generally is 20 to 30 percent.

The A horizon is 6 to 12 inches thick. It is reddish brown or brown.

The B horizon is light reddish brown, reddish brown, reddish yellow, or yellowish red. The content of calcium carbonate in the B3ca horizon ranges from a few threads and films to about 15 percent, by volume.

The C horizon is red, reddish brown, light red, yellowish red, or reddish yellow. It ranges from weakly cemented sandstone or siltstone to soft packsand.

Olton series

The Olton series consists of deep, loamy soils on uplands. Olton soils formed in calcareous, loamy sediment that has been modified by the wind. Slopes are 0 to 3 percent.

Typical pedon of Olton clay loam, 0 to 1 percent slopes (fig. 20); from the intersection of Interstate Highway 40 and Texas Highway 70 to Pampa, this pedon is located 0.2 mile west on south access road, 2.6 miles south and 0.25 mile southwest on county roads, and 60 feet north in a field:

Ap—0 to 6 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak very fine subangular blocky structure; hard, friable; neutral; abrupt smooth boundary.

B21t—6 to 16 inches; dark brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate fine and very fine subangular blocky structure; very hard, firm; common very fine pores; few worm casts; few very thin clay films on faces of peds; neutral; clear smooth boundary.

B22t—16 to 25 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, firm; common very fine pores; patchy clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B23t—25 to 38 inches; reddish brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate medium blocky structure; very hard, firm; common very fine pores; patchy clay films on faces of peds; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

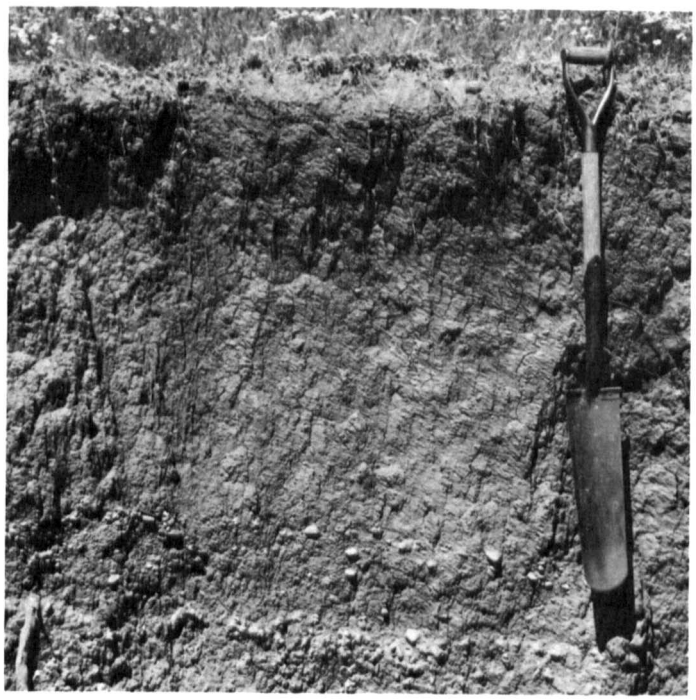


Figure 20.—Profile of Olton clay loam, 0 to 1 percent slopes.

B24tca—38 to 47 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate very fine blocky structure; very hard, firm; patchy clay films on faces of peds; common threads and films of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

B25tca—47 to 70 inches; pink (5YR 7/4) clay loam, light reddish brown (5YR 6/4) moist; moderate very fine blocky structure; very hard, firm; patchy clay films on faces of peds; about 35 percent medium to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; clear wavy boundary.

B26tca—70 to 80 inches; reddish yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate fine subangular blocky structure; very hard, friable; few patchy clay films on faces of peds; about 10 percent threads, films, soft masses, and concretions of calcium carbonate, by volume; calcareous; moderately alkaline.

The solum is 60 to more than 80 inches thick. The depth to secondary carbonates is 15 to 28 inches. Distinct calcic layers are within a depth of 30 to 60 inches. The mollic epipedon is 11 to 20 inches thick. It commonly comprises the A horizon and part of the B2t horizon.

The A horizon is 6 to 10 inches thick. It is brown, dark brown, or reddish brown.

The B21t horizon is 5 to 10 inches thick. It is part of the mollic epipedon and has the same colors as the A horizon.

The part of the B2t horizon that is between the mollic epipedon and the calcic layers is brown, reddish brown, or yellowish red. It is clay, clay loam, or silty clay loam that is 35 to 45 percent clay.

The lower part of the B2t horizon, including the calcic layers, is pink, yellowish red, reddish yellow, or light reddish brown. The calcium carbonate content is 5 to 40 percent, by volume.

Paloduro series

The Paloduro series consists of deep, loamy soils on uplands. Paloduro soils formed in calcareous, loamy sediment that derived mainly from local alluvium. Slopes range from 3 to 8 percent.

Typical pedon of Paloduro loam, 5 to 8 percent slopes; from the intersection of the Chicago, Rock Island, and Pacific Railroad and Texas Highway 70 at Jericho, this pedon is located 2 miles south on Texas Highway 70 and 300 feet west in rangeland:

A1—0 to 12 inches; dark brown (10YR 4/3) loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; many very fine roots; common worm casts; calcareous; moderately alkaline; clear smooth boundary.

B21—12 to 35 inches; light yellowish brown (10YR 6/4) loam, yellowish brown (10YR 5/4) moist; moderate very coarse prismatic structure parting to weak fine subangular blocky; hard, friable; common very fine roots; common worm casts; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—35 to 45 inches; very pale brown (10YR 7/4) loam, yellowish brown (10YR 5/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; common very fine roots; about 10 percent threads, films, and fine and very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; gradual wavy boundary.

B23—45 to 60 inches; pink (7.5YR 7/4) loam, light brown (7.5YR 6/4) moist; weak coarse prismatic structure parting to weak fine subangular blocky; hard, friable; common threads and films and fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 to more than 80 inches thick. The mollic epipedon is 10 to 18 inches thick. The soil is loam, clay loam, or sandy clay loam throughout and has a clay content of 18 to 35 percent.

The A horizon is 10 to 18 inches thick. It is dark brown or dark grayish brown. The A horizon generally is calcareous, but in a few pedons it is noncalcareous within a depth of 10 inches.

The B2 horizon is brown, light brown, light yellowish brown, very pale brown, or pink. The content of clay in the B2 horizon is the same or slightly more than that in the A horizon. The content of calcium carbonate in the B2 horizon ranges from a few threads and films to about 12 percent, by volume.

Polar series

The Polar series consists of deep, loamy soils on uplands. Polar soils formed in calcareous, loamy water-laid deposits of intermingled gravel and finer material. Slopes range from 10 to 30 percent.

Typical pedon of Polar very gravelly sandy loam, in an area of Mobeetie-Polar association, hilly; from the intersection of U.S. Highway 287 and Farm Road 2162 in Clarendon, this pedon is located about 13.5 miles southwest on Farm Road 2162 and on a county road to the bridge over Mulberry Creek, 850 feet north on county road, and 10 feet east in rangeland:

A1—0 to 7 inches; brown (7.5YR 5/4) very gravelly sandy loam, dark brown (7.5YR 4/4) moist; about 50 percent of the surface is covered with quartz pebbles; weak fine subangular blocky structure; slightly hard, very friable; about 40 percent, by volume, rounded quartz pebbles as much as 3 inches in diameter; a few pebbles have coatings of calcium carbonate on the lower surface; calcareous; moderately alkaline; gradual smooth boundary.

Cca—7 to 18 inches; light brown (7.5YR 6/3) very gravelly sandy loam, brown (7.5YR 5/3) moist; weak very fine granular structure; slightly hard, very friable; common very fine roots; about 20 percent, by volume, threads, films, and coatings of calcium carbonate on pebbles; about 40 percent, by volume, quartz pebbles as much as 3 inches in diameter; calcareous; moderately alkaline; diffuse wavy boundary.

C—18 to 50 inches; light brown (7.5YR 6/4) very gravelly sandy loam, brown (7.5YR 5/4) moist; single grained, loose, very friable; about 3 percent, by volume, threads, films, and patchy coatings of calcium carbonate on pebbles; about 40 percent, by volume, quartz pebbles as much as 3 inches in diameter; calcareous; moderately alkaline.

The solum, which comprises only the A horizon, is 4 to 14 inches thick. Pebbles generally are siliceous and rounded. They range from 2 millimeters to 3 inches in diameter and make up 35 to 70 percent, by volume, of the 10- to 40-inch control section.

The Cca horizon is brown, light brown, or pale brown. It is 8 to 25 inches thick. It is 15 to 35 percent, by volume, calcium carbonate.

The lower part of the C horizon is brown, light brown, pinkish gray, or pink. It is 2 to 15 percent calcium carbonate, by volume. Cross-bedded loamy sand and gravel are in some pedons.

Potter series

The Potter series consists of very shallow to shallow, loamy soils on uplands. Potter soils formed in calcareous, loamy caliche material. Slopes range from 1 to 45 percent.

Typical pedon of Potter loam, 1 to 8 percent slopes; from the intersection of Texas Highway 70 and the Chicago, Rock Island, and Pacific Railroad at Jericho, this pedon is located 3.4 miles south on Texas Highway 70 and 200 feet east in rangeland:

A11—0 to 5 inches; brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; moderate fine granular structure; hard, friable; common worm casts; few fine and medium concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

A12—5 to 11 inches; light brownish gray (10YR 6/2) loam, grayish brown (10YR 5/2) moist; moderate medium granular structure; hard, friable; common concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

C1ca—11 to 15 inches; light gray (10YR 7/2) loam, light brownish gray (10YR 6/2) moist; massive; hard, friable; many very fine to medium soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; abrupt wavy boundary.

C2ca—15 to 60 inches; pinkish white (7.5YR 8/2) loamy caliche material intermingled with pinkish calcareous earths, pinkish gray (7.5YR 7/2) moist; about 50 percent caliche fragments that have a hardness of slightly less than 3 on Mohs' scale.

The solum is 4 to 12 inches thick.

The A horizon is brown, light brown, grayish brown, pale brown, or light brownish gray. It is fine sandy loam, sandy clay loam, loam, or clay loam that is 18 to 35 percent clay. In some pedons, the A horizon is as much as 35 percent caliche pebbles, by volume.

The C horizon is pink, white, pinkish white, light brown, or light gray. In some pedons, pendants of calcium carbonate are on the lower surface of the caliche plates in the C1ca horizon. The C2ca horizon ranges from platy caliche that has a hardness of slightly less than 3 on the Mohs' scale and that contains soft caliche and intermingled pockets of pinkish loamy earths to beds of soft caliche or loamy calcareous material.

Pullman series

The Pullman series consists of deep, loamy soils on uplands. Pullman soils formed in loamy eolian material. This material was deposited in successive layers, and the period between each deposition was long enough for the soil-forming processes to operate. Slopes are 0 to 3 percent.

Typical pedon of Pullman clay loam, 0 to 1 percent slopes; from the intersection of Interstate Highway 40 and Texas Highway 70 to Pampa, this pedon is located 2 miles west on Interstate Highway 40, 2 miles south and 500 feet east on county roads, and 50 feet south in a field:

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

B21t—6 to 14 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate fine blocky structure; very hard, very firm; many very fine pores; few worm casts; shiny faces on peds; mildly alkaline; clear smooth boundary.

B22t—14 to 26 inches; dark grayish brown (10YR 4/2) clay, very dark grayish brown (10YR 3/2) moist; moderate medium blocky structure; extremely hard, very firm; common very fine pores; common shiny, smooth pressure faces on peds; mildly alkaline; clear smooth boundary.

B23t—26 to 44 inches; brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) moist; moderate medium blocky structure; very hard, very firm; few very fine pores; many shiny faces on peds; few threads, films, and very fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; diffuse smooth boundary.

B24t—44 to 56 inches; reddish brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; moderate medium blocky structure; very hard, firm; common very fine pores; common shiny faces on peds; common threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B25tca—56 to 68 inches; pink (5YR 7/4) clay loam, dark reddish brown (5YR 3/4) moist; weak medium blocky structure; hard, friable; few patchy clay films on faces of peds; about 35 percent, by volume, fine and very fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B26tca—68 to 80 inches; yellowish red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; weak medium blocky structure; hard, friable; few patchy clay films on faces of peds; about 20 percent, by volume, fine and very fine soft masses and concretions of calcium carbonate; calcareous; moderately alkaline.

The solum is 60 to more than 75 inches thick. The depth to secondary soft lime is 15 to 30 inches. When dry, these soils have 1/4- to 1-inch wide cracks that extend to a depth of 20 inches or more.

The mollic epipedon is more than 20 inches thick. It comprises the A horizon and the upper part of the B2t horizon. It is dark brown, brown, or dark grayish brown.

The A1 or Ap horizon is 4 to 8 inches thick.

The part of the B2t horizon between the mollic epipedon and the upper calcic layer is brown or reddish brown. The B2tca horizon is brown, light brown, pink, yellowish red, or reddish yellow clay loam, silty clay loam, or clay. It is 20 to 40 percent calcium carbonate, by volume.

Quinlan series

The Quinlan series consists of shallow, loamy soils on uplands. Quinlan soils formed in loamy, calcareous redbeds of weathered sandstone or siltstone. Slopes range from 5 to 16 percent.

Typical pedon of Quinlan loam, in an area of Obaro-Quinlan association, rolling; from the intersection of Farm Road 2162 and U.S. Highway 287 in Clarendon, this pedon is located 4.1 miles east on U.S. Highway 287, about 10.2 miles north and east on Farm Road 1260, 0.85 mile east on dirt road, and 200 feet north in rangeland:

A1—0 to 7 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; moderate medium granular structure; slightly hard, very friable; common very fine roots; calcareous; moderately alkaline; gradual smooth boundary.

B2—7 to 12 inches; yellowish red (5YR 5/6) loam, yellowish red (5YR 5/6) moist; moderate fine subangular blocky structure; hard, friable; few fragments of soft siltstone; calcareous; moderately alkaline; gradual wavy boundary.

C—12 to 60 inches; red (2.5YR 5/6) weakly cemented, calcareous siltstone, red (2.5YR 4/6) moist.

The solum is 10 to 20 inches thick. The soil generally is calcareous throughout.

The A horizon is 4 to 12 inches thick. It is brown, reddish brown, yellowish red, or light reddish brown. The A and B horizons are loam, very fine sandy loam, silt loam, or silty clay loam.

The B horizon is 2 to 12 inches thick. It is reddish brown, light reddish brown, yellowish red, or reddish yellow.

The C horizon is red, reddish brown, light red, yellowish red, or reddish yellow, weakly cemented sandstone or siltstone.

Randall series

The Randall series consists of deep, clayey soils on the bottom of playas or intermittent lakes. Randall soils formed in clayey local alluvium. Slopes are 0 to 1 percent.

Typical pedon of Randall clay; from the intersection of the Chicago, Rock Island, and Pacific Railroad and Texas Highway 70 at Jericho, this pedon is located 0.25 mile south on Texas Highway 70 and 80 feet east on a playa:

A1—0 to 15 inches; dark gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; weak coarse blocky structure parting to moderate fine blocky; very hard, firm, very sticky and plastic; many shiny faces on peds; common fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

AC1—15 to 48 inches; gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate to strong fine and medium angular blocky structure; wedge-shaped peds 1 to 3 inches in length with the long axis tilted 10 to 30 degrees from horizontal; extremely hard, very firm, very sticky and plastic; many shiny faces on peds; many intersecting slickensides, a few as much as 2 feet long; few fine concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

AC2—48 to 75 inches; gray (10YR 6/1) clay, gray (10YR 5/1) moist; few medium distinct light brown (7.5YR 6/4) mottles; weak medium blocky structure; extremely hard, very firm, very sticky and plastic; many shiny faces on peds; few short intersecting slickensides; common fine concretions of calcium carbonate; calcareous; moderately alkaline.

The soil typically is more than 6 feet deep to the underlying loamy material. When dry, the soil has cracks that are 0.4 inch to 1.6 inches wide and that extend to a depth of more than 20 inches. Undisturbed areas have a gilgai microrelief.

The A horizon is 10 to 22 inches thick. It is dark gray or very dark gray. It is mildly alkaline or moderately alkaline.

The AC horizon is gray or dark grayish brown. In some pedons, it has very fine to medium, faint to distinct reddish brown, yellowish brown, or light yellowish brown mottles.

Springer series

The Springer series consists of deep, sandy soils on uplands. Springer soils formed in sandy and loamy, eolian or alluvial sediment that has been modified by the wind. Slopes range from 0 to 8 percent.

Typical pedon of Springer loamy fine sand, 3 to 8 percent slopes; from the intersection of U.S. Highway 287 and Texas Highway 70 on the eastern side of Clarendon, this pedon is located 1 mile east on U.S. Highway 287, 1.8 miles north on county road, and 20 feet west on rangeland:

A11—0 to 8 inches; brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; weak very fine granular structure; loose; common very fine roots; neutral; clear smooth boundary.

A12—8 to 16 inches; reddish brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; weak very fine granular structure; loose; common very fine roots; neutral; clear smooth boundary.

B2t—16 to 28 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; common very fine roots; few patchy clay films on faces of prisms; mildly alkaline; gradual smooth boundary.

B3—28 to 40 inches; reddish yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak very coarse prismatic structure parting to weak fine subangular blocky; slightly hard, very friable; few very fine roots; clay bridges between sand grains and a few patchy clay films on faces of prisms; mildly alkaline; clear smooth boundary.

A'—40 to 48 inches; reddish yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; single grained; loose; mildly alkaline; abrupt smooth boundary.

B'2t—48 to 60 inches; yellowish red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, very friable; coatings of clay on sand grains and a few patchy clay films on faces of peds; mildly alkaline; gradual smooth boundary.

B'3—60 to 72 inches; yellowish red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak fine subangular blocky structure; slightly hard, very friable; few pockets of clean sand grains; a few thin bands of sandy clay loam; mildly alkaline.

The solum is 60 to more than 80 inches thick.

The A horizon generally is 8 to 18 inches thick but is less than 8 inches thick in some eroded fields. It is brown, pale brown, light brown, light yellowish brown, yellowish brown, or reddish brown. The soil is loamy fine sand or fine sandy loam and is neutral or mildly alkaline.

The B2t and B3 horizons are brown, reddish brown, reddish yellow, or yellowish red. They are fine sandy loam that is 12 to 18 percent clay. They are neutral or mildly alkaline.

The A' horizon, where present, is brown or reddish yellow.

The B'2t and B'3 horizons are yellowish red or reddish yellow. They are fine sandy loam or sandy clay loam. In some pedons, there are pockets of clean sand grains and thin bands of sandy clay loam. The soil is neutral to moderately alkaline. In some pedons, there are a few films, threads, and soft bodies of calcium carbonate in these horizons.

Spur series

The Spur series consists of deep, loamy soils on bottom lands. Spur soils formed in calcareous, loamy alluvial sediment. Slopes are 0 to 1 percent.

Typical pedon of Spur clay loam, occasionally flooded; from the intersection of U.S. Highway 287 and Texas Highway 203 in Hedley, this pedon is located about 4.7 miles southeast on U.S. Highway 287 and 100 feet northeast on rangeland:

A11—0 to 10 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak fine and medium subangular blocky structure; hard, friable; many very fine roots; many worm casts; faint very thin strata; calcareous; moderately alkaline; gradual wavy boundary.

A12—10 to 18 inches; dark brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, friable; common very fine roots; many worm casts; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

B2—18 to 36 inches; brown (10YR 5/3) clay loam, dark brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable; few threads and films of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C1—36 to 45 inches; grayish brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) moist; massive; hard, friable; few thin strata of sandy loam; few threads, films, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual wavy boundary.

C2—45 to 60 inches; dark grayish brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) moist; massive; hard, friable; few thin strata of sandy loam; few threads and films of calcium carbonate; calcareous; moderately alkaline.

The solum is 30 to 50 inches thick. The mollic epipedon, which comprises the A horizon, is 11 to 20 inches thick.

The A horizon is grayish brown, dark brown, or dark grayish brown.

The B horizon is brown or grayish brown. It is clay loam or loam that is 25 to 35 percent clay.

The C horizon is grayish brown, dark grayish brown, or yellowish brown loam or clay loam. Dark strata and layers of lighter colored and sandier soil material are common in this horizon.

Sweetwater series

The Sweetwater series consists of deep, loamy soils on bottom lands. Sweetwater soils formed in loamy alluvial sediment. They have a high water table. Slopes are 0 to 3 percent.

Typical pedon of Sweetwater clay loam, in an area of Sweetwater soils; from the intersection of Farm Road 2162 and U.S. Highway 287 in Clarendon, this pedon is located 2 miles east on U.S. Highway 287, 3.4 miles north and 0.25 mile east on county road, 1.05 miles northeast on dirt road, and 200 feet south on rangeland:

A11—0 to 16 inches; dark gray (10YR 4/1) clay loam, very dark gray (10YR 3/1) moist; few fine distinct yellowish brown mottles; moderate fine granular structure; very hard, friable; common fine and very fine roots; calcareous; moderately alkaline; clear smooth boundary.

A12—16 to 26 inches; grayish brown (2.5Y 5/2) clay loam, dark grayish brown (2.5Y 4/2) moist; common fine distinct yellowish brown mottles; moderate fine granular structure; very hard, friable; common very fine roots; calcareous; moderately alkaline; gradual smooth boundary.

C—26 to 60 inches; very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) moist; few medium to very fine faint yellowish brown (10YR 5/6) mottles; single grained; slightly hard, very friable; few very thin strata of fine sandy loam and sandy clay loam; calcareous; moderately alkaline.

The depth to the sandy C horizon is 17 to 30 inches. The mollic epipedon is 10 to 20 inches thick and generally comprises only the A11 horizon.

The A11 horizon is 10 to 20 inches thick. It is dark gray or very dark gray clay loam or sandy clay loam. Mottles are distinct to faint.

The A12 horizon is 7 to 15 inches thick. It is gray or grayish brown clay loam or sandy clay loam. Mottles are faint to distinct.

The C horizon is very pale brown or gray loamy fine sand or sand. Mottles are faint to distinct.

The water table is within a depth of 1 to 3 feet throughout most of the year.

Tivoli series

The Tivoli series consists of deep, sandy soils on uplands. Tivoli soils formed in sandy sediment that has been modified by the wind. Slopes range from 3 to 30 percent.

Typical pedon of Tivoli fine sand; from the intersection of the Gray-Donley county line and Texas Highway 273, this pedon is located 750 feet south on Texas Highway 273 and 100 feet west on rangeland:

A1—0 to 6 inches; pale brown (10YR 6/3) fine sand, brown (10YR 5/3) moist; weak fine granular structure; loose, very friable; common fine and very fine roots; neutral; clear wavy boundary.

C—6 to 60 inches; reddish yellow (7.5YR 7/6) fine sand, reddish yellow (7.5YR 6/6) moist; single grained; loose; few roots; mildly alkaline.

The A horizon is 6 to 10 inches thick. It is brown, pale brown, or grayish brown. The soil is slightly acid to mildly alkaline and is noncalcareous.

The C horizon is pale brown, very pale brown, light brown, light yellowish brown, reddish yellow, or pink. It is fine sand or sand. The soil is neutral to moderately alkaline. In some pedons, the soil is calcareous below a depth of 40 inches.

Veal series

The Veal series consists of deep, loamy soils on uplands. Veal soils formed in calcareous, loamy sediment that has been modified by the wind. Slopes range from 1 to 16 percent.

Typical pedon of Veal fine sandy loam, 3 to 5 percent slopes; from the intersection of U.S. Highway 287 and Farm Road 1755 in Lelia Lake, this pedon is located 1.1 miles west on U.S. Highway 287, 3.3 miles south and 0.4 mile east on county roads, and 45 feet south in a pasture:

A1—0 to 6 inches; grayish brown (10YR 5/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; weak fine granular structure; slightly hard, very friable; many worm casts; few medium and fine caliche pebbles; calcareous; moderately alkaline; clear smooth boundary.

B21—6 to 12 inches; brown (7.5YR 5/2) sandy clay loam, dark brown (7.5YR 4/2) moist; weak fine subangular blocky structure; hard, friable; many worm casts; common threads and films of calcium carbonate; few medium and fine caliche pebbles; calcareous; moderately alkaline; abrupt smooth boundary.

B22ca—12 to 26 inches; pinkish gray (7.5YR 7/2) sandy clay loam, pinkish gray (7.5YR 6/2) moist; moderate fine subangular blocky structure; hard, friable; common worm casts; about 60 percent threads, films, and medium to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; gradual smooth boundary.

B23ca—26 to 35 inches; pink (7.5YR 7/3) sandy clay loam, light brown (7.5YR 6/3) moist; weak fine subangular blocky structure; hard, friable; many fine and very fine pores; about 60 percent threads, films, and medium to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; gradual smooth boundary.

B3ca—35 to 45 inches; pink (5YR 7/4) sandy clay loam, light reddish brown (5YR 6/4) moist; weak fine subangular blocky structure; very hard, friable; many very fine pores; about 20 percent threads, films, and medium to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline; diffuse smooth boundary.

C—45 to 80 inches; pink (5YR 7/3) sandy clay loam, light reddish brown (5YR 6/3) moist; massive; very hard, friable; about 10 percent threads, films, and medium to very fine soft masses and concretions of calcium carbonate, by volume; calcareous; moderately alkaline.

The solum is more than 40 inches thick. The depth to the B2ca horizon is 10 to 24 inches. In the control section, the soil is more than 40 percent calcium carbonate.

The A horizon is 6 to 10 inches thick. It is brown or grayish brown fine sandy loam, loam, or clay loam.

The B21 horizon is 5 to 14 inches thick. It is brown, pale brown, or grayish brown loam, sandy clay loam, or clay loam.

The B2ca horizon is pink, pinkish gray, light yellowish brown, or very pale brown. It is loam, fine sandy loam, or sandy clay loam. The soil is 40 to 60 percent calcium carbonate, by volume.

The C horizon, where present, is pink, light brown, or very pale brown. It is fine sandy loam, loam, or sandy clay loam. The soil is 10 to 30 percent calcium carbonate, by volume. In some pedons, this horizon is weakly cemented.

Formation of the soils

In this section, the factors of soil formation are discussed and related to the soils in the survey area. In addition, the processes of soil formation are described.

Factors of soil formation

Soil is produced by soil-forming processes that act on the material that is deposited or accumulated by geologic forces. The characteristics of the soil at any given place are determined by (1) the physical and mineralogical composition of the parent material, (2) the climate under which the soil material has accumulated and existed since accumulation, (3) the plant and animal life on and in the soil, (4) the relief, or lay of the land, and (5) the length of time the processes of soil development have acted on the soil material.

Climate and plants and animals are the active factors in soil formation. They act on the parent material that has accumulated through the weathering of rock and slowly change it to a natural body that has genetically related horizons. The effects of climate and living organisms are conditioned by relief. The parent material also influences soil formation and, in extreme cases, entirely determines the kind of soil that is formed. Finally, time is needed for changing the parent material into soil and for horizon differentiation. In general, a long time is required for distinct horizons to develop.

The factors of soil formation are so closely interrelated in their effects on the soil that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the other four. In the following paragraphs, the factors of soil formation are briefly discussed as they relate to the soils in Donley County.

Parent material

Parent material is the unconsolidated mass in which a soil forms. The soils in Donley County formed in residual, outwash, eolian, and alluvial parent materials.

The nearly level to gently sloping soils on the High Plains in the northwestern part of the county formed in eolian, calcareous, loamy material that mantles the nearly level Ogallala constructional plain. This material commonly is referred to as cover sands. The main soils in this area are Estacado, Olton, and Pullman soils.

The soils in the Rolling Plains area formed in Ogallala and outwash material of the Pliocene and Pleistocene Epochs or in redbed material of the Permian Period. The Ogallala material, commonly called Rocky Mountain outwash, is calcareous, unconsolidated sandy and loamy material. The relief on this erosional surface is mainly gently sloping to steep. The major soils in this area are Berda, Bippus, Likes, Mobeetie, Paloduro, Potter, and Veal soils.

The Permian redbed material is exposed in the southern and eastern parts of the county. The relief on this erosional surface ranges from nearly level to rolling to steep. The major soils in this area are Aspermont, Burson, Carey, Obaro, and Quinlan soils.

Sandy and loamy outwash material has been deposited on the Ogallala and Permian surfaces. This material has been reworked by wind and water into an undulating to hummocky surface. The major soils in this area are Acuff, Altus, Miles, Springer, and Tivoli soils.

The alluvial soils in Donley County are the Clairemont, Guadalupe, Lincoln, Spur, and Sweetwater soils. These soils are on flood plains of the major streams, and they are very young.

Climate

Precipitation, temperature, and wind are some of the factors of climate that influence soil formation. The wet climate of past geological ages influenced the deposition of the parent materials. Later, after the soils began to develop, the climate became subhumid. The limited rainfall could not leach the minerals from the soils, and thus, except for the sandy soils, most of the soils in the county are high in fertility. The soils are seldom wet to a

depth of more than 6 feet. Consequently, many soils have a horizon of calcium carbonate accumulation within a few feet of the surface. Most of the young soils have lime throughout the profile.

Summer temperatures are high, and winter temperatures are mild. The high temperatures and low rainfall in Donley County have limited the accumulation of organic matter in the soils.

Plants and animals

Plants, animals, insects, and bacteria are important in the formation of soils. Living organisms can cause gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in soil structure and porosity.

Vegetation, mainly grasses, has affected soil formation in Donley County more than other living organisms.

Relief

Relief affects soil formation through its influence on drainage and runoff. The degree of profile development depends mainly on the average amount of moisture in the soil, if other factors are equal. Nearly level soils absorb more moisture than steeper soils, and thus they generally have a better developed profile. Also, on many of the steeper soils, the rate of erosion is almost as fast as that of soil formation.

Relief also affects the kind and amount of vegetation on a soil. The soils on slopes facing north and east receive less direct sunlight than those on slopes facing south and west, and thus they lose less moisture through evaporation. As a result, the soils on north- and east-facing slopes have denser vegetation.

Soils that are nearly level or slightly concave are likely to be darker than sloping soils because they receive more moisture, produce more vegetation, and consequently have more organic matter, which imparts a darker color.

Time

Time is required for the formation of soils that have distinct horizons. Differences in the length of time that the parent material has been in place, therefore, commonly are reflected in the degree of profile development in a soil.

The soils in Donley County range from young to old. The young soils have very little profile development, and the older soils have distinct soil horizons. The soils on bottom lands are young soils.

Soils that have been in place for a long time and that are nearly level to gently sloping normally have the most profile development. Examples are the Pullman and Acuff soils.

Many shallow and very shallow, steep soils have been forming for as long as the well developed, nearly level soils; however, geologic erosion has restricted soil formation on these soils. Potter and Quinlan soils are examples.

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Glossary

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

Badland. Steep or very steep, commonly nonstony, barren land dissected by many intermittent drainage channels. Badland is most common in semiarid and arid regions where streams are entrenched in soft geologic material. Local relief generally ranges from

25 to 500 feet. Runoff potential is very high, and geologic erosion is active.

Bedding planes. Fine stratifications, less than 5 millimeters thick, in unconsolidated alluvial, eolian, lacustrine, or marine sediments.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

Bottom land. The normal flood plain of a stream, subject to flooding.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in soils of warm-temperate, subhumid to arid areas. Caliche occurs as soft, thin layers in the soil or as hard, thick beds just beneath the solum, or it is exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

Climax vegetation. The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

Coarse fragments. Mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter.

Coarse textured soil. Sand or loamy sand.

Colluvium. Soil material, rock fragments, or both moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Compressible (in tables). Excessive decrease in volume of soft soil under load.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard; little affected by moistening.

Contour stripcropping (or contour farming). Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Decreasers. The most heavily grazed climax range plants. Because they are the most palatable, they are the first to be destroyed by overgrazing.

Deferred grazing. Postponing grazing or arresting grazing for a prescribed period.

Depth to rock. Bedrock is too near the surface for the specified use.

Diversion (or diversion terrace). A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:

Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some

are steep. All are free of the mottling related to wetness.

Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.

Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.

Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically for long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.

Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.

Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.

Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

Drainage, surface. Runoff, or surface flow of water, from an area.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

Fine textured soil. Sandy clay, silty clay, and clay.

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Gilgai. Commonly a succession of microbasins and microknolls in nearly level areas or of microvalleys and microridges parallel with the slope. Typically, the microrelief of Vertisols—clayey soils having a high coefficient of expansion and contraction with changes in moisture content.

Grassed waterway. A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

Gravel. Rounded or angular fragments of rock up to 3 inches (2 millimeters to 7.5 centimeters) in diameter. An individual piece is a pebble.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rainfall. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An ex-

planation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:

O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.

A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.

C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock commonly underlies a C horizon, but can be directly below an A or a B horizon.

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Increasers. Species in the climax vegetation that increase in amount as the more desirable plants are reduced by close grazing. Increasers commonly are the shorter plants and the less palatable to livestock.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

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 nearly level plains surrounded by levees or dikes.

Controlled flooding.—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

Furrow.—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Water, released at high points, is allowed to flow onto an area without controlled distribution.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Loess. Fine grained material, dominantly of silt-sized particles, deposited by wind.

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Minimum tillage. Only the tillage essential to crop production and prevention of soil damage.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor

aeration and impeded drainage. Descriptive terms are as follows: abundance—*few, common,* and *many*; size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Munsell notation. A designation of color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color of 10YR hue, value of 6, and chroma of 4.

Neutral soil. A soil having a pH value between 6.6 and 7.3. (See Reaction, soil.)

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Outwash plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permeability. The quality of the soil that enables water to move downward through the profile. Permeability is measured as the number of inches per hour that water moves downward through the saturated soil. Terms describing permeability are:

Very slow	less than 0.06 inch
Slow	0.06 to 0.20 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, differences in slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Plowpan. A compacted layer formed in the soil directly below the plowed layer.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity (soil). The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Rangeland. Land on which the potential natural vegetation is predominantly grasses, grasslike plants, forbs, or shrubs suitable for grazing or browsing. It includes natural grasslands, savannas, many wetlands, some deserts, tundras, and areas that support certain forb and shrub communities.

Range condition. The present composition of the plant community on a range site in relation to the potential natural plant community for that site. Range condition is expressed as excellent, good, fair, or poor, on the basis of how much the present plant community has departed from the potential.

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degree of acidity or alkalinity is expressed as—

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep sided channel resulting from accelerated erosion. A rill is generally a few inches deep and not wide enough to be an obstacle to farm machinery.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called groundwater runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shale. Sedimentary rock formed by the hardening of a clay deposit.

Sheet erosion. The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and runoff water.

Shrink-swell. The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Siltstone. Sedimentary rock made up of dominantly silt-sized particles.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on the steeper slopes; on faces of blocks, prisms, and columns; and in swelling clayey soils, where there is marked change in moisture content.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (7.5 centimeters) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated affect 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 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	Less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Stubble mulch. Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the A2 horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to

the contour. The terrace intercepts surface runoff so that it can soak into the soil or flow slowly to a prepared outlet without harm. A terrace in a field is generally built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt, silt loam, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or " very fine."

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress road-banks, lawns, and land affected by mining.

Unstable fill (in tables). Risk of caving or sloughing on banks of fill material.

Upland (geology). Land at a higher elevation, in general, than the alluvial plain or stream terrace; land above the low lands along streams.

Valley fill. In glaciated regions, material deposited in stream valleys by glacial melt water. In nonglaciated regions, alluvium deposited by heavily loaded streams.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

TABLES

TABLE 1.--TEMPERATURE AND PRECIPITATION

[TR means trace]

Month	Temperature (°F)****							Precipitation							Mean number of days that have--**				
	Means			Extremes								Snow or sleet****				Maximum temperatures of--		Minimum temperatures of--	
				Highest record		Lowest record				Maximum daily***			Maximum monthly						
	Daily Maximum	Daily Minimum	Monthly	Temp.	Year	Temp.	Year	Mean degree days**** (Base 65°F)	Mean***	Inches	Year	Mean	Inches	Year	Precipitation of .10 inch or more	90° and above	32° and below	32° and below	0° and below
Jan.	51.3	23.3	37.3	83	1956	-8	1963*	883	0.74	2.11	1946	2.0	10.5	1966*	1	0	4	27	1
Feb.	55.3	27.0	41.2	89	1963*	0	1960	717	0.60	1.80	1964	2.2	11.5	1964	2	0	3	23	*****
Mar.	63.0	32.2	47.7	94	1963	-2	1960	437	0.93	1.72	1961	0.9	6.4	1948	2	*****	1	18	*****
Apr.	74.3	43.7	59.0	99	1959	18	1940	271	1.58	3.96	1957	0.1	2.7	1949	2	2	*****	5	0
May	81.8	53.2	67.5	107	1953	30	1967*	62	4.02	5.71	1958	TR	TR	1957*	5	9	0	*****	0
Jun.	90.3	62.4	76.4	114	1953	45	1947	5	3.27	3.00	1947	0	0	--	6	16	0	0	0
Jul.	95.0	66.0	80.5	110	1954*	50	1952	*****	2.12	2.77	1959	0	0	--	5	25	0	0	0
Aug.	94.3	64.4	79.4	111	1944	47	1961	1	2.60	5.36	1968	0	0	--	4	25	0	0	0
Sep.	86.3	57.2	71.8	108	1939	35	1945	22	2.00	2.30	1958	0	0	--	4	11	0	0	0
Oct.	75.6	46.0	60.8	98	1952	23	1957	193	2.11	3.03	1946	0	0	--	3	3	0	2	0
Nov.	62.5	30.8	46.7	91	1952	2	1951	523	0.74	1.35	1964*	0.4	3.5	1958	2	0	*****	15	0
Dec.	53.8	25.3	39.6	86	1955	2	1939	781	0.80	2.64	1943	1.5	10.5	1942	2	0	3	26	0
Year	73.6	44.3	59.0	114	June 1953	-8	Jan.* 1963	3895	21.51	5.71	May 1958	7.1	11.5	Feb. 1964	38	91	11	116	1

*Also on earlier dates.
**Length of record--14 years
***Length of record--35 years.
****For the period 1939-1969.
*****Less than one half.

TABLE 2.--POTENTIALS AND LIMITATIONS OF MAP UNITS ON THE GENERAL SOIL MAP FOR SPECIFIED USES

Map unit	Percent of county	Cultivated farm crops	Specialty crops	Rangeland	Urban uses	Recreation areas
1. Mobeetie-Veal-Potter	33	Low: slope, water erosion, depth to rock.	Low: slope, depth to rock, water erosion.	Medium: slope, water erosion, depth to rock.	Medium: slope, depth to rock.	Medium: slope, small stones.
2. Obaro-Aspermont-Quinlan	22	Low: slope, water erosion, depth to rock.	Low: slope, water erosion, depth to rock.	Medium: slope, water erosion, depth to rock.	Medium: slope, depth to rock.	Medium: slope, too clayey.
3. Miles-Veal-Acuff	17	Medium: low rainfall, slope, soil blowing, water erosion.	Medium: slope, water erosion, soil blowing.	High: soil blowing, water erosion.	High: low strenth, corrosivity, soil blowing.	High: slope, soil blowing.
4. Springer-Lincoln-Likes	12	Low: slope, available water capacity, soil blowing.	Low: slope, soil blowing, available water capacity, flooding.	Medium: slope, soil blowing, available water capacity.	Low: slope, seepage, flooding.	Low: too sandy, soil blowing, slope, flooding.
5. Miles-Springer	11	Medium: soil blowing, low rainfall.	Medium: soil blowing, slope, water erosion.	High: soil blowing, slope.	High: soil blowing, low strength, seepage.	Medium: too sandy, slope.
6. Pullman-Estacado-Olton	3	High: slow permeability, low rainfall, soil blowing.	High: slow permeability.	Medium: slow permeability, too clayey.	Medium: shrink-swell, corrosivity, low strength.	Medium: too clayey, soil blowing, slow permeability.
7. Olton-Acuff-Miles	2	High: low rainfall, slope, water erosion.	High: slope, water erosion.	High: water erosion, soil blowing.	High: low strength, corrosivity.	High: slope.

TABLE 3.--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	Soil name	Acres	Percent
1	Acuff loam, 0 to 1 percent slopes	1,970	0.3
2	Acuff loam, 1 to 3 percent slopes	8,400	1.4
3	Acuff loam, 3 to 5 percent slopes	4,400	0.8
4	Altus fine sandy loam, 0 to 1 percent slopes	5,820	1.0
5	Aspermont silty clay loam, 1 to 3 percent slopes	1,030	0.2
6	Aspermont silty clay loam, 3 to 5 percent slopes	11,050	1.9
7	Berda-Estacado-Potter association, rolling	11,040	1.9
8	Berda-Potter-Rock outcrop association, steep	15,500	2.7
9	Bippus clay loam, 0 to 1 percent slopes	390	0.1
10	Bippus clay loam, 1 to 3 percent slopes	980	0.2
11	Burson-Aspermont association, steep	12,300	2.1
12	Carey loam, 0 to 1 percent slopes	400	0.1
13	Carey loam, 1 to 3 percent slopes	2,310	0.4
14	Clairemont silt loam, occasionally flooded	1,770	0.3
15	Delwin fine sand, 0 to 3 percent slopes	3,960	0.7
16	Estacado clay loam, 0 to 1 percent slopes	1,710	0.3
17	Estacado clay loam, 1 to 3 percent slopes	1,110	0.2
18	Estacado clay loam, 3 to 5 percent slopes	2,220	0.4
19	Guadalupe fine sandy loam, occasionally flooded	6,610	1.1
20	Likes loamy fine sand, 1 to 8 percent slopes	10,670	1.8
21	Lincoln loamy fine sand, frequently flooded	20,800	3.6
22	Miles loamy fine sand, 0 to 3 percent slopes	35,730	6.1
23	Miles loamy fine sand, 3 to 5 percent slopes	4,380	0.8
24	Miles loamy fine sand, 3 to 8 percent slopes, severely eroded	1,290	0.2
25	Miles fine sandy loam, 0 to 1 percent slopes	7,770	1.3
26	Miles fine sandy loam, 1 to 3 percent slopes	46,550	8.0
27	Miles fine sandy loam, 3 to 5 percent slopes	30,090	5.2
28	Miles fine sandy loam, 3 to 5 percent slopes, eroded	2,920	0.5
29	Mobeetie fine sandy loam, 1 to 3 percent slopes	1,860	0.3
30	Mobeetie fine sandy loam, 3 to 5 percent slopes	7,610	1.3
31	Mobeetie fine sandy loam, 5 to 12 percent slopes	13,690	2.4
32	Mobeetie-Badland association, steep	5,410	0.9
33	Mobeetie-Polar association, hilly	34,070	5.9
34	Mobeetie-Veal-Potter association, rolling	76,270	13.1
35	Nobscot fine sand, 1 to 8 percent slopes	2,540	0.4
36	Obaro-Quinlan association, rolling	75,720	13.0
37	Olton clay loam, 0 to 1 percent slopes	5,500	0.9
38	Olton clay loam, 1 to 3 percent slopes	2,030	0.4
39	Paloduro loam, 3 to 5 percent slopes	940	0.2
40	Paloduro loam, 5 to 8 percent slopes	1,180	0.2
41	Potter loam, 1 to 8 percent slopes	2,210	0.4
42	Pullman clay loam, 0 to 1 percent slopes	12,290	2.1
43	Pullman clay loam, 1 to 3 percent slopes	860	0.1
44	Randall clay	1,920	0.3
45	Springer loamy fine sand, 0 to 3 percent slopes	4,830	0.8
46	Springer loamy fine sand, 3 to 8 percent slopes	27,430	4.7
47	Springer loamy fine sand, 3 to 8 percent slopes, severely eroded	6,060	1.0
48	Springer fine sandy loam, 5 to 8 percent slopes	3,880	0.7
49	Spur clay loam, occasionally flooded	810	0.1
50	Sweetwater soils	1,260	0.2
51	Tivoli fine sand	8,510	1.5
52	Veal fine sandy loam, 1 to 3 percent slopes	8,480	1.5
53	Veal fine sandy loam, 3 to 5 percent slopes	20,730	3.6
	Water	2,500	0.4
	Total	581,760	100.0

TABLE 4.--YIELDS PER ACRE OF CROPS

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Soil name and map symbol	Cotton lint		Wheat		Grain sorghum	
	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu
1---------- Acuff	200	900	18	50	25	120
2---------- Acuff	175	750	16	45	20	100
3---------- Acuff	150	600	14	40	15	80
4---------- Altus	350	900	30	60	40	110
5---------- Aspermont	200	600	15	40	20	80
6---------- Aspermont	150	---	12	30	15	---
7*:						
Berda----------	---	---	---	---	---	---
Estacado----------	---	---	---	---	---	---
Potter----------	---	---	---	---	---	---
8*:						
Berda----------	---	---	---	---	---	---
Potter----------	---	---	---	---	---	---
Rock outcrop.						
9**---------- Bippus	225	900	18	60	25	110
10---------- Bippus	200	750	16	50	20	100
11*:						
Burson----------	---	---	---	---	---	---
Aspermont----------	---	---	45	---	35	---
12---------- Carey	300	750	25	55	35	110
13---------- Carey	275	700	20	50	30	100
14---------- Clairemont	350	900	25	60	40	110
15---------- Delwin	225	600	18	40	25	80
16---------- Estacado	200	750	18	45	25	100
17---------- Estacado	175	500	15	40	20	90

See footnotes at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Cotton lint		Wheat		Grain sorghum	
	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu
18---------- Estacado	125	---	12	35	15	70
19---------- Guadalupe	350	750	25	45	35	100
20---------- Likes	---	---	---	---	---	---
21---------- Lincoln	---	---	---	---	---	---
22---------- Miles	250	650	15	35	25	75
23---------- Miles	---	---	15	30	15	45
24---------- Miles	---	---	---	---	---	---
25---------- Miles	300	700	20	50	35	85
26---------- Miles	250	650	20	45	30	75
27---------- Miles	200	500	15	35	25	60
28---------- Miles	150	450	15	30	15	50
29---------- Mobeetie	175	650	12	35	15	60
30---------- Mobeetie	---	---	10	30	12	50
31---------- Mobeetie	---	---	---	---	---	---
32*:						
Mobeetie----------	---	---	---	---	---	---
Badland.						
33*:						
Mobeetie----------	---	---	---	---	---	---
Polar----------	---	---	---	---	---	---
34*:						
Mobeetie----------	---	---	---	---	---	---
Veal----------	---	---	---	---	---	---
Potter----------	---	---	---	---	---	---
35---------- Nobscot	---	---	---	---	25	---
36*:						
Obaro----------	---	---	---	---	---	---
Quinlan----------	---	---	---	---	---	---

See footnote at end of table.

TABLE 4.--YIELDS PER ACRE OF CROPS--Continued

Soil name and map symbol	Cotton lint		Wheat		Grain sorghum	
	N	I	N	I	N	I
	Lb	Lb	Bu	Bu	Bu	Bu
37---------- Olton	200	850	16	60	20	115
38---------- Olton	175	780	14	50	15	100
39---------- Paloduro	---	---	10	35	12	70
40---------- Paloduro	---	---	---	---	---	---
41---------- Potter	---	---	---	---	---	---
42---------- Pullman	200	850	15	60	20	120
43---------- Pullman	150	700	12	45	15	90
44---------- Randall	---	---	---	---	---	---
45---------- Springer	225	600	14	40	25	75
46---------- Springer	---	---	12	30	20	---
47---------- Springer	---	---	---	---	---	---
48---------- Springer	---	---	10	30	15	50
49---------- Spur	225	900	20	60	30	110
50---------- Sweetwater	---	---	---	---	---	---
51---------- Tivoli	---	---	---	---	---	---
52---------- Veal	150	400	12	25	20	55
53---------- Veal	125	---	10	20	15	45

* See description of the map unit for composition and behavior characteristics of the map unit.
** Yields are for areas protected from flooding.

TABLE 5.--CAPABILITY CLASSES AND SUBCLASSES

[All soils are assigned to nonirrigated capability subclasses (N). Only those soils that are suited to irrigation are assigned to irrigated subclasses (I). Miscellaneous areas are excluded. Dashes indicate no acreage]

Class	Total acreage	Major management concerns (Subclass)			
		Erosion (e)	Wetness (w)	Soil problem (s)	Climate (c)
		Acres	Acres	Acres	Acres
I (N)	--	--	--	--	--
(I)	6,610	--	--	--	--
II (N)	26,860	16,880	9,190	--	790
(I)	89,300	67,820	9,190	12,290	--
III (N)	157,920	157,920	--	--	--
(I)	97,350	97,350	--	--	--
IV (N)	94,040	94,040	--	--	--
(I)	85,560	85,560	--	--	--
V (N)	22,060	--	22,060	--	--
VI (N)	184,930	170,060	1,920	12,950	--
VII (N)	64,365	38,885	--	25,480	--
VIII (N)	3,250	--	--	3,250	--

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES

[Only the soils that support rangeland vegetation suitable for grazing are listed]

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
1, 2, 3 Acuff	Clay Loam	Favorable	2,200	Blue grama	30
		Normal	1,800	Buffalograss	25
		Unfavorable	1,200	Sideoats grama	5
				Vine-mesquite	10
				Tobosa	5
4 Altus	Sandy Loam	Favorable	3,800	Little bluestem	25
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Sideoats grama	15
				Blue grama	10
				Indiangrass	5
				Texas needlegrass	5
				Sand lovegrass	5
				Sand sagebrush	5
5, 6 Aspermont	Clay Loam	Favorable	2,000	Blue grama	25
		Normal	1,600	Buffalograss	15
		Unfavorable	1,200	Sideoats grama	10
				Vine-mesquite	10
				Arizona cottontop	5
				Texas needlegrass	5
				Sand dropseed	5
				Western wheatgrass	5
7*:					
Berda	Hardland Slopes	Favorable	2,800	Sideoats grama	35
		Normal	2,000	Blue grama	20
		Unfavorable	1,200	Little bluestem	5
				Buffalograss	5
				Threeawn	5
				Silver bluestem	5
				Plains bristlegrass	5
Estacado	Loamy	Favorable	2,300	Blue grama	30
		Normal	1,700	Sideoats grama	25
		Unfavorable	1,300	Buffalograss	15
				Vine mesquite	5
Potter	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Threeawn	5
				Hairy grama	5
				Black grama	5
8*:					
Berda	Rough Breaks	Favorable	1,400	Sideoats grama	25
		Normal	800	Little bluestem	15
		Unfavorable	400	Hairy grama	10
				Sand bluestem	5
				Indiangrass	5
				Blue grama	5
				Black grama	5
				Silver bluestem	5
Potter	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Threeawn	5
				Hairy grama	5
				Black grama	5
Rock outcrop.					

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
9, 10 Bippus	Draw	Favorable	3,000	Sideoats grama	25
		Normal	2,400	Vine-mesquite	10
		Unfavorable	1,800	Blue grama	10
				Western wheatgrass	10
				Little bluestem	5
				Arizona cottontop	5
				Plains bristlegrass	5
				White tridens	5
				Buffalograss	5
11*:					
Burson	Rough Breaks	Favorable	700	Sideoats grama	20
		Normal	500	Little bluestem	15
		Unfavorable	300	Blue grama	10
				Sand bluestem	5
				Threeawn	5
				Hairy grama	5
Aspermont	Rough Breaks	Favorable	2,000	Blue grama	25
		Normal	1,600	Buffalograss	15
		Unfavorable	1,200	Sideoats grama	10
				Vine-mesquite	10
				Arizona cottontop	5
				Texas needlegrass	5
				Sand dropseed	5
				Western wheatgrass	5
12, 13 Carey	Loamy Prairie	Favorable	2,600	Blue grama	20
		Normal	2,100	Sideoats grama	15
		Unfavorable	1,600	Buffalograss	15
				Arizona cottontop	5
				Plains bristlegrass	5
				Vine-mesquite	5
				Texas needlegrass	5
				Sand dropseed	5
				Hairy grama	5
14 Clairemont	Loamy Bottomland	Favorable	3,400	Sideoats grama	20
		Normal	2,600	Sand bluestem	10
		Unfavorable	1,800	Indiangrass	10
				Vine-mesquite	10
				Switchgrass	5
				Little bluestem	5
				Western wheatgrass	5
				Arizona cottontop	5
				Texas needlegrass	5
				Plains bristlegrass	5
15 Delwin	Sandy	Favorable	3,200	Little bluestem	30
		Normal	2,400	Sand bluestem	15
		Unfavorable	1,500	Sideoats grama	5
				Switchgrass	5
				Indiangrass	5
				Plains bristlegrass	5
				Sand lovegrass	5
				Sand dropseed	5
16, 17, 18 Estacado	Loamy	Favorable	2,300	Blue grama	30
		Normal	1,700	Sideoats grama	25
		Unfavorable	1,300	Buffalograss	15
				Silver bluestem	5
				Threeawn	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
19 Guadalupe	Sandy Bottomland	Favorable	4,000	Little bluestem	10
		Normal	3,000	Switchgrass	10
		Unfavorable	2,000	Vine-mesquite	10
				Indiangrass	5
				Sideoats grama	5
				Canada wildrye	5
				Sand bluestem	5
				Blue grama	5
				Western wheatgrass	5
				Arizona cottontop	5
				Texas needlegrass	5
				Plains bristlegrass	5
20 Likes	Loamy Sand	Favorable	3,000	Little bluestem	20
		Normal	2,100	Sand bluestem	15
		Unfavorable	1,300	Sideoats grama	15
				Indiangrass	10
				Sand lovegrass	10
				Switchgrass	10
				Canada wildrye	5
				Sand sagebrush	5
21 Lincoln	Sandy Bottomland	Favorable	3,000	Switchgrass	30
		Normal	2,280	Sand bluestem	15
		Unfavorable	1,800	Indiangrass	15
				Little bluestem	5
				Texas bluegrass	5
				Sedges and rushes	5
				Heath aster	5
				Tamarisk	5
22, 23, 24 Miles	Loamy Sand	Favorable	3,200	Little bluestem	15
		Normal	2,300	Sand bluestem	15
		Unfavorable	1,500	Sideoats grama	10
				Indiangrass	10
				Arizona cottontop	5
				Silver bluestem	5
				Sand lovegrass	5
				Switchgrass	5
				Sand sagebrush	5
25, 26, 27, 28 Miles	Sandy Loam	Favorable	2,800	Blue grama	20
		Normal	2,250	Sideoats grama	20
		Unfavorable	1,800	Plains bristlegrass	10
				Arizona cottontop	10
				Little bluestem	5
				Silver bluestem	5
				Buffalograss	5
				Vine-mesquite	5
29, 30, 31 Mobeetie	Mixedland Slopes	Favorable	3,000	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Buffalograss	5
				Sand dropseed	5
				Indiangrass	5
				Hairy grama	5
32*:					
Mobeetie	Mixedland Slopes	Favorable	3,000	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Buffalograss	5
				Sand dropseed	5
				Indiangrass	5
				Hairy grama	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
33*:					
Mobeetie	Mixedland Slopes	Favorable	3,000	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Buffalograss	5
				Sand dropseed	5
				Indiangrass	5
				Hairy grama	5
Polar	Gravelly	Favorable	1,500	Sideoats grama	30
		Normal	1,100	Little bluestem	15
		Unfavorable	700	Black grama	10
				Sand bluestem	5
				Blue grama	5
				Canada wildrye	5
				Indiangrass	5
				Hairy grama	5
34*:					
Mobeetie	Mixedland Slopes	Favorable	3,000	Sideoats grama	30
		Normal	2,250	Blue grama	15
		Unfavorable	1,500	Little bluestem	10
				Sand bluestem	5
				Buffalograss	5
				Sand dropseed	5
				Indiangrass	5
				Hairy grama	5
Veal	Loamy	Favorable	2,800	Sideoats grama	30
		Normal	2,100	Blue grama	15
		Unfavorable	1,400	Buffalograss	10
				Little bluestem	5
				Sand dropseed	5
				Plains bristlegrass	5
Potter	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Rough tridens	5
				Hairy grama	5
35 Nobscot	Sandy	Favorable	3,900	Little bluestem	25
		Normal	2,800	Sand bluestem	20
		Unfavorable	2,000	Indiangrass	5
				Switchgrass	5
				Sand lovegrass	5
				Canada wildrye	5
				Sideoats grama	5
				Shinnery oak	15
36*:					
Obaro	Loamy Prairie	Favorable	2,400	Blue grama	25
		Normal	1,800	Buffalograss	15
		Unfavorable	1,200	Sideoats grama	10
				Arizona cottontop	5
				Little bluestem	5
				Plains bristlegrass	5
				Hairy grama	5
				Silver bluestem	5
				Sand dropseed	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production: Kind of year	Total production: Dry weight	Characteristic vegetation	Composition
			Lb/acre		Pct
36*:					
Quinlan	Loamy Prairie	Favorable	2,500	Little bluestem	30
		Normal	1,800	Sand bluestem	15
		Unfavorable	1,300	Indiangrass	10
				Sideoats grama	5
				Prairie-clover	5
				Dotted gayfeather	5
37, 38 Olton	Clay Loam	Favorable	2,100	Blue grama	35
		Normal	1,600	Buffalograss	25
		Unfavorable	1,200	Vine-mesquite	10
				Western wheatgrass	10
				Sideoats grama	5
39, 40 Paloduro	Hardland Slopes	Favorable	2,800	Blue grama	30
		Normal	2,000	Sideoats grama	15
		Unfavorable	1,200	Buffalograss	10
				Vine-mesquite	5
				Little bluestem	5
				Silver bluestem	5
				Wright threeawn	5
				Sand dropseed	5
41 Potter	Very Shallow	Favorable	900	Sideoats grama	30
		Normal	700	Blue grama	10
		Unfavorable	400	Little bluestem	10
				Buffalograss	10
				Threeawn	5
				Hairy grama	5
42, 43 Pullman	Clay Loam	Favorable	2,000	Blue grama	40
		Normal	1,500	Buffalograss	25
		Unfavorable	1,000	Sideoats grama	5
				Western wheatgrass	5
				Vine-mesquite	5
				Silver bluestem	5
44 Randall	Lakebed	Favorable	3,000	Pennsylvania smartweed	20
		Normal	1,200	Blue grama	15
		Unfavorable	500	Common spikesedge	15
				Buffalograss	15
				Western wheatgrass	10
				Knotgrass	5
45, 46, 47 Springer	Loamy Sand	Favorable	3,300	Little bluestem	15
		Normal	2,500	Sand bluestem	15
		Unfavorable	1,600	Sideoats grama	10
				Plains bristlegrass	10
				Indiangrass	10
				Sand lovegrass	5
				Sand dropseed	5
				Canada wildrye	5
				Switchgrass	5
48 Springer	Sandy Loam	Favorable	3,200	Sideoats grama	20
		Normal	2,400	Blue grama	20
		Unfavorable	1,600	Little bluestem	10
				Plains bristlegrass	10
				Arizona cottontop	5
				Vine-mesquite	5
				Sand dropseed	5
				Buffalograss	5

See footnote at end of table.

TABLE 6.--RANGELAND PRODUCTIVITY AND CHARACTERISTIC PLANT COMMUNITIES--Continued

Soil name and map symbol	Range site name	Total production		Characteristic vegetation	Composition
		Kind of year	Dry weight		
			Lb/acre		Pct
49---------- Spur	Draw----------	Favorable	3,000	Sideoats grama----------	25
		Normal	2,400	Vine-mesquite----------	10
		Unfavorable	1,800	Blue grama----------	10
				Western wheatgrass----------	10
				Little bluestem----------	5
				Switchgrass----------	5
				White tridens----------	5
				Buffalograss----------	5
50*---------- Sweetwater	Wet Bottomland----------	Favorable	5,000	Switchgrass----------	15
		Normal	4,250	Indiangrass----------	10
		Unfavorable	3,500	Sand bluestem----------	10
				Western wheatgrass----------	10
				Sedges----------	10
				Little bluestem----------	5
				Sideoats grama----------	5
				Prairie cordgrass----------	5
				Eastern gamagrass----------	5
				Vine-mesquite----------	5
				Alkali sacaton----------	5
51---------- Tivoli	Sand Hills----------	Favorable	2,000	Little bluestem----------	25
		Normal	1,400	Sand bluestem----------	20
		Unfavorable	1,000	Big sandreed----------	10
				Texas bluegrass----------	10
				Sand lovegrass----------	5
				Scribner panicum----------	5
				Sand dropseed----------	5
				Shrubs----------	10
52, 53---------- Veal	Loamy----------	Favorable	2,800	Sideoats grama----------	30
		Normal	2,100	Blue grama----------	15
		Unfavorable	1,400	Buffalograss----------	10
				Little bluestem----------	5
				Sand dropseed----------	5
				Hairy grama----------	5

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS

[The symbol < means less than; > means more than. Absence of an entry indicates that trees generally do not grow to the given height on that soil]

Soil name and map symbol	Trees having a predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
1, 2, 3 Acuff	---	Green ash, osageorange, Russian-olive, Arizona cypress, Rocky Mt. juniper.	Honeylocust, oriental arborvitae.	Siberian elm	---
4 Altus	---	---	---	Eastern redcedar, Austrian pine.	Eastern cottonwood, Siberian elm, American sycamore.
5, 6 Aspermont	---	Osageorange, eastern redcedar, oriental arborvitae.	Siberian elm	---	---
7*:					
Berda	---	Osageorange, eastern redcedar, oriental arborvitae.	---	Siberian elm	---
Estacado	---	Osageorange, eastern redcedar, oriental arborvitae, Rocky Mt. juniper.	---	Siberian elm	---
Potter.					
8*:					
Berda	---	Osageorange, eastern redcedar, oriental arborvitae.	---	Siberian elm	---
Potter.					
Rock outcrop.					
9, 10 Bippus	---	Russian-olive, eastern redcedar, Rocky Mt. juniper.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
11*:					
Burson.					
Aspermont	---	Osageorange, eastern redcedar, oriental arborvitae.	Siberian elm	---	---
12, 13 Carey	---	Russian-olive	Green ash, honeylocust, osageorange, eastern redcedar, oriental arborvitae, Arizona cypress.	Siberian elm	---

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having a predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
14---------- Clairemont	---	---	---	Austrian pine, ponderosa pine, eastern redcedar, shortleaf pine.	Eastern cottonwood, loblolly pine, green ash.
15---------- Delwin	---	Russian-olive, eastern redcedar, Rocky Mt. juniper.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
16, 17, 18-------- Estacado	---	Osageorange, eastern redcedar, oriental arborvitae, Rocky Mt. juniper.	---	Siberian elm------	---
19. Guadalupe					
20. Likes					
21. Lincoln					
22, 23, 24, 25, 26, 27, 28------- Miles	---	Russian-olive, eastern redcedar, Rocky Mt. juniper.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
29, 30, 31-------- Mobeetie	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm------	---
32*:					
Mobeetie---------	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm------	---
Badland.					
33*:					
Mobeetie---------	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm------	---
Polar.					
34*:					
Mobeetie---------	---	Eastern redcedar, Russian-olive, osageorange.	Arizona cypress, oriental arborvitae, green ash, honeylocust.	Siberian elm------	---
Veal----------	---	Oriental arborvitae, Rocky Mt. juniper, Russian-olive, osageorange, eastern redcedar.	Honeylocust, Siberian elm.	---	---
Potter.					

See footnote at end of table.

TABLE 7.--WINDBREAKS AND ENVIRONMENTAL PLANTINGS--Continued

Soil name and map symbol	Trees having a predicted 20-year average height, in feet, of--				
	<8	8-15	16-25	26-35	>35
35---------- Nobscot	---	---	Eastern redcedar, Austrian pine.	---	Siberian elm.
36*:					
Obaro----------	---	Oriental arborvitae, Rocky Mt. juniper, Russian-olive, eastern redcedar, osageorange.	Siberian elm------	---	---
Quinlan----------	---	---	---	---	---
37, 38---------- Olton	---	Green ash, osageorange, Russian-olive, eastern redcedar, Arizona cypress.	Honeylocust, oriental arborvitae.	Siberian elm------	---
39, 40---------- Paloduro	---	Osageorange, eastern redcedar, oriental arborvitae.	Honeylocust, Arizona cypress.	Siberian elm------	---
41. Potter					
42, 43---------- Pullman	---	Osageorange, Russian-olive.	Eastern redcedar, honeylocust, Arizona cypress, oriental arborvitae.	Siberian elm------	---
44. Randall					
45, 46, 47, 48---- Springer	---	Russian-olive, eastern redcedar.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
49---------- Spur	---	Russian-olive, eastern redcedar.	Green ash, osageorange, oriental arborvitae, Arizona cypress.	Siberian elm, honeylocust.	---
50*. Sweetwater					
51. Tivoli					
52, 53---------- Veal	---	Oriental arborvitae, Rocky Mt. juniper, Russian-olive, osageorange, eastern redcedar.	Honeylocust, Siberian elm.	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 8.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
1, 2 Acuff	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
3 Acuff	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
4 Altus	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
5 Aspermont	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: low strength, shrink-swell.
6 Aspermont	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: slope, shrink-swell, low strength.	Moderate: low strength, shrink-swell.
7*:					
Berda	Moderate: slope.	Moderate: slope, low strength.	Moderate: slope, low strength.	Severe: slope.	Moderate: slope, low strength.
Estacado	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength, slope.
Potter	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
8*:					
Berda	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Potter	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
Rock outcrop.					
9, 10 Bippus	Slight	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Moderate: low strength, shrink-swell.	Severe: floods.
11*:					
Burson	Severe: depth to rock, slope.	Severe: slope.	Severe: slope, depth to rock.	Severe: slope, depth to rock.	Severe: slope.
Aspermont	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
12, 13 Carey	Moderate: too clayey.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
14 Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
15 Delwin	Slight	Slight	Slight	Slight	Slight

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
16, 17 Estacado	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.	Moderate: low strength.
18 Estacado	Slight	Moderate: low strength.	Moderate: low strength.	Moderate: slope, low strength.	Moderate: low strength.
19 Guadalupe	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
20 Likes	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
21 Lincoln	Severe: cutbanks cave, floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.
22 Miles	Slight	Slight	Slight	Slight	Moderate: low strength.
23, 24 Miles	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
25, 26 Miles	Slight	Slight	Slight	Slight	Moderate: low strength.
27, 28 Miles	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.
29 Mobeetie	Slight	Slight	Slight	Slight	Slight.
30 Mobeetie	Slight	Slight	Slight	Moderate: slope.	Slight.
31 Mobeetie	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
32*:					
Mobeetie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Badland.					
33*:					
Mobeetie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Polar	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
34*:					
Mobeetie	Moderate: slope.	Moderate: slope.	Moderate: slope.	Seere: slope.	Moderate: slope.
Veal	Moderate: slope.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: low strength.
Potter	Slight	Slight	Slight	Moderate: slope.	Slight.
35 Nobscot	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
36*:					
Obaro	Moderate: depth to rock.	Slight	Moderate: depth to rock.	Severe: slope.	Moderate: low strength.

See footnote at end of table.

TABLE 8.--BUILDING SITE DEVELOPMENT--Continued

Soil name and map symbol	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
36*:					
Quinlan	Moderate: depth to rock.	Moderate: depth to rock.	Moderate: depth to rock.	Severe: slope.	Moderate: slope, depth to rock.
37, 38 Olton	Moderate: too clayey.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Moderate: shrink-swell, low strength.	Severe: low strength, shrink-swell.
39, 40 Paloduro	Slight	Slight	Slight	Moderate: slope.	Slight.
41 Potter	Slight	Slight	Slight	Moderate: slope.	Slight.
42, 43 Pullman	Severe: too clayey, cutbanks cave.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.	Severe: shrink-swell, low strength.
44 Randall	Severe: too clayey, wetness.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.	Severe: shrink-swell, wetness, floods.
45 Springer	Severe: cutbanks cave.	Slight	Slight	Slyght	Slight.
46, 47 Springer	Severe: cutbanks cave.	Slight	Slight	Moderate: slope.	Slight.
48 Springer	Slight	Slight	Slight	Moderate: slope.	Slight.
49 Spur	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods, low strength.
50* Sweetwater	Severe: cutbanks cave, floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.
51 Tivoli	Severe: cutbanks cave, too sandy.	Moderate: slope.	Moderate: slope.	Severe: slope.	Moderate: slope.
52 Veal	Slight	Slight	Slight	Slight	Moderate: low strength.
53 Veal	Slight	Slight	Slight	Moderate: slope.	Moderate: low strength.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Acuff	Slight	Moderate: seepage.	Slight	Slight	Good.
2, 3 Acuff	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
4 Altus	Slight	Moderate: seepage.	Slight	Slight	Good.
5, 6 Aspermont	Moderate: percs slowly.	Moderate: seepage, slope.	Moderate: too clayey.	Slight	Fair: too clayey.
7*:					
Berda	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.
Estacado	Slight	Severe: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
Potter	Moderate: slope.	Severe: slope, seepage, small stones.	Severe: seepage.	Severe: seepage.	Poor: small stones.
8*:					
Berda	Severe: slope.	Severe: slope.	Moderate: slope.	Severe: slope.	Poor: slope.
Potter	Moderate: slope.	Severe: slope, seepage, small stones.	Severe: seepage.	Severe: seepage.	Poor: small stones.
Rock outcrop.					
9 Bippus	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
10 Bippus	Moderate: floods.	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
11*:					
Burson	Severe: slope.	Severe: depth to rock, slope.	Severe: slope, depth to rock.	Severe: slope.	Poor: thin layer, slope.
Aspermont	Severe: slope.	Severe: slope.	Moderate: slope, too clayey.	Severe: slope.	Poor: slope.
12 Carey	Slight	Moderate: seepage.	Slight	Slight	Fair: too clayey.
13 Carey	Slight	Moderate: slope, seepage.	Slight	Slight	Fair: too clayey.
14 Clairemont	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Good.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
15 Delwin	Slight	Moderate: seepage.	Slight	Slight	Poor: too sandy.
16 Estacado	Slight	Moderate: seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
17, 18 Estacado	Slight	Moderate: slope, seepage.	Moderate: too clayey.	Slight	Fair: too clayey.
19 Guadalupe	Severe: floods.	Severe: floods, seepage.	Severe: floods, seepage.	Severe: seepage, floods.	Good.
20 Likes	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
21 Lincoln	Severe: floods.	Severe: seepage, floods.	Severe: floods, seepage, too sandy.	Severe: floods, seepage.	Fair: too sandy.
22 Miles	Slight	Moderate: seepage.	Slight	Slight	Good.
23, 24 Miles	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
25 Miles	Slight	Moderate: seepage.	Slight	Slight	Good.
26, 27, 28 Miles	Slight	Moderate: seepage, slope.	Slight	Slight	Good.
29, 30 Mobeetie	Slight	Severe: seepage.	Severe: seepage.	Slight	Good.
31 Mobeetie	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
32*:					
Mobeetie	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope.	Poor: slope.
Badland.					
33*:					
Mobeetie	Severe: slope.	Severe: slope, seepage.	Severe: seepage.	Severe: slope.	Poor: slope.
Polar	Severe: slope.	Severe: seepage, slope.	Severe: seepage.	Severe: seepage.	Poor: slope.
34*:					
Mobeetie	Moderate: slope.	Severe: slope, seepage.	Severe: seepage.	Moderate: slope.	Fair: slope.
Veal	Moderate: slope.	Severe: slope.	Slight	Moderate: slope.	Fair: slope.

See footnote at end of table.

TABLE 9.--SANITARY FACILITIES--Continued

Soil name and map symbol	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
34*:					
Potter	Slight	Severe: slope, seepage, small stones.	Severe: seepage.	Severe: seepage.	Poor: small stones.
35 Nobscot	Slight	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: too sandy.
36*:					
Obaro	Moderate: percs slowly, depth to rock.	Severe: depth to rock.	Moderate: depth to rock.	Moderate: slope.	Fair: thin layer.
Quinlan	Severe: depth to rock.	Severe: seepage, slope.	Moderate: depth to rock, seepage.	Severe: seepage.	Poor: thin layer.
37 Olton	Moderate: percs slowly.	Slight	Moderate: too clayey.	Slight	Fair: too clayey.
38 Olton	Moderate: percs slowly.	Moderate: slope.	Moderate: too clayey.	Slight	Fair: too clayey.
39, 40 Paloduro	Slight	Moderate: seepage.	Slight	Slight	Good.
41 Potter	Slight	Severe: seepage, small stones.	Severe: seepage.	Severe: seepage.	Poor: small stones.
42 Pullman	Severe: percs slowly.	Slight	Severe: too clayey.	Slight	Poor: too clayey.
43 Pullman	Severe: percs slowly.	Moderate: slope.	Severe: too clayey.	Slight	Poor: too clayey.
44 Randall	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: floods.	Poor: too clayey, wetness.
45, 46, 47 Springer	Slight	Severe: seepage.	Slight	Slight	Fair: too sandy.
48 Springer	Slight	Severe: seepage.	Slight	Slight	Good.
49 Spur	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Fair: too clayey.
50* Sweetwater	Severe: floods, wetness.	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Poor: wetness.
51 Tivoli	Moderate: slope.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: too sandy.
52, 53 Veal	Slight	Moderate: slope, seepage.	Slight	Slight	Good.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
1, 2, 3 Acuff	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
4 Altus	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
5, 6 Aspermont	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
7*:				
Berda	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Estacado	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
Potter	Good	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
8*:				
Berda	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
Potter	Good	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
Rock outcrop.				
9, 10 Bippus	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
11*:				
Burson	Poor: slope, thin layer.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope, thin layer.
Aspermont	Fair: slope, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: slope.
12, 13 Carey	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Fair: thin layer.
14 Clairemont	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
15 Delwin	Good	Poor: thin layer.	Unsuited: excess fines.	Poor: too sandy.
16, 17, 18 Estacado	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
19 Guadalupe	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
20 Likes	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
21 Lincoln	Good	Fair: excess fines.	Unsuited: excess fines.	Fair: too sandy.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
22, 23, 24 Miles	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too sandy.
25, 26, 27, 28 Miles	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: thin layer.
29, 30 Mobeetie	Good	Unsuited: excess fines.	Unsuited: excess fines.	Good.
31 Mobeetie	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
32*:				
Mobeetie	Poor: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Badland.				
33*:				
Mobeetie	Fair: slope.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Polar	Moderate: slope.	Poor: excess fines.	Fair: excess fines.	Poor: small stones.
34*:				
Mobeetie	Good	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Veal	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.
Potter	Good	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
35 Nobscot	Fair: low strength.	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.
36*:				
Obaro	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: slope.
Quinlan	Poor: area reclaim.	Unsuited: excess fines, thin layer.	Unsuited: excess fines.	Fair: area reclaim, slope.
37, 38 Olton	Poor: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
39, 40 Paloduro	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Good.
41 Potter	Good	Unsuited: excess fines.	Unsuited: excess fines.	Poor: thin layer, small stones.
42, 43 Pullman	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
44 Randall	Poor: shrink-swell, low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Poor: too clayey.
45, 46, 47 Springer	Good	Poor: excess fines.	Unsuited: excess fines.	Poor: too sandy.

See footnote at end of table.

TABLE 10.--CONSTRUCTION MATERIALS--Continued

Soil name and map symbol	Roadfill	Sand	Gravel	Topsoil
48 Springer	Good	Poor: excess fines.	Unsuited: excess fines.	Good.
49 Spur	Fair: low strength, shrink-swell.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: too clayey.
50* Sweetwater	Poor: wetness.	Fair: excess fines.	Unsuited: excess fines.	Poor: wetness.
51 Tivoli	Good	Fair	Unsuited: excess fines.	Poor: too sandy.
52, 53 Veal	Fair: low strength.	Unsuited: excess fines.	Unsuited: excess fines.	Fair: excess lime.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
1, 2, 3 Acuff	Moderate: seepage.	Slight	Severe: no water.	Favorable	Favorable	Favorable.
4 Altus	Moderate: seepage.	Moderate: unstable fill, piping, compressible.	Severe: no water.	Favorable	Favorable	Favorable.
5, 6 Aspermont	Moderate: seepage.	Slight	Severe: no water.	Slope, erodes easily.	Slope	Erodes easily, slope.
7*:						
Berda	Moderate: seepage.	Slight	Severe: no water.	Slope, erodes easily, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Estacado	Moderate: seepage.	Slight	Severe: no water.	Erodes easily, slope.	Favorable	Favorable.
Potter	Severe: seepage.	Severe: thin layer, seepage.	Severe: no water.	Rooting depth, droughty, complex slope.	Slope, rooting depth.	Droughty, rooting depth, slope.
8*:						
Berda	Moderate: seepage.	Slight	Severe: no water.	Slope, erodes easily, soil blowing.	Slope, erodes easily, soil blowing.	Slope, erodes easily.
Potter	Severe: seepage.	Severe: thin layer, seepage.	Severe: no water.	Rooting depth, droughty, complex slope.	Slope, rooting depth.	Droughty, rooting depth, slope.
Rock outcrop.						
9 Bippus	Moderate: seepage.	Slight	Severe: no water.	Floods	Favorable	Favorable.
10 Bippus	Moderate: seepage.	Slight	Severe: no water.	Erodes easily	Favorable	Favorable.
11*:						
Burson	Severe: depth to rock, seepage.	Severe: thin layer.	Severe: deep to water.	Rooting depth	Slope, depth to rock.	Slope, rooting depth.
Aspermont	Moderate: seepage.	Slight	Severe: no water.	Slope, erodes easily.	Slope	Erodes easily, slope.
12, 13 Carey	Moderate: seepage.	Moderate: seepage, piping.	Severe: no water.	Erodes easily	Erodes easily	Erodes easily.
14 Clairemont	Moderate: seepage.	Slight	Severe: no water.	Floods	Not needed	Erodes easily.
15 Delwin	Moderate: seepage.	Slight	Severe: no water.	Fast intake, soil blowing.	Too sandy, soil blowing.	Favorable.
16, 17, 18 Estacado	Moderate: seepage.	Slight	Severe: no water.	Erodes easily, slope.	Favorable	Favorable.
19 Guadalupe	Severe: seepage.	Moderate: piping, seepage.	Severe: deep to water.	Fast intake, floods.	Erodes easily, poor outlets.	Erodes easily.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
20 Likes	Severe: seepage.	Severe: erodes easily, seepage, piping.	Severe: deep to water.	Erodes easily, fast intake.	Too sandy	Erodes easily.
21 Lincoln	Severe: seepage.	Severe: seepage.	Severe: no water.	Fast intake, floods, soil blowing.	Not needed	Droughty.
22, 23, 24, 25, 26, 27, 28 Miles	Moderate: seepage.	Slight	Severe: no water.	Fast intake, soil blowing, slope.	Soil blowing	Favorable.
29, 30, 31 Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
32*:						
Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Badland.						
33*:						
Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Polar	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, droughty, fast intake.	Complex slope, piping.	Droughty, slope, erodes easily.
34*:						
Mobeetie	Severe: seepage.	Moderate: piping, seepage.	Severe: no water.	Complex slope, fast intake, erodes easily.	Complex slope, erodes easily, too sandy.	Droughty, erodes easily, slope.
Veal	Moderate: seepage.	Moderate: low strength, piping.	Severe: no water.	Complex slope, droughty, excess lime.	Erodes easily, slope.	Droughty, erodes easily, slope.
Potter	Severe: seepage.	Severe: thin layer, seepage.	Severe: no water.	Rooting depth, droughty, complex slope.	Slope, rooting depth.	Droughty, rooting depth, slope.
35 Nobscot	Severe: seepage.	Moderate: unstable fill, compressible, piping.	Severe: no water.	Fast intake, seepage, droughty.	Not needed	Droughty, erodes easily, fast intake.
36*:						
Obaro	Severe: depth to rock.	Moderate: thin layer.	Severe: no water.	Rooting depth, complex slope.	Depth to rock, erodes easily, slope.	Erodes easily, slope.
Quinlan	Severe: depth to rock.	Severe: thin layer.	Severe: no water.	Droughty, slope, rooting depth.	Depth to rock, slope.	Droughty, slope, rooting depth.
37, 38 Olton	Moderate: seepage.	Moderate: piping.	Severe: no water.	Slow intake	Favorable	Favorable.
39, 40 Paloduro	Moderate: seepage.	Moderate: piping, erodes easily.	Severe: no water.	Favorable	Favorable	Favorable.

See footnote at end of table.

TABLE 11.--WATER MANAGEMENT--Continued

Soil name and map symbol	Limitations for-- Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Features affecting-- Irrigation	Terraces and diversions	Grassed waterways
41 Potter	Severe: seepage.	Severe: thin layer, seepage.	Severe: no water.	Rooting depth, droughty, complex slope.	Slope, rooting depth.	Droughty, rooting depth, slope.
42, 43 Pullman	Slight	Moderate: shrink-swell, low strength.	Severe: no water.	Slow intake	Favorable	Favorable.
44 Randall	Slight	Moderate: unstable fill, hard to pack.	Severe: deep to water.	Slow intake, wetness.	Not needed	Not needed.
45, 46, 47, 48 Springer	Severe: seepage.	Moderate: seepage, piping.	Severe: deep to water.	Fast intake, erodes easily.	Too sandy, erodes easily.	Erodes easily.
49 Spur	Moderate: seepage.	Moderate: low strength, shrink-swell.	Severe: deep to water.	Favorable	Favorable	Favorable.
50* Sweetwater	Severe: seepage.	Moderate: low strength, unstable fill.	Slight	Floods, wetness.	Floods, wetness.	Wetness.
51 Tivoli	Severe: seepage.	Severe: unstable fill, seepage, piping.	Severe: deep to water.	Complex slope, erodes easily, droughty.	Complex slope, erodes easily, fast intake.	Erodes easily, droughty, seepage.
52, 53 Veal	Moderate: seepage.	Moderate: low strength, piping.	Severe: no water.	Complex slope, droughty, excess lime.	Erodes easily, slope.	Droughty, erodes easily, slope.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
1 Acuff	Slight	Slight	Slight	Slight.
2, 3 Acuff	Slight	Slight	Moderate: slope.	Slight.
4 Altus	Slight	Slight	Slight	Slight.
5, 6 Aspermont	Slight	Slight	Moderate: too clayey, slope.	Slight.
7*:				
Berda	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Estacado	Slight	Slight	Severe: slope.	Slight.
Potter	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
8*:				
Berda	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Potter	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Rock outcrop.				
9 Bippus	Severe: floods.	Moderate: floods, too clayey.	Severe: floods.	Moderate: too clayey.
10 Bippus	Severe: floods.	Moderate: floods, too clayey.	Moderate: too clayey.	Moderate: too clayey.
11*:				
Burson	Severe: slope.	Severe: slope.	Severe: depth to rock, slope.	Severe: slope.
Aspermont	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
12 Carey	Slight	Slight	Slight	Slight.
13 Carey	Slight	Slight	Moderate: slope.	Slight.
14 Clairemont	Severe: floods.	Slight	Moderate: floods.	Slight.
15 Delwin	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.
16 Estacado	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.	Moderate: too clayey.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
17, 18 Estacado	Moderate: too clayey.	Moderate: too clayey.	Moderate: slope, too clayey.	Moderate: too clayey.
19 Guadalupe	Severe: floods.	Slight	Moderate: floods.	Slight.
20 Likes	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
21 Lincoln	Severe: floods.	Moderate: too sandy, floods.	Severe: floods.	Moderate: floods, too sandy.
22 Miles	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
23, 24 Miles	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
25 Miles	Slight	Slight	Slight	Slight.
26, 27, 28 Miles	Slight	Slight	Moderate: slope.	Slight.
29, 30 Mobeetie	Slight	Slight	Moderate: slope.	Slight.
31 Mobeetie	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
32*:				
Mobeetie	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.
Badland.				
33*:				
Mobeetie	Severe: slope.	Severe: slope.	Severe: slope.	Moderate: slope.
Polar	Severe: slope.	Severe: slope.	Severe: slope, small stones.	Moderate: small stones.
34*:				
Mobeetie	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Veal	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Potter	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
35 Nobscot	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
36*:				
Obaro	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Quinlan	Moderate: slope.	Moderate: slope.	Severe: depth to rock, slope.	Slight.

See footnote at end of table.

TABLE 12.--RECREATIONAL DEVELOPMENT--Continued

Soil name and map symbol	Camp areas	Picnic areas	Playgrounds	Paths and trails
37, 38 Olton	Moderate: percs slowly.	Moderate: too clayey.	Moderate: percs slowly.	Moderate: too clayey.
39 Paloduro	Slight	Slight	Moderate: slope.	Slight.
40 Paloduro	Slight	Slight	Severe: slope.	Slight.
41 Potter	Slight	Slight	Moderate: slope, small stones.	Slight.
42, 43 Pullman	Moderate: percs slowly, too clayey.	Moderate: too clayey.	Moderate: percs slowly, too clayey.	Moderate: too clayey.
44 Randall	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
45 Springer	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.	Moderate: too sandy.
46, 47 Springer	Moderate: too sandy.	Moderate: too sandy.	Moderate: slope, too sandy.	Moderate: too sandy.
48 Springer	Slight	Slight	Severe: slope.	Slight.
49 Spur	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: floods.
50* Sweetwater	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness.
51 Tivoli	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.	Severe: too sandy, dusty.
52, 53 Veal	Slight	Slight	Moderate: slope.	Slight.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 13.--WILDLIFE HABITAT POTENTIALS

[See text for definitions of "good," "fair," "poor," and "very poor." Absence of an entry indicates that the soil was not rated]

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
1, 2, 3 Acuff	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
4 Altus	Good	Good	Good	Good	Poor	Very poor	Good	Very poor	Good.
5, 6 Aspermont	Fair	Good	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
7*:									
Berda	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Estacado	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Potter	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
8*:									
Berda	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Potter	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
Rock outcrop.									
9 Bippus	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
10 Bippus	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
11*:									
Burson	Very poor	Very poor	Poor	Very poor	Very poor	Very poor	Very poor	Very poor	Very poor.
Aspermont	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
12, 13 Carey	Good	Good	Fair	Fair	Very poor	Very poor	Good	Very poor	Fair.
14 Clairemont	Good	Good	Fair	Good	Very poor	Very poor	Good	---	Fair.
15 Delwin	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
16, 17, 18 Estacado	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
19 Guadalupe	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
20 Likes	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
21 Lincoln	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
22, 23, 24 Miles	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
25, 26, 27, 28 Miles	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
29, 30 Mobeetie	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

See footnote at end of table.

TABLE 13.--WILDLIFE HABITAT POTENTIALS--Continued

Soil name and map symbol	Potential for habitat elements						Potential as habitat for--		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Wetland wildlife	Rangeland wildlife
31---------- Mobeetie	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
32*:									
Mobeetie----------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Badland.									
33*:									
Mobeetie----------	Very poor	Very poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
Polar----------	Poor	Poor	Fair	Fair	Very poor	Very poor	Poor	Very poor	Fair.
34*:									
Mobeetie----------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Veal----------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Potter----------	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
35---------- Nobscot	Fair	Fair	Good	Good	Poor	Very poor	Fair	Very poor	Good.
36*:									
Obaro----------	Poor	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
Quinlan----------	Poor	Poor	Fair	Poor	Very poor	Very poor	Fair	Very poor	Poor.
37, 38---------- Olton	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
39, 40---------- Paloduro	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
41---------- Potter	Very poor	Very poor	Poor	Poor	Very poor	Very poor	Very poor	Very poor	Poor.
42, 43---------- Pullman	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.
44---------- Randall	Poor	Poor	Fair	Poor	Poor	Fair	Poor	Poor	Poor.
45, 46, 47--------- Springer	Poor	Fair	Good	Good	Very poor	Very poor	Fair	Very poor	Good.
48---------- Springer	Fair	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
49---------- Spur	Good	Good	Good	Good	Very poor	Very poor	Good	Very poor	Good.
50*---------- Sweetwater	Poor	Fair	Good	Fair	Good	Good	Fair	Good	Fair.
51---------- Tivoli	Poor	Poor	Fair	Poor	Very poor	Very poor	Poor	Very poor	Poor.
52, 53---------- Veal	Fair	Fair	Fair	Fair	Very poor	Very poor	Fair	Very poor	Fair.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS

[The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated]

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
1, 2, 3---------- Acuff	0-6	Loam----------	CL	A-4, A-6	0	100	95-100	95-100	51-70	24-32	8-16
	6-48	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	100	95-100	95-100	65-75	28-45	12-25
	48-80	Clay loam, sandy clay loam, loam.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-75	25-42	12-25
4---------- Altus	0-12	Fine sandy loam	SM, ML, SC, CL	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	12-65	Fine sandy loam, sandy clay loam.	SM, ML, SC, CL	A-4, A-6	0	100	98-100	90-100	36-65	<37	NP-16
5, 6---------- Aspermont	0-25	Silty clay loam	CL	A-7-6, A-6	0	100	98-100	90-100	51-90	30-45	12-28
	25-45	Loam, silty clay loam, clay loam.	CL	A-7-6, A-6	0	100	95-100	80-98	51-95	30-45	12-28
	45-70	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	95-100	85-100	51-95	25-45	8-30
7*:											
Berda----------	0-9	Loam----------	SC, CL, SM-SC, CL-ML	A-4, A-6	0-3	85-100	85-100	75-95	36-70	20-35	7-20
	9-60	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	75-95	40-75	20-35	7-20
Estacado----------	0-15	Loam----------	CL	A-6, A-4	0	95-100	95-100	55-100	51-90	25-40	8-20
	15-24	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	24-80	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
Potter----------	0-11	Loam----------	CL, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	11-60	Variable--------	GC, SC, GM-GC, SM-SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
8*:											
Berda----------	0-9	Loam----------	SC, CL, SM-SC, CL-ML	A-4, A-6	0-3	85-100	85-100	75-95	36-70	20-35	7-20
	9-60	Loam, clay loam, sandy clay loam.	SC, CL, SM-SC, CL-ML	A-4, A-6	0	85-100	85-100	75-95	40-75	20-35	7-20
Potter----------	0-11	Loam----------	CL, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	11-60	Variable--------	GC, SC, GM-GC, SM-SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
Rock outcrop.											
9, 10---------- Bippus	0-12	Clay loam-------	CL, SC, SM-SC	A-4, A-6	0	100	95-100	85-98	36-80	22-40	7-20
	12-80	Clay loam, loam, sandy clay loam.	SC, CL, SM-SC	A-4, A-6	0	100	95-100	85-98	36-75	22-40	7-20

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
11*:											
Burson	0-6	Silt loam	ML, CL, CL-ML	A-4, A-6	0	95-100	90-100	80-100	50-85	18-30	3-12
	6-60	Weathered bedrock, variable.	---	---	---	---	---	---	---	---	---
Aspermont	0-25	Silty clay loam	CL	A-7-6, A-6	0	100	98-100	90-100	51-90	30-45	12-28
	25-45	Loam, silty clay loam, clay loam.	CL	A-7-6, A-6	0	100	95-100	80-98	51-95	30-45	12-28
	45-70	Silt loam, loam, silty clay loam.	CL	A-4, A-6, A-7	0	100	95-100	85-100	51-95	25-45	8-30
12, 13 Carey	0-9	Loam	CL, ML, CL-ML	A-4, A-6	0	100	98-100	90-100	51-90	20-32	3-15
	9-55	Silty clay loam, clay loam, loam.	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	60-95	25-40	5-20
	55-80	Silt loam, loam, very fine sandy loam.	CL, ML, CL-ML, SM	A-4, A-6	0	100	90-100	85-100	44-85	20-35	3-12
14 Clairemont	0-65	Silt loam	CL, CL-ML	A-4, A-6	0	100	98-100	95-100	51-95	25-40	7-20
15 Delwin	0-15	Fine sand	SM, SM-SC, SP-SM	A-2-4, A-3	0	100	85-100	85-100	9-25	<24	NP-4
	15-80	Sandy clay loam, fine sandy loam.	SC, SM-SC	A-2-4, A-2-6, A-4, A-6	0	100	90-100	90-100	15-40	20-35	4-15
16, 17, 18 Estacado	0-15	Clay loam	CL	A-6, A-4	0	95-100	95-100	55-100	51-90	25-40	8-20
	15-24	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	85-100	55-90	30-42	12-25
	24-80	Clay loam, sandy clay loam.	CL	A-6, A-7-6	0	95-100	95-100	80-100	60-95	30-45	13-25
19 Guadalupe	0-34	Fine sandy loam	SM, SC, SM-SC	A-2, A-4	0	95-100	95-100	70-99	25-50	18-30	2-10
	34-65	Loamy fine sand, fine sandy loam.	SM, SM-SC	A-2, A-4	0	95-100	90-100	55-90	20-40	<24	NP-5
20 Likes	0-66	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4	0-2	90-100	90-98	75-95	10-30	<25	NP-6
21 Lincoln	0-8	Loamy fine sand	SM	A-2	0	100	98-100	90-100	15-35	---	NP
	8-60	Stratified fine sand to clay loam.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
22, 23, 24 Miles	0-7	Loamy fine sand	SM, SM-SC	A-2-4	0	95-100	90-100	80-98	15-35	<22	NP-4
	7-80	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	90-100	90-98	30-72	20-40	4-22

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Fragments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plasticity index
	In				Pct					Pct	
25, 26, 27, 28----- Miles	0-7	Fine sandy loam	SM, SM-SC, CL-ML, ML	A-2-4, A-4	0	95-100	90-100	80-98	25-55	18-25	2-7
	7-80	Sandy clay loam, clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6, A-2-4, A-2-6	0	95-100	90-100	90-98	30-72	20-40	4-22
29, 30, 31--------- Mobeetie	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
32*:											
Mobeetie----------	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Badland.											
33*:											
Mobeetie----------	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Polar----------	0-7	Very gravelly sandy loam.	GM, SC, SM, SM-SC	A-1, A-2	0-2	50-90	30-60	25-50	15-30	<30	NP-11
	7-50	Very gravelly sandy loam, very gravelly loam, very gravelly loamy sand.	GC, SM, GM, GM-GC	A-1, A-2	0-2	45-80	25-50	15-45	10-25	<25	NP-8
34*:											
Mobeetie----------	0-60	Fine sandy loam	CL-ML, SM-SC, SM, ML	A-4, A-2-4	0-5	90-100	90-98	80-95	30-65	18-25	2-7
Veal----------	0-6	Fine sandy loam	SM, SC, SM-SC	A-2-4, A-4	0	90-100	85-100	70-98	30-50	15-25	3-10
	6-12	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	80-100	40-80	22-40	7-20
	12-80	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	65-100	35-80	22-40	7-20
Potter----------	0-11	Loam----------	CL, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	11-60	Variable---------	GC, SC, GM-GC, SM-SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
35---------- Nobscot	0-6	Fine sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
	6-27	Fine sand-------	SM, SP-SM	A-2, A-3	0	100	98-100	82-98	5-25	---	NP
	27-62	Fine sandy loam	ML, SM, CL, SC	A-4	0	100	98-100	94-100	36-60	<30	NP-10
	62-80	Loamy fine sand, fine sand.	SM, SP-SM	A-2, A-3	0	100	98-100	82-100	5-35	---	NP
36*:											
Obaro----------	0-32	Silty clay loam	CL, CL-ML, ML	A-4, A-6	0	98-100	95-100	95-100	80-98	25-40	7-20
	32-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification: Unified	Classification: AASHTO	Frag- ments > 3 inches	Percentage passing sieve number--: 4	10	40	200	Liquid limit	Plas- ticity index
	In				Pct					Pct	
36*:											
Quinlan	0-12	Loam	ML, CL, CL-ML	A-4, A-6	0	100	95-100	90-100	55-97	<37	NP-14
	12-60	Weathered bedrock.	---	---	---	---	---	---	---	---	---
37, 38 Olton	0-6	Clay loam	CL	A-4, A-6	0	100	95-100	85-100	55-80	25-35	8-18
	6-47	Clay loam, silty clay loam, clay.	CL	A-6, A-7-6	0	95-100	90-100	90-100	60-95	35-50	18-32
	47-80	Clay loam, sandy clay loam, loam.	CL	A-4, A-6	0	90-100	85-100	80-100	60-85	20-40	8-25
39, 40 Paloduro	0-12	Loam	CL, SC	A-4, A-6	0	95-100	95-100	80-95	40-75	20-35	8-20
	12-60	Loam, clay loam, sandy clay loam.	CL, SC	A-4, A-6	0	95-100	95-100	80-95	40-75	20-35	8-20
41 Potter	0-11	Loam	CL, CL-ML	A-4, A-6	0-5	70-95	70-95	60-85	51-70	20-40	5-20
	11-60	Variable	GC, SC, GM-GC, SM-SC	A-2-4, A-4, A-6, A-2-6	5-50	30-80	25-75	20-60	13-50	20-40	5-20
42, 43 Pullman	0-6	Clay loam	CL	A-6, A-7-6	0	100	100	95-100	70-90	30-50	15-30
	6-44	Clay, silty clay	CL, CH	A-7-6	0	100	100	95-100	85-98	41-55	22-35
	44-80	Clay loam, clay, silty clay.	CL	A-6, A-7-6	0	95-100	90-100	80-100	75-95	30-50	15-30
44 Randall	0-75	Clay	CL, CH	A-7-6	0	100	100	95-100	75-98	41-70	22-45
45, 46, 47 Springer	0-16	Loamy fine sand	SM, SP-SM, SM-SC	A-2-4, A-3	0	98-100	95-100	70-96	8-25	<22	NP-4
	16-40	Fine sandy loam	SM, SM-SC	A-2-4	0	98-100	95-100	75-99	11-35	18-25	2-7
	40-48	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3	0	98-100	95-100	70-96	8-25	<22	NP-4
	48-72	Fine sandy loam, sandy clay loam.	SM, SM-SC, SC	A-2-4, A-4	0	98-100	95-100	75-99	11-45	18-25	2-8
48 Springer	0-16	Fine sandy loam	SM, SM-SC	A-2-4	0	98-100	95-100	75-99	11-35	18-25	2-7
	16-40	Fine sandy loam	SM, SM-SC	A-2-4	0	98-100	95-100	75-99	11-35	18-25	2-7
	40-48	Loamy sand, loamy fine sand, fine sand.	SM, SP-SM, SM-SC	A-2-4, A-3	0	98-100	95-100	70-96	8-25	<22	NP-4
	48-72	Fine sandy loam, sandy clay loam.	SM, SM-SC, SC	A-2-4, A-4	0	98-100	95-100	75-99	11-45	18-25	2-8
49 Spur	0-18	Clay loam	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	51-95	25-45	7-25
	18-60	Loam, clay loam, sandy clay loam.	CL, SC, SM-SC, CL-ML	A-4, A-6	0	100	95-100	90-100	45-95	22-45	7-25
50* Sweetwater	0-26	Clay loam	CL, CL-ML, SC	A-4, A-6	0	100	95-100	80-95	40-70	25-40	7-20
	26-60	Loamy fine sand, fine sand.	SM	A-2	0	95-100	90-100	50-80	15-35	<22	NP-2
51 Tivoli	0-6	Fine sand	SM, SP-SM	A-2, A-3	0	100	98-100	80-100	5-35	---	NP
	6-60	Fine sand, sand	SM, SP-SM	A-2, A-3	0	100	98-100	80-98	5-20	---	NP

See footnote at end of table.

TABLE 14.--ENGINEERING PROPERTIES AND CLASSIFICATIONS--Continued

Soil name and map symbol	Depth	USDA texture	Classification		Frag- ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas- ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
52, 53---------- Veal	0-6	Fine sandy loam	SM, SC, SM-SC	A-2-4, A-4	0	90-100	85-100	70-98	30-50	15-25	3-10
	6-12	Sandy clay loam, clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	80-100	40-80	22-40	7-20
	12-80	Clay loam, sandy clay loam, loam.	CL, SC, CL-ML, SM-SC	A-4, A-6	0-2	85-100	80-100	65-100	35-80	22-40	7-20

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS

[The symbol < means less than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Soil name and map symbol	Depth	Permea- bility	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		Wind erodibility group
						K	T	
	In	In/hr	In/in	pH				
1, 2, 3---------- Acuff	0-6	0.6-2.0	0.12-0.18	6.6-7.8	Low----------	0.28	5	5
	6-48	0.6-2.0	0.14-0.19	7.4-8.4	Low----------	0.32		
	48-80	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.32		
4---------- Altus	0-12	2.0-6.0	0.11-0.15	6.1-7.3	Low----------	0.24	5	3
	12-65	0.6-2.0	0.11-0.17	6.6-8.4	Low----------	0.32		
5, 6---------- Aspermont	0-25	0.6-2.0	0.16-0.22	7.9-8.4	Moderate------	0.32	4	4L
	25-45	0.6-2.0	0.12-0.18	7.9-8.4	Moderate------	0.32		
	45-70	0.6-2.0	0.10-0.18	7.9-8.4	Moderate------	0.32		
7*:								
Berda----------	0-9	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.28	5	4L
	9-60	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.28		
Estacado--------	0-15	0.6-2.0	0.14-0.19	7.9-8.4	Low----------	0.28	5	4L
	15-24	0.6-2.0	0.12-0.18	7.9-8.4	Low----------	0.32		
	24-80	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.32		
Potter----------	0-11	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.28	1	---
	11-60	0.6-6.0	0.-0.06	7.9-8.4	Low----------	---		
8*:								
Berda----------	0-9	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.28	5	4L
	9-60	0.6-2.0	0.14-0.18	7.9-8.4	Low----------	0.28		
Potter----------	0-11	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.28	1	---
	11-60	0.6-6.0	0.-0.06	7.9-8.4	Low----------	---		
Rock outcrop.								
9, 10---------- Bippus	0-12	0.6-2.0	0.14-0.20	7.4-8.4	Moderate------	0.28	5	6
	12-80	0.6-2.0	0.14-0.20	7.9-8.4	Moderate------	0.28		
11*:								
Burson----------	0-6	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.43	1	---
	6-60	---	---	---	----------	---		
Aspermont-------	0-25	0.6-2.0	0.16-0.22	7.9-8.4	Moderate------	0.32	4	4L
	25-45	0.6-2.0	0.12-0.18	7.9-8.4	Moderate------	0.32		
	45-70	0.6-2.0	0.10-0.18	7.9-8.4	Moderate------	0.32		
12, 13---------- Carey	0-9	0.6-2.0	0.15-0.20	6.6-7.8	Low----------	0.43	5	6
	9-55	0.6-2.0	0.15-0.20	6.6-8.4	Low----------	0.43		
	55-80	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.43		
14---------- Clairemont	0-65	0.6-2.0	0.16-0.22	7.9-8.4	Low----------	0.43	5	6
15---------- Delwin	0-15	6.0-20	0.04-0.10	6.1-7.3	Very low------	0.17	5	1
	15-80	0.6-2.0	0.12-0.16	6.6-8.4	Low----------	0.24		
16, 17, 18------- Estacado	0-15	0.6-2.0	0.14-0.19	7.9-8.4	Low----------	0.28	5	4L
	15-24	0.6-2.0	0.12-0.18	7.9-8.4	Low----------	0.32		
	24-80	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.32		
19---------- Guadalupe	0-34	2.0-6.0	0.10-0.15	7.9-8.4	Low----------	0.28	4	3
	34-65	2.0-6.0	0.06-0.10	7.9-8.4	Very low------	0.17		
20---------- Likes	0-66	2.0-6.0	0.04-0.10	7.4-8.4	Very low------	0.15	5	2

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
21---------- Lincoln	0-8	6.0-20	0.06-0.11	7.4-8.4	Low----------	0.17	5	2
	8-60	6.0-20	0.02-0.08	7.9-8.4	Low----------	0.17		
22, 23, 24------- Miles	0-7	2.0-6.0	0.06-0.10	6.6-7.8	Low----------	0.20	5	2
	7-80	0.6-2.0	0.12-0.18	6.6-8.4	Low----------	0.32		
25, 26, 27, 28--- Miles	0-7	2.0-6.0	0.10-0.15	6.6-7.8	Low----------	0.24	5	3
	7-80	0.6-2.0	0.12-0.18	6.6-8.4	Low----------	0.32		
29, 30, 31------- Mobeetie	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
32*:								
Mobeetie--------	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
Badland.								
33*:								
Mobeetie--------	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
Polar----------	0-7	2.0-6.0	0.05-0.09	7.9-8.4	Very low------	0.10	2	---
	7-50	2.0-6.0	0.03-0.08	7.9-8.4	Very low------	0.10		
34*:								
Mobeetie--------	0-60	2.0-6.0	0.10-0.14	7.9-8.4	Low----------	0.24	3	3
Veal----------	0-6	2.0-6.0	0.10-0.15	7.9-8.4	Low----------	0.24	4	3
	6-12	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.28		
	12-80	0.6-2.0	0.10-0.15	7.9-8.4	Low----------	0.28		
Potter----------	0-11	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.28	1	---
	11-60	0.6-6.0	0.-0.06	7.9-8.4	Low----------	---		
35---------- Nobscot	0-6	6.0-20.0	0.07-0.11	5.6-7.3	Low----------	0.17	5	1
	6-27	6.0-20.0	0.05-0.08	5.6-7.3	Low----------	0.17		
	27-62	2.0-6.0	0.11-0.15	5.1-6.5	Low----------	0.20		
	62-80	2.0-6.0	0.05-0.11	6.1-7.3	Low----------	0.17		
36*:								
Obaro----------	0-32	0.6-2.0	0.14-0.20	7.9-8.4	Low----------	0.43	3	4L
	32-60	---	---	---	----------	---		
Quinlan---------	0-12	2.0-6.0	0.15-0.20	7.4-8.4	Low----------	0.32	2	5
	12-60	---	---	---	----------	---		
37, 38---------- Olton	0-6	0.6-2.0	0.15-0.20	6.6-8.4	Moderate------	0.32	5	6
	6-47	0.2-0.6	0.14-0.19	7.4-8.4	Moderate------	0.32		
	47-80	0.2-0.6	0.10-0.16	7.9-8.4	Moderate------	0.32		
39, 40---------- Paloduro	0-12	0.6-2.0	0.15-0.20	7.9-8.4	Low----------	0.28	5	6
	12-60	0.6-2.0	0.12-0.18	7.9-8.4	Low----------	0.28		
41---------- Potter	0-11	0.6-2.0	0.10-0.16	7.9-8.4	Low----------	0.28	1	---
	11-60	0.6-6.0	0.-0.06	7.9-8.4	Low----------	---		
42, 43---------- Pullman	0-6	0.2-0.6	0.14-0.19	6.6-8.4	Moderate------	0.37	5	6
	6-44	<0.06	0.12-0.17	7.4-8.4	High----------	0.37		
	44-80	0.06-0.2	0.10-0.16	7.9-8.4	Moderate------	0.37		
44---------- Randall	0-75	<0.06	0.12-0.18	7.4-8.4	Very high-----	0.32	5	4
45, 46, 47------- Springer	0-16	6.0-20.0	0.06-0.10	6.6-7.8	Very low------	0.17	5	2
	16-40	2.0-6.0	0.10-0.15	6.6-8.4	Low----------	0.20		
	40-48	6.0-20.0	0.06-0.10	6.6-8.4	Very low------	0.20		
	48-72	0.6-6.0	0.10-0.16	6.6-8.4	Low----------	0.20		

See footnote at end of table.

TABLE 15.--PHYSICAL AND CHEMICAL PROPERTIES OF SOILS--Continued

Soil name and map symbol	Depth	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors K	Erosion factors T	Wind erodibility group
	In	In/hr	In/in	pH				
48---------- Springer	0-16	2.0-6.0	0.10-0.15	6.6-7.8	Low----------	0.20	5	3
	16-40	2.0-6.0	0.10-0.15	6.6-8.4	Low----------	0.20		
	40-48	6.0-20.0	0.06-0.10	6.6-8.4	Very low------	0.20		
	48-72	0.6-6.0	0.10-0.16	6.6-8.4	Low----------	0.20		
49---------- Spur	0-18	0.6-2.0	0.14-0.20	7.9-8.4	Moderate------	0.28	5	6
	18-60	0.6-2.0	0.14-0.20	7.9-8.4	Moderate------	0.28		
50*---------- Sweetwater	0-26	0.2-0.6	0.16-0.20	7.4-8.4	Low----------	0.28	3	---
	26-60	6.0-20	0.04-0.10	7.9-8.4	Very low------	0.17		
51---------- Tivoli	0-6	6.0-20.0	0.05-0.11	6.1-7.8	Low----------	0.17	5	1
	6-60	6.0-20.0	0.02-0.06	6.1-8.4	Low----------	0.17		
52, 53---------- Véal	0-6	2.0-6.0	0.10-0.15	7.9-8.4	Low----------	0.24	4	3
	6-12	0.6-2.0	0.10-0.18	7.9-8.4	Low----------	0.28		
	12-80	0.6-2.0	0.10-0.15	7.9-8.4	Low----------	0.28		

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 16.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched" are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
1, 2, 3---------- Acuff	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
4---------- Altus	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
5, 6---------- Aspermont	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
7*:											
Berda----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Estacado--------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Potter----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
8*:											
Berda----------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Potter----------	C	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
Rock outcrop.											
9, 10---------- Bippus	B	None to rare.	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
11*:											
Burson----------	C	None--------	---	---	>6.0	---	---	3-12	Rippable	Low------	Low.
Aspermont--------	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
12, 13---------- Carey	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
14---------- Clairemont	B	Occasional	Very brief	Apr-Nov	>6.0	---	---	>60	---	Moderate	Low.
15---------- Delwin	A	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
16, 17, 18-------- Estacado	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
19---------- Guadalupe	B	Occasional	Very brief	Apr-Sep	>6.0	---	---	>60	---	Low------	Low.
20---------- Likes	A	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
21---------- Lincoln	A	Frequent----	Very brief to brief.	Apr-Oct	5.0-8.0	Apparent	Nov-May	>60	---	Low------	Low.
22, 23, 24, 25, 26, 27, 28------- Miles	B	None--------	---	---	>6.0	---	---	>60	---	Moderate	Low.
29, 30, 31-------- Mobeetie	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
32*:											
Mobeetie---------	B	None--------	---	---	>6.0	---	---	>60	---	Low------	Low.
Badland.											

See footnote at end of table.

TABLE 16.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Bedrock		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Depth	Hardness	Uncoated steel	Concrete
					Ft			In			
33*:											
Mobeetie	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
Polar	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
34*:											
Mobeetie	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
Veal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
Potter	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
35 Nobscot	A	None	---	---	>6.0	---	---	>60	---	Low	Moderate.
36*:											
Obaro	B	None	---	---	>6.0	---	---	20-40	Rippable	Low	Low.
Quinlan	C	None	---	---	>6.0	---	---	10-20	Rippable	Moderate	Low.
37, 38 Olton	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
39, 40 Paloduro	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
41 Potter	C	None	---	---	>6.0	---	---	>60	---	Moderate	Low.
42, 43 Pullman	D	None	---	---	>6.0	---	---	>60	---	High	Low.
44 Randall	D	Common	Long to very long.	May-Nov	>6.0	---	---	>60	---	High	Low.
45, 46, 47, 48 Springer	B	None	---	---	>6.0	---	---	>60	---	Low	Low.
49 Spur	B	Occasional	Very brief	Apr-Oct	>6.0	---	---	>60	---	Moderate	Low.
50* Sweetwater	D	Common	Brief	Apr-Oct	0.5-3.0	Apparent	Jan-Dec	>60	---	High	Low.
51 Tivoli	A	None	---	---	>6.0	---	---	>60	---	Low	Low.
52, 53 Veal	B	None	---	---	>6.0	---	---	>60	---	Moderate	Low.

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 17.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Acuff	Fine-loamy, mixed, thermic Aridic Paleustolls
Altus	Fine-loamy, mixed, thermic Pachic Argiustolls
Berda	Fine-loamy, mixed, thermic Aridic Ustochrepts
Bippus	Fine-loamy, mixed, thermic Cumulic Haplustolls
Burson	Loamy, mixed (calcareous), thermic, shallow Ustic Torriorthents
Carey	Fine-silty, mixed, thermic Typic Argiustolls
Clairemont	Fine-silty, mixed (calcareous), thermic Typic Ustifluvents
Delwin	Fine-loamy, mixed, thermic Udic Paleustalfs
Estacado	Fine-loamy, mixed, thermic Calciorthidic Paleustolls
Guadalupe	Coarse-loamy, mixed, thermic Fluventic Ustochrepts
Likes	Mixed, thermic Typic Ustipsamments
Lincoln	Sandy, mixed, thermic Typic Ustifluvents
Miles	Fine-loamy, mixed, thermic Udic Paleustalfs
Mobeetie	Coarse-loamy, mixed, thermic Aridic Ustochrepts
Nobscot	Loamy, mixed, thermic Arenic Paleustalfs
Obaro	Fine-silty, mixed, thermic Typic Ustochrepts
Olton	Fine, mixed, thermic Aridic Paleustolls
Palodurо	Fine-loamy, mixed, thermic Aridic Haplustolls
Polar	Loamy-skeletal, mixed, thermic Ustollic Calciorthids
Potter	Loamy, carbonatic, thermic, shallow Ustollic Calciorthids
Pullman	Fine, mixed, thermic Torrertic Paleustolls
Quinlan	Loamy, mixed, thermic, shallow Typic Ustochrepts
Randall	Fine, montmorillonitic, thermic Udic Pellusterts
Springer	Coarse-loamy, mixed, thermic Udic Paleustalfs
Spur	Fine-loamy, mixed, thermic Fluventic Haplustolls
Sweetwater	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), thermic Fluvaquentic Haplaquolls
Tivoli	Mixed, thermic Typic Ustipsamments
Veal	Fine-loamy, carbonatic, thermic Aridic Ustochrepts

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