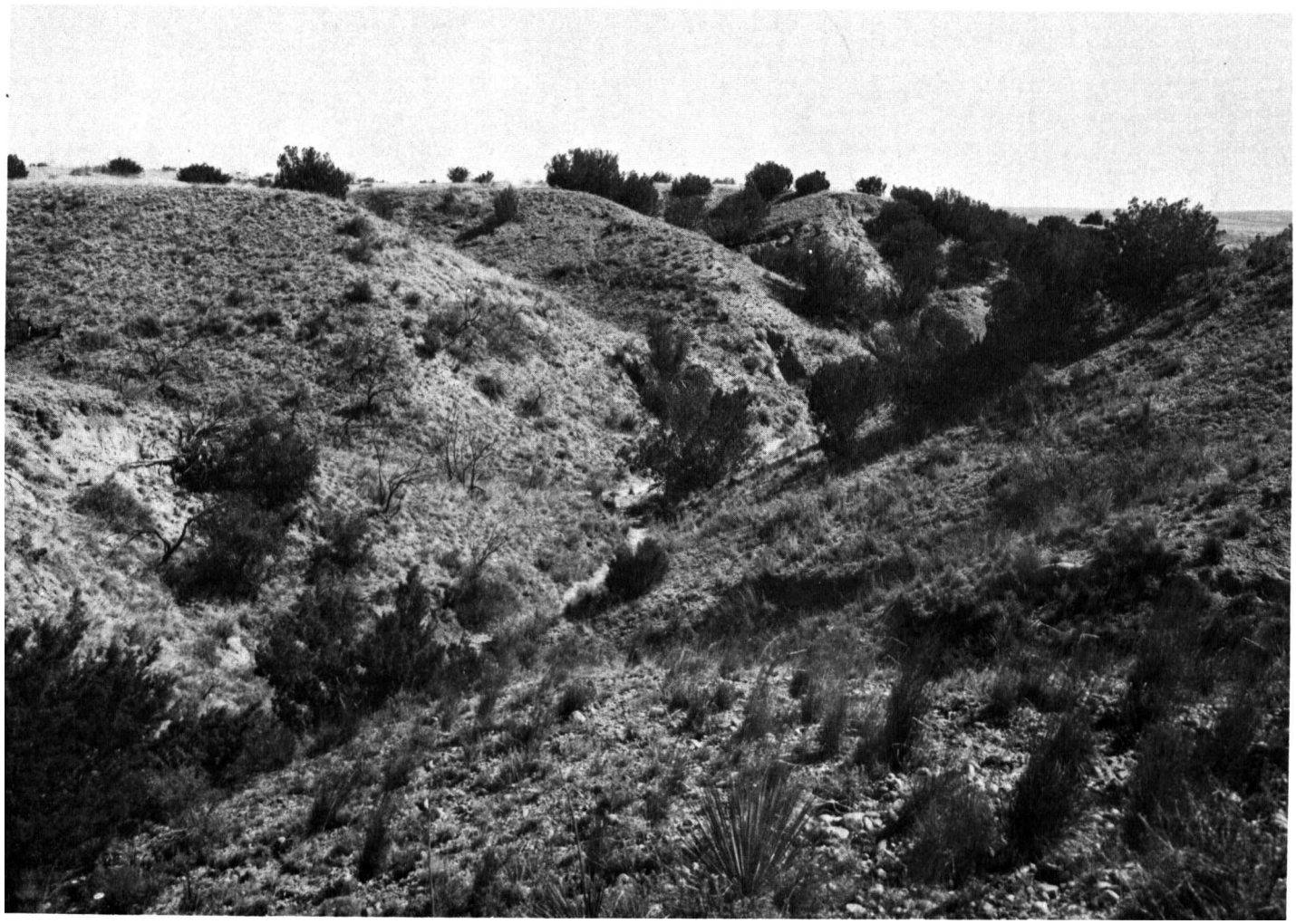
SOIL SURVEY OF

Motley County, Texas



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

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

Major fieldwork for this soil survey was completed in the period 1967–71. Soil names and descriptions were approved in 1972. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1971. 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 Upper Pease Soil and Water Conservation District.

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

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

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

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

Community planners and others can read about soil properties that affect the choice of sites for recreation areas in the section "Recreation."

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

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

Newcomers in Motley County may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication.

Cover: Typical area of Hilgrave gravelly sandy loam, 10 to 30 percent slopes, in Motley County.

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Issued July 1977

SOIL SURVEY OF MOTLEY COUNTY, TEXAS

BY WAYNE E. RICHARDSON, JOHNNY HAJEK, AND CONRAD NEITSCH, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH THE TEXAS AGRICULTURAL EXPERIMENT STATION

MOTLEY COUNTY is in the northwestern part of Texas (fig. 1). It has an area of 1,011 square miles, or 647,040 acres. Matador, the county seat, is near the center of the county.

Motley County is in the western part of the Rolling Plains resource area. The southwest corner of Motley County is in the High Plains resource area.

Motley County is an agricultural county, and income is mostly from farming and ranching enterprises. About 507,000 acres is rangeland, 127,600 acres is cropland, and 12,438 acres is water areas.

Cattle ranching is extensive, and several large ranches are in the county. The larger ranches are confined mostly to the rough, steep, and sandy areas that are unsuitable for cultivation.

The chief crops grown in the county are cotton, wheat, and grain sorghum. There are many areas of soils that are marginal for crops, especially where the soils are more sandy. These soils are better suited to grass than to other purposes. Some areas have been seeded to grass, but many other areas need to be seeded to grass.

In 1954, 700 farms were in Motley County, but by 1967 the number of farms had decreased to 510.

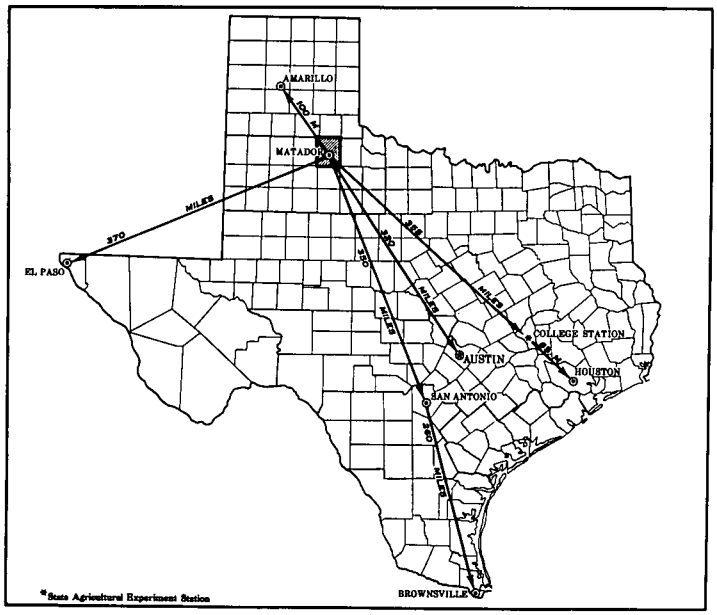

Figure 1.—Location of Motley County in Texas.

Drainage in the county is mainly from west to east. Most of the county is drained by the North, Middle, and South Pease Rivers and their tributaries. These rivers generally flow only during the wetter months. Springs, however, commonly occur along some of their tributaries in the central part of the county, producing a permanent flow of water.

Irrigation is confined mostly to the northwestern, south-central, and southwestern parts of the county. Most water is of poor quality except in the southwestern part of the county.

Elevation ranges from 3,000 feet in the southwest corner of the county to 1,800 feet in the northeast corner.

Motley County is mostly in the Upper Pease Soil and Water Conservation District. This district, organized in 1945, also includes Cottle County. About 6,000 acres in the north-central part of Motley County north of the Pease River is in the Hall-Childress Soil and Water Conservation District, which was organized in 1940.

How This Survey Was Made

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

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

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named

for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Obaro and Sagerton, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Obaro loam, 1 to 3 percent slopes, is one of several phases within the Obaro series.

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

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

Some mapping units are made up of soils of different series, or of different phases within one series. Three such kinds of mapping units are shown on the soil map of Motley County: the soil complex, the soil association, and the undifferentiated group.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Obaro-Burson complex, 3 to 12 percent slopes, is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Polar-Mobeetie association, hilly, is an example.

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

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

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

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

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

General Soil Map

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

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

differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Motley County are discussed on the following pages.

The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association 2, the words "medium-textured" refer to the texture of the surface layer.

1. Miles-Flomot association

Deep, nearly level to strongly sloping and undulating, coarse textured and moderately coarse textured soils

This association is on broad upland plains that are dissected at wide intervals by drainageways. The association consists of sandy and loamy soils that formed in loamy material or in alluvium and old outwash material.

This association covers about 43 percent of the county. It is about 50 percent Miles soils and about 11 percent Flomot soils. The remaining 39 percent is mostly Motley, Hilgrave, Devol, Springer, Mobeetie, Tivoli, Paloduro, Yahola, Yomont, Lincoln, and Altus soils.

Miles soils are on flats between drainageways. These soils are nearly level to sloping and undulating. They have a surface layer of reddish-brown loamy fine sand or fine sandy loam 14 inches thick. The lower layers are reddish-brown and yellowish-red sandy clay loam.

Flomot soils are on ridges and side slopes that border drainageways. These soils are gently sloping to strongly sloping. They have a surface layer of brown fine sandy loam 6 inches thick. The lower layers are loam.

About one-half of this association is cultivated. Some of the soils are not cultivated, but they are suited to cultivation. All crops grown in the county are suited to the soils in this association.

2. Woodward-Quinlan association

Moderately deep to shallow, nearly level to moderately steep and rolling, medium-textured soils

This association is on ridges separated by gullies that are dissected by many drainageways. The association consists of loamy soils that formed in fine-grained sandstone, packsand, or silty red-bed materials or in material that weathered from soft calcareous sandstone.

This association covers about 25 percent of the county. It is about 34 percent Woodward soils and about 21 percent Quinlan soils. The remaining 45 percent is mostly Obaro, Yomont, Burson, Lincoln, Sagerton, Gageby, and Aspermont soils.

Woodward soils are nearly level to rolling. They have a surface layer of reddish-brown loam 6 inches thick. The lower layers are yellowish-red loam.

Quinlan soils have a surface layer of reddish-yellow loam, about 5 inches thick, that overlies light-red loam. The underlying material, at a depth of 10 to 20 inches, is soft, fine-grained sandstone.

Only a small part of this association is cultivated. Most of the soils are not suited to cultivation.

3. Heatly-Delwin-Nobscot association

Deep, nearly level to gently sloping and gently undulating to rolling, coarse-textured soils

This association is on broad upland plains that have few drainageways. It consists of sandy soils that formed in sandy eolian material and in moderately sandy or sandy outwash material that was reworked by wind.

This association covers about 12 percent of the county. It is about 36 percent Heatly soils, about 21 percent Delwin soils, and about 12 percent Nobscot soils. The remaining 31 percent is mostly Springer, Devol, Tivoli, and Miles soils.

Heatly soils are nearly level to gently undulating. They have a surface layer of light-brown fine sand 24 inches thick. This layer overlies red sandy clay loam.

Delwin soils are nearly level to gently sloping. They have a surface layer of fine sand, 17 inches thick, that is brown in the upper part and light brown in the lower part. The lower layers are mainly red and reddish-yellow sandy clay loam.

Nobscot soils are gently undulating to rolling. They have a surface layer of fine sand, 26 inches thick, that is brown in the upper part and light brown in the lower part. The lower layers are yellowish-red fine sandy loam and reddish yellow loamy sand.

Most of this association is used for range and it is suited to this purpose. Many areas of Heatly soils that were formerly cultivated are now in native vegetation.

4. Sagerton-Aspermont association

Deep, nearly level to strongly sloping, moderately fine textured soils

This association is on small ridges on uplands that are separated by narrow to broad valleys. It consists of loamy soils that formed in loamy alluvial-colluvial material over red beds or clayey material.

This association covers about 10 percent of the county. It is about 45 percent Sagerton soils and about 35 percent Aspermont soils. The remaining 20 percent is mostly Frankirk, Abilene, Bukreek, Tulia, and Obaro soils.

Sagerton soils are nearly level to gently sloping. They have a surface layer of dark-brown clay loam 7 inches thick. Below this layer is dark-brown clay.

Aspermont soils are on ridges and side slopes that extend into drainageways. These soils are gently sloping to strongly sloping. They have a surface layer of reddish-brown silty clay loam 7 inches thick. The lower layers are reddish-brown and red silty clay loam.

Most of the nearly level and gently sloping soils in this association are cultivated. Most crops grown in the county are well suited to the soils in this association.

5. Polar-Latom-Mobeetie association

Very shallow to deep, gently sloping to strongly sloping and undulating to hilly, moderately coarse textured and gravelly soils

This association consists of loamy and gravelly loamy soils that formed in water-laid deposits of stratified gravel and sandy material, in material

weathered from sandstone and conglomerate, or in moderately sandy, calcareous material.

This association covers about 7 percent of the county. It is about 27 percent Polar soils, about 13 percent Latom soils, and 12 percent Mobeetie soils. The remaining 48 percent is mostly Berda, Flomot, Quinlan, Burson, and Woodward soils and outcrops of sandstone and conglomerate rock.

Polar soils are on dissected hills and convex ridges. They have a surface layer of brown gravelly sandy loam 7 inches thick. The lower layers are pink very gravelly sandy loam.

Latom soils are gently sloping to strongly sloping and rolling. They have a surface layer of brown fine sandy loam 9 inches thick. This layer overlies strongly cemented sandstone.

Mobeetie soils are in the valleys and concave areas between hills and ridges. These soils are gently sloping to strongly sloping. They have a surface layer of brown fine sandy loam, 9 inches thick, that overlies brown fine sandy loam.

This association is used almost entirely as range. It is better suited to range, wildlife, and recreational uses than to other purposes.

6. *Potter-Berda-Mobeetie association*

Deep to very shallow, gently sloping to moderately steep and hilly, medium textured and moderately coarse textured soils

This association occurs in a complex pattern below and almost parallel to the caprock escarpment on numerous hills, on side slopes, and in valleys. It consists of loamy soils that formed in calcareous moderately sandy and loamy materials and in thick beds of caliche.

This association covers about 2 percent of the county. It is about 25 percent Potter soils, about 24 percent Berda soils, and about 15 percent Mobeetie soils. The remaining 36 percent is mostly Paloduro, Posey, Mansker, and Miles soils.

Potter soils are gently sloping to moderately steep. They have a surface layer of pale-brown loam, 6 inches thick, that overlies pale-brown loam.

Berda soils are sloping to moderately steep and hilly. They have a surface layer of brown fine sandy loam 7 inches thick. The lower layers are brown loam in the upper part and light-brown loam in the lower part.

Mobeetie soils are gently sloping to strongly sloping. They have a surface layer of brown fine sandy loam 9 inches thick. The lower layers are fine sandy loam that is brown in the upper part and light reddish brown in the lower part.

All of this association is used as range. The soils in this association are better suited to range, wildlife, or recreational uses than to other purposes.

7. *Pullman association*

Deep, nearly level, moderately fine textured soils

This association consists of loamy soils that formed in eolian material. The surface is smooth except for scattered depressions, which collect runoff water.

This association covers about 1 percent of the county. The association is about 70 percent Pullman soils. The remaining 30 percent is mostly Sagerton, Randall, Posey, and Mansker soils.

Pullman soils have a surface layer of brown clay loam 7 inches thick. This layer overlies brown clay and reddish-brown silty clay.

Most of this association is cultivated. Most crops grown in the county are suited to the soils in this association.

Descriptions of the Soils

In this section the soils of Motley County are described in detail and their use and management are discussed. Each soil series is described in detail, and then, briefly, the mapping units in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

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

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

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

[1] United States Department of Agriculture. Soil survey manual. U.S. Dept. Agric. Handbook No. 18, 503 pp., illus. 1951. [Supplement issued in May 1962]

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Abilene clay loam, 0 to 1 percent slopes	7,940	1.2	Miles fine sandy loam, 5 to 8 percent slopes	19,360	3.0
Abilene clay loam, 1 to 3 percent slopes	1,660	.3	Mobeetie fine sandy loam, 0 to 3 percent slopes	3,560	.5
Altus very fine sandy loam, 0 to 1 percent slopes	920	.1	Mobeetie fine sandy loam, 3 to 5 percent slopes	9,930	1.5
Aspermont silty clay loam, 1 to 3 percent slopes	6,920	1.1	Mobeetie fine sandy loam, 5 to 12 percent slopes	3,060	.5
Aspermont silty clay loam, 3 to 5 percent slopes	14,780	2.3	Motley loam, 0 to 1 percent slopes	19,450	3.0
Aspermont silty clay loam, 5 to 12 percent slopes	4,600	.7	Motley loam, 1 to 3 percent slopes	1,300	.2
Berda and Potter soils, 5 to 20 percent slopes	7,620	1.2	Nobscot soils, 3 to 12 percent slopes	9,800	1.5
Bukreek loam, 0 to 1 percent slopes	2,760	.4	Obaro loam, 1 to 3 percent slopes	3,280	.5
Bukreek loam, 1 to 3 percent slopes	4,380	.7	Obaro loam, 3 to 5 percent slopes	8,900	1.4
Cottonwood loam, 3 to 20 percent slopes	700	.1	Obaro-Burson complex, 3 to 12 percent slopes	4,260	.7
Delwin fine sand, 0 to 3 percent slopes	16,640	2.6	Paloduro loam, 0 to 1 percent slopes	1,990	.3
Devol loamy fine sand, 3 to 8 percent slopes	12,870	2.0	Paloduro loam, 1 to 3 percent slopes	3,460	.5
Devol and Tivoli soils, 1 to 8 percent slopes	1,430	.2	Polar-Mobeetie association, hilly	21,620	3.3
Flomot fine sandy loam, 1 to 3 percent slopes	4,890	.8	Posey-Mansker complex, 3 to 5 percent slopes	1,770	.3
Flomot fine sandy loam, 3 to 5 percent slopes	6,340	1.0	Potter loam, 3 to 20 percent slopes	1,280	.2
Flomot fine sandy loam, 5 to 12 percent slopes	19,760	3.1	Pullman clay loam, 0 to 1 percent slopes	4,540	.7
Flomot-Potter complex, 0 to 3 percent slopes	960	.1	Quinlan loam, 3 to 12 percent slopes	5,350	.8
Frankirk loam, 0 to 1 percent slopes	3,400	.5	Randall clay	230	[1]
Frankirk loam, 1 to 3 percent slopes	4,420	.7	Sagerton clay loam, 0 to 1 percent slopes	6,360	1.0
Gageby clay loam	4,260	.7	Sagerton silt loam, 1 to 3 percent slopes	25,160	3.9
Heatly fine sand, 0 to 5 percent slopes	28,150	4.4	Springer loamy fine sand, 0 to 3 percent slopes	11,960	1.8
Hilgrave gravelly sandy loam, 10 to 30 percent slopes	15,020	2.3	Tivoli fine sand	8,740	1.4
Latom-Rock outcrop complex, 3 to 12 percent slopes	12,540	1.9	Tulia loam, 1 to 3 percent slopes	2,200	.3
Lincoln soils	7,070	1.1	Tulia loam, 3 to 5 percent slopes	7,310	1.1
Lincoln soils, frequently flooded	4,410	.7	Woodward loam, 1 to 3 percent slopes	2,830	.4
Lipan clay, depressional	440	[1]	Woodward loam, 3 to 5 percent slopes	9,820	1.5
Miles loamy fine sand, 0 to 3 percent slopes	37,320	6.0	Woodward-Yomont complex, 0 to 15 percent slopes	27,910	4.3
Miles loamy fine sand, 3 to 5 percent slopes	20,780	3.2	Woodward-Quinlan association, rolling	68,220	10.5
Miles fine sandy loam, 1 to 3 percent slopes	47,150	7.3	Yahola fine sandy loam	1,730	.3
Miles fine sandy loam, 3 to 5 percent slopes	27,680	4.3	Yomont very fine sandy loam	3,912	.6
			Yomont and Lincoln soils	7,500	1.1
			Rivers and water areas	12,438	1.9
			Total	647,040	100.0

[1] Less than 0.05 percent.

Abilene Series

The Abilene series consists of deep, well-drained, moderately slowly permeable, loamy soils on uplands. These soils formed in calcareous, loamy outwash material.

In a representative profile the surface layer is dark-brown clay loam about 8 inches thick. Below this layer is about 8 inches of dark grayish-brown, friable clay loam. The next layer is about 37 inches of firm clay that is dark grayish brown in the upper part and brown in the lower part. The upper 12 inches of the underlying material is very pale brown clay loam that is about 60 percent soft masses and concretions of calcium carbonate. The lower part of the underlying material is white clay loam that is about 10 percent soft masses of calcium carbonate.

Runoff is slow. Available water capacity is high.

Representative profile of Abilene clay loam, 0 to 1 percent slopes, 4.75 miles east of the courthouse in Matador via U.S. Highways 62 and 70, 1 mile south and 0.3 mile west along county road and then 100 feet north in a cultivated field:

Ap—0 to 8 inches, dark-brown (10YR 4/3) clay loam, dark brown (10YR 3/3) moist; weak, granular structure; slightly hard, friable; mildly alkaline; abrupt, smooth boundary.

B1t—8 to 16 inches, dark grayish-brown (10YR 4/2) clay loam, very dark brown (10YR 2/2) moist; moderate, medium, subangular blocky and irregular blocky structure; hard, friable; few fine roots; few fine pores; clay films on ped surfaces; mildly alkaline; gradual, smooth boundary.

B21t—16 to 27 inches, dark grayish-brown (10YR 4/2) clay, very dark brown (10YR 2/2) moist; moderate, fine and medium, blocky structure; very hard, firm; few fine pores; clay films on ped surfaces; few films and threads of calcium carbonate in lower part; calcareous; moderately alkaline; gradual, smooth boundary.

B22t—27 to 53 inches, brown (10YR 5/3) clay, dark brown (10YR 3/3) moist; moderate, medium, blocky structure; very hard, firm; few fine pores; many films and threads and few soft masses of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

Cca—53 to 65 inches, very pale brown (10YR 8/3) clay loam, very pale brown (10YR 7/3) moist; massive; about 60 percent, by volume, calcium carbonate in soft masses and small concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

C—65 to 84 inches, white (10YR 8/2) clay loam, light gray (10YR 7/2) moist; massive; about 10 percent, by volume, calcium carbonate and calcium sulfate in soft powdery masses; calcareous; moderately alkaline.

The A horizon ranges from 6 to 10 inches in thickness. It is dark brown, grayish brown, or brown. Reaction is neutral to mildly alkaline.

The B1t horizon ranges from 5 to 11 inches in thickness.

It is neutral to mildly alkaline. The B1t and B21t horizons are dark grayish brown, very dark grayish brown, or brown. The B21t horizon ranges from 8 to 11 inches in thickness. It is clay loam or clay. Reaction is mildly alkaline to moderately alkaline. The B22t and B23t horizons are brown, dark-brown, or dark grayish-brown clay loam or clay. The Bt horizon ranges from fine or medium subangular blocky to fine or medium blocky in structure.

The Cca horizon is at a depth of 35 to 60 inches. Films, soft masses, and strongly cemented concretions of calcium carbonate make up 15 to 65 percent of this horizon. The Cca and C horizons are very pale brown, white, or pink. The C horizon consists of variable material that ranges from loam to clay alluvium or outwash.

Abilene clay loam, 0 to 1 percent slopes (AbA).—This soil is nearly level and is in slightly concave flats on uplands. Areas are irregular in shape and range from 10 to 300 acres in size. Slopes are mostly 0.2 to 0.8 percent.

This soil has the profile described as representative for the series.

Included with this soil in mapping are areas, less than 5 acres, of Sagerton, Frankirk, and Bukreek soils. Also included are some areas of soils that have slopes of 1 to 1.8 percent.

The hazards of soil blowing and water erosion are slight.

Most areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the principal crops. This soil responds to good management practices, such as crop rotation, adequate return of crop residue to the soil for improvement and protection, and timely but limited tillage. Terraces help to conserve water. Capability unit IIc–1; Clay Loam range site.

Abilene clay loam, 1 to 3 percent slopes (AbB).—This gently sloping soil is on uplands. Areas generally are elongated and follow the slope contours above drainageways. Areas range from 10 to 200 acres, but most areas are smaller than 50 acres.

The surface layer is grayish-brown clay loam about 6 inches thick. Below this layer is about 7 inches of dark grayish-brown, firm clay loam. The next layer is firm clay about 45 inches thick. It is grayish brown in the upper part and brown in the lower part. The underlying material is pink clay loam that is about 50 percent soft masses and concretions of calcium carbonate.

Included with this soil in mapping are areas of Sagerton, Frankirk, Bukreek, and Tulia soils. Also included are some areas of soils that have slopes of less than 1 percent.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

Most areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the principal crops. Management practices that reduce the amount of runoff, preserve tilth, and maintain productivity are needed. Terracing, cultivating on the contour, and growing grain sorghum, small grain, or other crops that leave a large amount of residue help to control erosion. Capability unit IIe–2; Clay Loam range site.

Altus Series

The Altus series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in calcareous, loamy old alluvium.

In a representative profile the surface layer is dark-brown very fine sandy loam about 8 inches thick. Below this layer is about 32 inches of dark-brown, friable sandy clay loam. The next layer is about 16 inches of brown, friable sandy clay loam. The underlying material is very pale brown, loose loamy fine sand.

Runoff is slow. Available water capacity is medium.

Representative profile of Altus very fine sandy loam, 0 to 1 percent slopes, 2.35 miles east of Northfield via Farm Road 94 and then 0.15 mile north in a cultivated field:

Ap—0 to 8 inches, dark-brown (10YR 4/3) very fine sandy loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; soft, very friable; few roots; neutral; abrupt, smooth boundary.

B1t—8 to 22 inches, dark-brown (7.5YR 4/2) sandy clay loam, dark brown (7.5YR 3/2) moist; weak to moderate, medium, subangular blocky structure; slightly hard, friable; few roots; common pores; mildly alkaline; gradual, smooth boundary.

B21t—22 to 30 inches, dark-brown (7.5YR 4/4) sandy clay loam, dark brown (7.5YR 3/4) moist; moderate, medium, subangular blocky structure; hard, friable; few pores; few faint films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B22t—30 to 40 inches, dark-brown (10YR 4/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate, medium, subangular blocky structure; hard, friable; few roots; few pores; few thin clay films; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3—40 to 56 inches, brown (10YR 5/3) sandy clay loam, dark brown (10YR 4/3) moist; weak to moderate, subangular blocky structure; slightly hard, friable; few roots; few thin clay films; many films and threads of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

C—56 to 80 inches, very pale brown (10YR 8/3) loamy fine sand, pale brown (10YR 6/3) moist; single grained; loose; calcareous; moderately alkaline.

The A horizon ranges from 6 to 10 inches in thickness. It is brown or dark brown. Reaction is neutral to mildly alkaline.

The Bt horizon is brown to dark brown. Reaction ranges from neutral in the upper part to moderately alkaline in the lower part. Soft, powdery lime is between depths of 20 to 30 inches.

The C horizon consists of sandy alluvium.

Altus very fine sandy loam, 0 to 1 percent slopes (AcA).—This soil is on slightly concave flats on uplands. Areas are oval in shape and range from 10 to 200 acres in size.

Included with this soil in mapping are small areas, less than 5 acres, of Bukreek, Miles, and Flomot soils. Also included are a few areas of soils that have slopes of 1 to 2.5 percent and a few small areas that have a surface layer of loamy fine sand.

The hazards of soil blowing and water erosion are slight.

Most areas of this soil are cultivated to cotton, wheat, and grain sorghum. Conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. The cropping system should include sorghum, small grain, and other crops that leave large amounts of residue. Terraces help to conserve water. Capability unit IIc–2; Sandy Loam range site.

Aspermont Series

The Aspermont series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in calcareous, loamy alluvial-colluvial materials overlying red beds.

In a representative profile the surface layer is reddish-brown silty clay loam about 7 inches thick. Below this layer is about 12 inches of reddish-brown, friable silty clay loam. The next layer is about 15 inches of light reddish-brown friable silty clay loam. The underlying material extends to a depth of 60 inches and is red silty clay loam.

Runoff is medium to rapid. Available water capacity is very high.

Representative profile of Aspermont silty clay loam, 3 to 5 percent slopes, 10 miles east of the courthouse in Matador, via U.S. Highways 62 and 70; 0.8 mile east, 1.85 miles north, and 0.35 mile east on county road, then 50 feet north of county road in area of rangeland:

A1—0 to 7 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular and subangular blocky structure; hard, very friable; common roots; many fine pores; calcareous; moderately alkaline; gradual, smooth boundary.

B21—7 to 19 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; moderate, fine and medium, subangular blocky structure; hard, friable; common roots; many fine pores; common worm casts; few strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; clear, wavy boundary.

B22ca—19 to 34 inches, light reddish-brown (5YR 6/4) silty clay loam, reddish brown (5YR 5/4) moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable; few roots; 10 percent, by volume, fine, strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C—34 to 60 inches, red (2.5YR 5/6) silty clay loam, red (2.5YR 4/6) moist; massive; 2 to 3 percent, by volume, fine, strongly cemented concretions of calcium carbonate; partly weathered, calcareous shaly red bed.

The A horizon ranges from 5 to 8 inches in thickness. It is brown, reddish brown, light brown, or light reddish brown.

The B21 horizon is 8 to 16 inches thick. It is reddish brown or red. Few films, soft masses, or hard concretions of calcium carbonate are in this horizon. It ranges from clay to silty clay loam. Depth to the B22ca horizon ranges from 15 to 25 inches. It is light red, red, yellowish red, reddish brown, or light reddish brown and is 12 to 24 inches thick. The content of calcium carbonate ranges from about 10 to 30 percent, by volume. It ranges from loam to silty clay loam.

The C horizon is old alluvium or outwash sediment of silty clay loam or partly weathered silty or clayey red beds. It is red, reddish brown, or yellowish red.

Aspermont silty clay loam, 1 to 3 percent slopes (AsB).—This gently sloping soil is on low ridges, on hilltops, or on the side slopes flanking natural drainageways. Areas are irregular in shape and range from 8 to 300 acres.

The surface layer is reddish-brown silty clay loam about 5 inches thick. Below this layer is about 11 inches of reddish-brown, firm silty clay loam. The next layer is about 14 inches of yellowish-red, friable silty clay loam. The underlying material is red silty clay loam.

Included with this soil in mapping are some small areas, less than 5 acres, of Frankirk, Sagerton, Obaro, and Abilene soils, which occupy the slightly lower part of the landscape. A few shallow gullies, as much as 11 inches deep, in some cultivated areas are included. Also included are small areas, less than 5 acres, of Woodward soils.

The hazard of water erosion is moderate.

About 30 to 40 percent of the acreage of this soil is cultivated. Small grain, grain sorghum, and cotton are the main crops. Controlling water erosion and maintaining tilth are the main concerns in management. Rotating crops is a necessary practice. Leaving adequate residue on the surface helps to control erosion and to maintain tilth. Terraces, along with contour farming, are needed for row crops. Excess water can be safely carried off by diversions and grassed waterways. Capability unit IIIe–5; Clay Loam range site.

Aspermont silty clay loam, 3 to 5 percent (AsC).—This gently sloping soil is on uplands. Areas are oblong to irregular in shape, and slopes are mainly 3 to 4 percent. Areas are 10 to 300 acres in size, but they are generally smaller than 100 acres.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas of soils that have slopes of 1 to 3 percent. Also included are areas of Woodward and Obaro soils in narrow valleys between ridges and narrow scarps of gyp rock.

The hazard of water erosion is high.

This soil is largely cultivated, and the main crops are wheat, grain sorghum, and cotton. Some areas that were formerly cultivated are now in native vegetation. This soil needs a rotation of residue-producing crops such as small grain and sorghum to protect the soil and to get moisture into the soil. Tillage should be limited to conserve residue and moisture. Contour farming of row crops and the use of terraces are necessary management practices. In places diversion terraces and grassed waterways are also needed as part of a runoff water disposal system. Capability unit IVe–1; Clay Loam range site.

Aspermont silty clay loam, 5 to 12 percent slopes (AsE).—This sloping to strongly sloping soil is along drainageways. The areas are irregular and oblong. Slopes dominantly range from 5 to 8 percent. Areas are mostly less than 100 acres in size but range from 25 to about 300 acres.

The surface layer is reddish-brown silty clay loam about 5 inches thick. Below this layer is about 12 inches of reddish-brown, firm silty clay loam. The next layer is about 21 inches of yellowish-red, friable silty clay loam. The underlying material is red, partly weathered silty and clayey shale.

Included with this soil in mapping are small areas, less than 5 acres, that have slopes of 3 to 5 percent. Also included are areas of Obaro, Woodward, and Quinlan soils and small areas of Obaro and Burson soils.

The hazard of water erosion is high.

Most areas of this soil are in range. About 15 to 30 percent of this soil is moderately to severely eroded.

These soils are better suited to range or wildlife habitat than to other uses. Capability unit VIe–2; Clay Loam range site.

Berda Series

The Berda series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in calcareous loamy material that washed from higher lying soils.

In a representative profile, the surface layer is brown fine sandy loam about 7 inches thick. Below this layer is about 33 inches of friable loam; it is brown in the upper 19 inches and light brown in the lower part. The underlying material is light-brown, calcareous, massive loam.

Runoff is medium. Available water capacity is medium.

Representative profile of Berda fine sandy loam, in an area of Berda and Potter soils, 5 to 20 percent slopes, 0.1 mile west of Motley-Floyd County line via U.S. Highways 62 and 70, then 2.7 miles north on Floyd county road, and 0.47 mile west into Motley County in area of range:

A1—0 to 7 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, very fine, granular; slightly hard, friable; many roots; few fine pores; few, fine, cemented fragments of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B21—7 to 26 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, fine, granular and weak, subangular blocky; slightly hard, friable; few roots; many fine pores; many worm casts; few strongly cemented concretions or fragments and films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, smooth boundary.

B22ca—26 to 40 inches, light-brown (7.5YR 6/4) loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure; slightly hard, friable; few roots and fine pores in upper part; less than 5 percent calcium carbonate is visible in concretions of fragments and films and threads; calcareous; moderately alkaline; diffuse, smooth boundary.

Cca—40 to 70 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 5/4) moist; massive; slightly hard, friable; few small nodules, films, and threads of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 7 to 15 inches in thickness. It is dark grayish-brown, grayish-brown, reddish-brown, or brown fine sandy loam to clay loam.

The B2 horizon is brown, pale brown, or light brown. It ranges from 30 to 45 inches in thickness and from loam to clay loam in texture. This horizon is as much as 10 percent, by volume, visible calcium carbonate, ranging from films and threads to concretions and fragments.

The C horizon is light reddish-brown, reddish-brown, light-brown, or brown fine sandy loam to clay loam.

Berda and Potter soils, 5 to 20 percent slopes (BpF).—This undifferentiated group is mostly rough, sloping to moderately steep and hilly soils. Areas are generally just below and along escarpments. There are also a few, small, isolated areas. Small drainageways, several hundred feet apart, dissect areas of these soils. Areas range from 10 to 1,000 acres in size. They are several hundred feet to more than a mile wide and several miles long (fig. 2). The Berda soils are on alluvial fans and foot slopes. The Potter soils are on crests and knolls. The upper part of the areas is a rim or cap of indurated caliche.

The composition of areas of this mapping unit is variable, and the pattern of soils is not uniform from one area to another. It is on the average about 41 percent Berda soils, 26 percent Potter soils, and 33 percent other soils. The range in proportion from area to area is as follows: Berda soils from 8 to 59 percent; Potter soils from 2 to 40 percent; barren, exposed Ogallala material from 10 to 40 percent; and other soils from 15 to 45 percent.

Potter soils have a surface layer of brown loam 4 inches thick. The underlying material is pinkish, slightly platy caliche that contains concretions and soft masses of calcium carbonate.

Included with these soils in mapping are some areas of soils similar to Berda and Potter soils. In some areas there are sheer bluffs that range from 5 to 30 feet in height.

Runoff is medium to rapid. The hazard of water erosion is high. Most areas are cut by a network of shallow to deep, U-shaped gullies.

All areas of these soils are in range. The soils are better suited to range, wildlife habitat, and recreational use than to most other uses. Conservative use of grasses on these soils helps to control erosion. Rest from grazing is needed if the vigor of grasses is low. Care is also needed in locating roads and other improvements where traffic by livestock or vehicles may produce erosion problems. Both soils in capability unit VIIs–1; Berda part in Mixedland Slopes range site; Potter part in Very Shallow range site.

Bukreek Series

The Bukreek series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils developed in calcareous loamy outwash material.

In a representative profile the surface layer is reddish-brown loam about 8 inches thick. Below this layer is about 27 inches of reddish-brown sandy clay loam. The upper 8 inches of this layer is friable, and the lower part is firm. The next layer is about 14 inches of yellowish-red, friable sandy clay loam. Below this layer is 16 inches of reddish-yellow, friable sandy clay loam that is about 20 percent soft masses and concretions of calcium carbonate. The next layer is yellowish-red, friable sandy clay loam.

Runoff is slow. Available water capacity is medium.

Representative profile of Bukreek loam, 1 to 3 percent slopes, 2.7 miles east via U.S. Highways 62 and 70 from the courthouse in Matador, Tex., 1.5 miles south on county road and 0.3 mile east in a cultivated field:

Ap—0 to 8 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak, granular structure; soft, very friable; few fine roots; mildly alkaline; abrupt, smooth boundary.

B21t—8 to 16 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; compound moderate, coarse, prismatic structure parting to weak fine and moderate medium, subangular blocky; hard, friable; few pores; few fine quartz pebbles; mildly alkaline; gradual, smooth boundary.

B22t—16 to 35 inches, reddish-brown (5YR 4/4) sandy clay

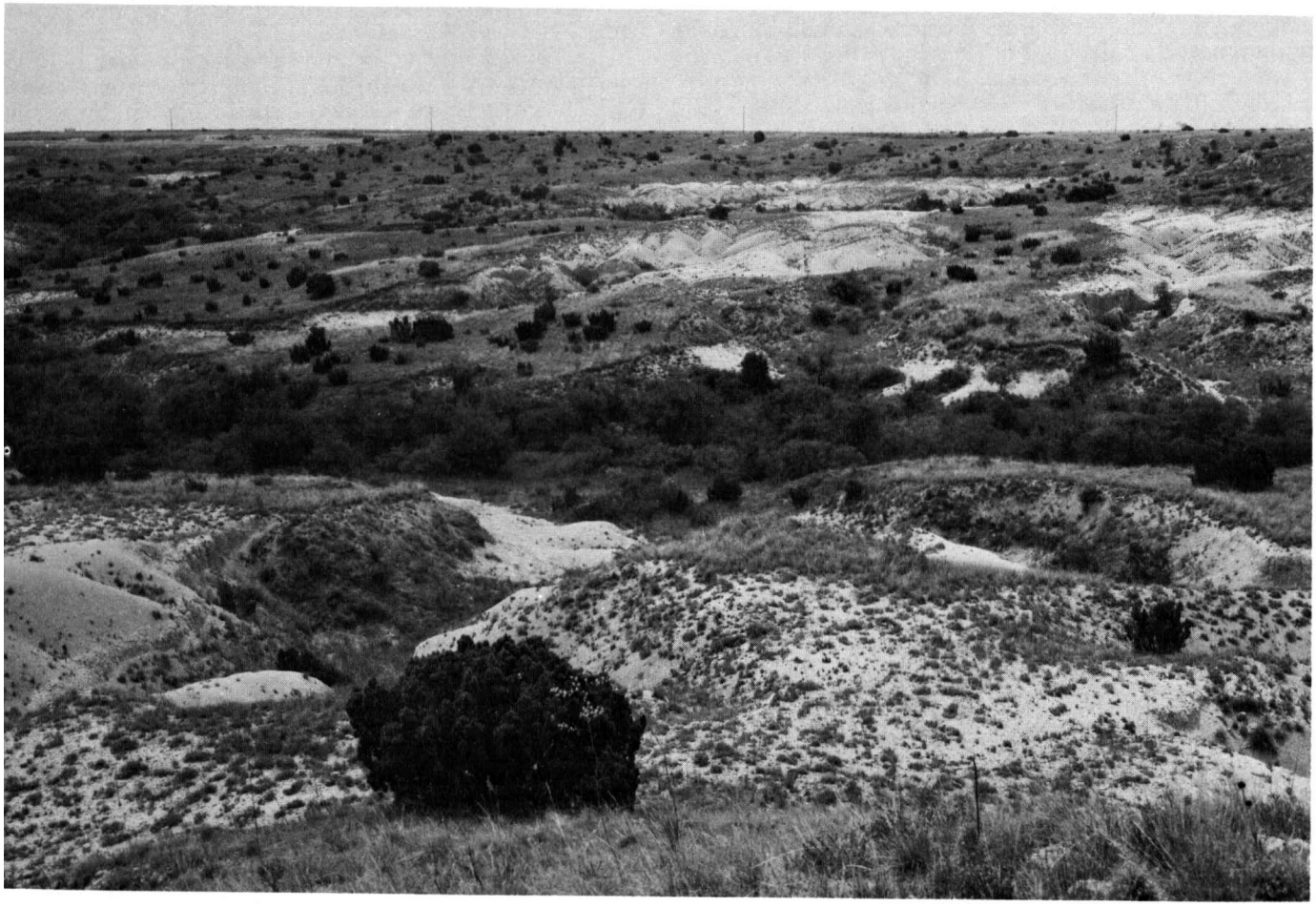

Figure 2.—**Area of Berda and Potter soils, 5 to 20 percent slopes. Barren areas are raw exposed Ogallala material.**

loam, dark reddish brown (5YR 3/4) moist; compound moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, firm; common pores; worm casts; few, thin, patchy clay films on ped surfaces; few films of powdery lime on ped surfaces; noncalcareous, moderately alkaline matrix; gradual, smooth boundary.

B23t—35 to 49 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; coarse, moderate, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few quartz pebbles; few films and threads of calcium carbonate; calcareous, moderately alkaline; clear, smooth boundary.

B24tca—49 to 65 inches, reddish-yellow (5YR 6/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, medium, subangular blocky structure; slightly hard, friable; common pores; 18 to 20 percent, by volume, soft masses and strongly cemented concretions of calcium carbonate; calcareous, moderately alkaline; gradual, smooth boundary.

B25t—65 to 82 inches, yellowish-red (5YR 5/6) sandy clay loam; yellowish red (5YR 4/6) moist; weak, medium, subangular blocky structure; common pores; vertical stringers of calcium carbonate and few, small, soft masses; calcareous, moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to secondary lime is 24 to 32 inches, and depth to a calcic horizon is 40 to 60 inches.

The A horizon is reddish brown, dark reddish brown, or brown. It ranges from 5 to 12 inches in thickness.

The B2t horizon above the calcic horizon is reddish-brown or yellowish-red sandy clay loam, loam, or clay loam. The B2tca horizon is red or reddish-yellow sandy clay loam, loam, or clay loam. Estimated content of calcium carbonate ranges from 15 to 60 percent, by volume. Below the calcic horizon the B2t horizon is yellowish-red or reddish-yellow fine sandy loam to sandy clay loam.

Bukreek loam, 0 to 1 percent slopes (BuA).—This nearly level soil is on plains on uplands. Slopes are mainly 0.3 to 0.8 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

The surface layer is brown loam about 6 inches thick. Below this layer is about 41 inches of reddish-brown sandy clay loam. The upper 12 inches of this layer is friable, and the lower part is firm. The next layer is about 18 inches of reddish-yellow, friable sandy clay loam that is about 30 percent calcium carbonate in soft masses and concretions. Below this layer is yellowish red, friable loam.

Included with this soil in mapping are small areas of Abilene, Altus, Motley, Miles, Sagerton, and Frankirk soils. Also included are a few areas of Tulia and Woodward soils and some small areas of soils that have slopes of more than 1 percent.

The hazards of soil blowing and water erosion are slight.

About 70 percent of the acreage of this soil is cultivated. Cotton, wheat, and grain sorghum are the main crops. Conserving moisture, preserving tilth, and

maintaining productivity are the main concerns of management. The cropping system should include sorghum, small grain, and other crops that leave large amounts of residue. Terraces help in conserving water. Capability unit IIc–2; Mixedland range site.

Bukreek loam, 1 to 3 percent slopes (BuB).—This gently sloping soil is on smooth uplands. Slopes are mostly 1 to 2 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas, less than 5 acres, of Frankirk, Motley, Miles, and Tulia soils. Also included are a few areas of Bukreek loam, 0 to 1 percent slopes.

The hazard of soil blowing is slight. The hazard of water erosion is moderate.

Most of the acreage of this soil is cultivated. Cotton, wheat, and grain sorghum are the main crops. Reducing runoff, preserving tilth, and maintaining productivity are needed concerns of management. Terracing, cultivating on the contour, and growing grain sorghum, small grain, or other crops that leave large amounts of residue help to control erosion. Capability unit IIe–2; Mixedland range site.

Burson Series

The Burson series consists of very shallow to shallow, well-drained to excessively drained, moderately permeable, loamy soils on uplands. These soils formed in silty and sandy red-bed material.

In a representative profile the surface layer is reddish-brown loam about 6 inches thick. The underlying material is red, weakly cemented sandstone and siltstone.

Runoff is very rapid. Available water capacity is very low.

These soils are mapped only in a complex with the Obaro series.

Representative profile of Burson loam in an area of Obaro-Burson complex, 3 to 12 percent slopes, 0.6 mile southeast of the Q.A.&P. Railroad, Russelville shipping point, to the junction in county road; then 2.3 miles east on county road and 100 feet north in area of rangeland:

A1—0 to 6 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; soft, very friable; few roots; many rounded quartz pebbles on surface; calcareous, moderately alkaline; abrupt, smooth boundary.

C—6 to 36 inches, red (2.5YR 5/6) weakly cemented very fine grained sandstone and siltstone; red (2.5YR 4/6) moist; common, fine, bluish-gray splotches; calcareous, moderately alkaline.

The A horizon ranges from 3 to 12 inches in thickness. It is reddish brown, yellowish red, or red. It ranges from very fine sandy loam to silty clay loam.

The C horizon is reddish brown, yellowish red, reddish yellow, or red. It is weakly cemented to strongly cemented, very fine grained sandstone or siltstone.

Cottonwood Series

The Cottonwood series consists of very shallow, well-drained, moderately permeable, calcareous, loamy soils on uplands. These soils formed in impure gypsum beds.

In a representative profile the surface layer is brown loam about 8 inches thick. The underlying material is pinkish-white, soft, chalky gypsiferous material that becomes compact at a depth of 20 inches.

Runoff is rapid. Available water capacity is very low.

Representative profile of Cottonwood loam, 3 to 20 percent slopes, 3.8 miles south via Farm Road 94 from Northfield, then 0.8 mile west in area of rangeland:

A1—0 to 8 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 4/2) moist; weak and moderate, fine, subangular blocky and granular structure; soft, very friable; many grass roots; common fine and many very fine pores; calcareous, moderately alkaline; clear, wavy boundary.

C—8 to 36 inches, pinkish-white (7.5YR 8/2), soft, chalky, gypsiferous material of loam texture, becoming very compact at a depth of 20 inches.

The A horizon ranges from 3 to 10 inches in thickness. It is reddish brown, light brownish gray, brown, light brown, or yellowish brown.

The C horizon is light gray, pinkish white, pinkish gray, or pink. It is weakly consolidated to strongly cemented gypsiferous material, gypsite, or alabaster.

Cottonwood loam, 3 to 20 percent slopes (CoF).—This gently sloping to moderately steep soil is on uplands. Areas are long and narrow and parallel side slopes along drainageways. They range from 5 to 100 acres in size.

Included with this soil in mapping are narrow bands of Yomont and Lincoln soils on the bottoms of drainageways. Making up about 15 percent of this unit is barren, exposed gypsum material.

The hazard of water erosion is high.

Almost all of this soil is in range. This soil is suited to range, wildlife habitat, and recreational uses. Conservative use of grasses on this soil is needed to help control erosion. Rest periods from grazing are needed if the vigor of grasses is low. Careful planning is also needed in locating roads and other improvements in areas where livestock or vehicle traffic is likely to result in further erosion. Capability unit VIIs–1; Gyp range site.

Delwin Series

The Delwin series consists of deep, well-drained, moderately permeable, sandy soils on uplands. These soils formed in sandy outwash or eolian material.

In a representative profile the surface layer is fine sand about 17 inches thick; it is brown in the upper 7 inches and light brown in the lower part. Below this layer is about 31 inches of friable sandy clay loam; it is red in the upper part and reddish yellow in the lower part. The next layer is about 9 inches of reddish-yellow, very friable loamy fine sand. Below this layer is red, friable sandy clay loam.

Runoff is very slow. Available water capacity is medium.

Representative profile of Delwin fine sand, 0 to 3 percent slopes, 0.5 mile east of Matador via U.S. Highways 62 and 70, then 1.55 miles south on county road and 100 feet east in area of rangeland:

A1—0 to 7 inches, brown (7.5YR 5/4) fine sand, dark brown (7.5YR 3/2) moist; single grained; loose; neutral; gradual, smooth boundary.
A2—7 to 17 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; neutral; clear, smooth boundary.
B21t—17 to 34 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few fine roots; few fine pores; few root channels; few thin clay films on ped surfaces; neutral; gradual, smooth boundary.
B22t—34 to 48 inches, reddish-yellow (5YR 6/8) sandy clay loam, yellowish red (5YR 5/8) moist; weak, medium, subangular blocky structure; slightly hard, friable; few roots; few thin clay films on ped surfaces; neutral; gradual, smooth boundary.
B23t—48 to 57 inches, reddish-yellow (5YR 6/6) loamy fine sand, yellowish red (5YR 5/6) moist; single grained; soft, very friable; bleached sand grains, pink (7.5YR 7/4); mildly alkaline; clear, smooth boundary.
B24t—57 to 108 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; moderate, medium, blocky and subangular blocky structure; slightly hard, friable; few thin clay films on ped surfaces; few iron-manganese concretions; noncalcareous; moderately alkaline.

The solum ranges from 70 to more than 90 inches in thickness. Depth to secondary carbonates ranges from 48 to more than 80 inches.

The A horizon ranges from 9 to 20 inches in thickness. It is reddish brown, brown, light brown, or pale brown. Reaction is slightly acid or neutral.

The Bt horizon is yellowish red, reddish brown, reddish yellow, or red. It is sandy clay loam in the upper part and sandy clay loam, sandy loam, or loamy fine sand in the lower part. Reaction is slightly acid or neutral in the upper part and mildly alkaline or moderately alkaline in the lower part.

Delwin fine sand, 0 to 3 percent slopes (DeB).—This nearly level to gently undulating soil is on uplands. Areas are irregular in shape and range from 8 to 600 acres in size.

Included with this soil in mapping are some areas of Heatly, Miles, Devol, and Springer soils. Also included are areas of Nobscot soils on low ridges or on higher parts of the landscape.

The hazard of soil blowing is high. The hazard of water erosion is slight.

If this soil is properly managed, it is suitable for cultivation. About 40 percent of this soil is cultivated. Cotton and sorghum are the principal crops. Deep plowing helps to increase the clay content of the soil and to reduce susceptibility to soil blowing. About 60 percent of the cultivated areas of this soil have been deep plowed to a depth of 12 to 22 inches.

Suitable management practices include rotation of crops and use of fertilizer. If crop residue is left on the soil surface to help to control soil blowing, cotton can be grown in alternate strips with sorghum. Tillage should be limited to that needed for good growth of crops. Capability unit IIIe–8; Sandy range site.

Devol Series

The Devol series consists of deep, well-drained, moderately rapidly permeable, sandy soils on uplands. These soils formed in sandy eolian material or in alluvium reworked by wind.

In a representative profile the surface layer is a brown loamy fine sand about 15 inches thick. Below this layer is about 37 inches of reddish-yellow, very friable fine sandy loam. The underlying material is reddish-yellow, loose loamy fine sand.

Runoff is very slow. Available water capacity is medium.

Representative profile of Devol loamy fine sand, 3 to 8 percent slopes, 2.1 miles northwest via U.S. Highway 70 from its intersection with U.S. Highway 62 in Matador, then 100 feet east in area of rangeland:

A11—0 to 7 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 3/4) moist; single grained; loose; few roots; slightly acid; clear, smooth boundary.
A12—7 to 15 inches, brown (7.5YR 5/4) loamy fine sand, brown (7.5YR 4/4) moist; single grained; loose; few roots; few pebbles; slightly acid; clear, smooth boundary.
B2t—15 to 38 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak, medium, prismatic structure; slightly hard, very friable; few roots; clay bridges between sand grains; neutral; gradual, smooth boundary.
B3—38 to 52 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; weak, coarse, prismatic structure; soft, very friable; few roots; few pebbles; few thin stratifications in lower part of coarse sand and fine sandy loam; neutral; diffuse, smooth boundary.
C—52 to 75 inches, reddish-yellow (5YR 7/6) loamy fine sand, yellowish red (5YR 5/6) moist; massive; loose; faint stratification of coarse sand and fine sandy loam; noncalcareous; moderately alkaline.

The A horizon is brown or light brown. It ranges from 12 to 18 inches in thickness. Reaction is slightly acid to mildly alkaline.

The B2t horizon is brown, reddish yellow, or yellowish red and is 8 to 24 inches thick. Texture is fine sandy loam that is about 8 to 18 percent clay. Reaction is neutral or mildly alkaline. The B3 horizon has the same color range as the B2t horizon. Texture ranges from fine sandy loam to loamy fine sand. Reaction ranges from neutral to moderately alkaline.

Depth to the C horizon ranges from 35 to 60 inches. It is loamy fine sand or fine sand. Reaction is mildly to moderately alkaline. This horizon is noncalcareous to a depth of 60 inches.

Devol loamy fine sand, 3 to 8 percent slopes (DoD).—This gently sloping to undulating soil is on uplands. Areas are elongated to irregular in shape and range from 5 to 800 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Miles, Mobeetie, Tivoli, Delwin, Springer, and Heatly soils. Also included are a few areas of soils that have slopes of less than 3 percent, a few areas of Nobscot soils, and small blowouts or eroded spots.

The hazard of soil blowing is high.

A few areas of this soil are cultivated. Most areas that were formerly cultivated have been seeded to grass.

This soil is better suited to range, wildlife habitat, or recreational uses than to other purposes. Capability unit IVe–10; Sandy Loam range site.

Devol and Tivoli soils, 1 to 8 percent slopes (DtD).—This undifferentiated group consists of gently sloping and undulating soils in fields that are no longer cultivated. Most areas are small and range from 10 to 225 acres. These soils have been eroded by both wind

and water. The surface has been wind drifted and occurs as a series of undulating small dunes.

This group consists of soils that are not uniform from one area to another. It is on the average about 52 percent Devol soils, 15 percent Tivoli soils, and 33 percent other soils. The range in proportion from one area to another is as follows: Devol soils from 40 to 60 percent, Tivoli soils from 5 to 30 percent, and other soils from 10 to 45 percent.

Devol soils are on the lower side slopes and in depressions. The surface layer is brown loamy fine sand about 15 inches thick. Below this layer is 20 inches of reddish-yellow, friable fine sandy loam. The next layer is about 15 inches of yellowish-red, very friable fine sandy loam. The underlying material is reddish-yellow, loose loamy fine sand.

Tivoli soils are on the crests of dunes. The surface layer is brown fine sand about 5 inches thick. The underlying material is light reddish-brown, loose fine sand.

Included with this unit in mapping are some small spots, less than 5 acres, of Nobscot, Miles, Springer, and Delwin soils. Blowouts, in which all the surface layer has been removed and the subsoil is exposed, are also included.

The hazard of soil blowing is high. The hazard of water erosion is moderate.

Most areas of these soils were formerly cultivated, but most of them have been reseeded to grass or abandoned and left to return to grass by natural means. It is difficult to establish grass in the blowout areas, but if a good cover of dead litter is first established, the other areas can be reseeded. These soils are not suited to cultivation, because of past erosion and the soil blowing hazard. They are suitable only for range, recreational uses, and wildlife habitat. Both soils in capability unit VIe–3; Devol part in Sandy Loam range site; Tivoli part in Deep Sand range site.

Flomot Series

The Flomot series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in calcareous loamy material.

In a representative profile the surface layer is brown fine sandy loam about 6 inches thick. Below this layer is about 9 inches of brown, friable loam that is about 45 percent calcium carbonate. The next layer is about 25 inches of reddish-yellow, friable loam that is about 50 percent calcium carbonate. Below this layer is light-red, friable loam.

Runoff is medium to rapid. Available water capacity is medium.

Representative profile of Flomot fine sandy loam, 5 to 12 percent slopes, 2 miles east of Flomot, via Farm Road 97, then 5.9 miles south and east on Farm Road 2009 and 100 feet east in area of rangeland:

A1—0 to 6 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; soft, very friable; few roots; few strongly cemented calcium carbonate concretions as much as 1 centimeter in diameter; calcareous, moderately alkaline; gradual, smooth boundary.

B21ca—6 to 15 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; moderate, fine, granular and subangular blocky structure; hard, friable; few roots; few worm casts; many soft masses and weakly and strongly cemented concretions of calcium carbonate; about 45 percent calcium carbonate; calcareous, moderately alkaline; clear, wavy boundary.

B22ca—15 to 40 inches, reddish-yellow (5YR 6/6) loam, yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure; hard, friable; few roots; few worm casts in upper part; about 50 percent calcium carbonate as soft masses and weakly to strongly cemented concretions as much as 3 centimeters in diameter; calcareous, moderately alkaline; diffuse, smooth boundary.

B23tca—40 to 75 inches, light-red (2.5YR 6/6) loam, red (2.5YR 5/6) moist; weak, medium, subangular blocky structure; soft, friable; common soft masses and concretions of calcium carbonate, few thin clay films visible on ped surfaces; calcareous, moderately alkaline.

Depth to the zone of maximum accumulation of calcium carbonate ranges from 10 to 20 inches.

The A horizon ranges from 5 to 12 inches in thickness. It is brown, light brown, or reddish brown.

The B2ca horizon is reddish yellow, reddish brown, brown, light brown, or pink. It is fine sandy loam, loam, or sandy clay loam that is 40 to 60 percent, by volume, concretions and soft masses of calcium carbonate. The Btca horizon is light red, red, yellowish red, or reddish yellow. It is fine sandy loam, loam, or sandy clay loam. Content of calcium carbonate ranges from 5 to 40 percent.

Flomot fine sandy loam, 1 to 3 percent slopes (FmB).—This gently sloping soil is on uplands. Areas along natural drainageways are longer than they are wide, but the other areas are oval to irregular in shape. They range from 10 to 100 acres in size but are mainly less than 50 acres.

The surface layer is brown fine sandy loam about 6 inches thick. The next layer is about 13 inches of light-brown, friable fine sandy loam. Below this layer is about 11 inches of pink, friable loam that is about 40 percent calcium carbonate. The next layer is light-red or brown, friable loam that is about 5 percent calcium carbonate.

Included with this soil in mapping are some small areas of Flomot soils that have slopes of less than 1 percent. Also included are areas of Miles, Bukreek, Tulia, and Woodward soils.

The hazards of soil blowing and water erosion are moderate.

About 40 percent of the area of this soil is cultivated, and cotton is the main crop. Some grain sorghum is also grown. Careful management of adequate residue is needed to help control soil blowing and water erosion. Tillage should be held to a minimum. Terraces are needed to support contour farming. Diversion terraces and grassed waterways are needed in places to safely dispose of water from adjacent areas or excess accumulations of water. Capability unit IVe–7; Mixedland Slopes range site.

Flomot fine sandy loam, 3 to 5 percent slopes (FmC).—This gently sloping soil is on uplands. Most areas are irregular in shape and are along drainageways. Most areas are 20 to 500 acres in size, but a few range to 1,000 acres.

The surface layer is brown fine sandy loam about 8 inches thick. Below this layer is about 8 inches of light-brown, friable loam that is about 50 percent calcium carbonate. The next layer is about 20 inches of pink,

friable loam that is about 55 percent calcium carbonate. Below this layer is about 12 inches of reddish-yellow, friable loam that is about 30 percent calcium carbonate. The next layer is reddish-yellow, firm sandy clay loam.

Included with this soil in mapping are areas of Miles, Bukreek, Tulia, and Woodward soils. Also included are small areas of Flomot soils that have slopes of more than 5 percent.

The hazards of soil blowing and water erosion are moderate.

Most areas of this soil are in range. Where this soil is cultivated, cotton and wheat are the main crops. Management consists of using close spaced or drilled sorghum and small grain to protect and maintain the soil. Limited tillage and conservation of residue during critical periods will conserve moisture and reduce erosion. Contour farming and terracing help to control erosion. Capability unit IVe–4; Mixedland Slopes range site.

Flomot fine sandy loam, 5 to 12 percent slopes (FmE).—This sloping to strongly sloping soil is on uplands. Most areas are irregular in shape and occur along drainageways. They range from 200 to 1,000 acres in size but are generally less than 500 acres.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas of soils, less than 5 acres, that have slopes of 3 to 5 percent. Also included are areas of Miles, Tulia, Bukreek, and Woodward soils.

The hazard of soil blowing is moderate.

All areas of this soil are in range. This soil is highly susceptible to water erosion. It is better suited to range, wildlife habitat, or recreational uses than to other purposes. Capability unit VIe–1; Mixedland Slopes range site.

Flomot-Potter complex, 0 to 3 percent slopes (FpB).—This complex is on uplands. The soils are nearly level to gently sloping. The areas are irregular in shape and are 10 to 450 acres in size.

This complex consists of soils so closely associated and so intermingled that it is not practical to map them separately (fig. 3).

It is on the average about 45 percent Flomot soils, 31 percent Potter soils, and 24 percent other soils and caliche outcrops. The range in proportion from area to area is as follows: Flomot soils from 38 to 51 percent, Potter soils from 28 to 35 percent, and other soils and land from 14 to 34 percent.

Flomot soils are in smooth areas between areas of Potter soils. The surface layer is brown fine sandy loam about 12 inches thick. Below this layer is about 5 inches of reddish-brown, friable sandy clay loam. The next layer is light brown, friable sandy clay loam that is about 50 percent calcium carbonate. Below this layer is yellowish-red, firm sandy clay loam that is about 5 percent calcium carbonate.

Potter soils are in irregularly shaped areas, ranging from a few feet wide to more than 100 feet wide and several hundred feet long, that are mostly surrounded by Flomot soils. They are on smooth, slightly convex ridges. The surface layer is light-brown fine sandy loam 9 inches thick. The underlying material is pale-brown loam; the upper 20 inches is hard, fractured,

Figure 3.—**Pattern of Flomot-Potter complex, 0 to 3 percent slopes. The light-colored areas are Potter soils.**

platy caliche that is about 60 percent powdery calcium carbonate; the lower part is firm and is about 40 percent calcium carbonate.

Included with this complex in mapping are areas of Mansker, Mobeetie, and Abilene soils. Also included are a few small areas of caliche outcrop.

The hazard of soil blowing is moderate. The hazard of water erosion is slight.

Most areas of this complex are cultivated. Cotton is the chief crop, but wheat, grain sorghum, and peanuts are also grown. Suitable management practices include growing crops in the rotation and leaving crop residue on the surface to help control erosion and to retain soil moisture. Timely but limited tillage, contour farming along with the use of terraces, diversions, and grassed waterways are also important conservation practices. Both soils in capability unit IVe–6; Flomot part in Mixedland Slopes range site; Potter part in Very Shallow range site.

Frankirk Series

The Frankirk series consists of deep, well-drained, moderately slowly permeable, loamy soils on uplands. These soils formed in loamy outwash material or in old alluvium that has been modified by wind.

In a representative profile the surface layer is reddish-brown loam about 8 inches thick. Below this layer is about 30 inches of reddish-brown, firm clay loam. The next layer is about 12 inches of red, firm clay loam. Below this layer, and extending to a depth of 85 inches, is friable clay loam that is yellowish red in the upper part and reddish yellow in the lower part (fig. 4).

Runoff is slow. Available water capacity is high.

Representative profile of Frankirk loam, 0 to 1 percent slopes, 2 miles north of Whiteflat, via Texas Highway 70, then 1 mile west on Farm Road 2009 and 300 feet north in a cultivated field:

Ap—0 to 8 inches, reddish-brown (5YR 5/3) loam, dark reddish brown (5YR 3/3) moist; weak, granular structure; slightly hard, friable; few fine roots; few quartz pebbles; mildly alkaline; abrupt, smooth boundary.

B21t—8 to 17 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; moderate, medium and fine, blocky and subangular blocky structure; hard, firm; few fine roots; few fine quartz pebbles; few thin clay films on ped surfaces; common worm casts; mildly alkaline; gradual, smooth boundary.

B22t—17 to 38 inches, reddish-brown (5YR 4/4) clay loam, dark reddish brown (5YR 3/4) moist; weak, fine, and moderate, medium, blocky structure; very hard, firm; few fine roots; few fine pores; common thin clay films on ped surfaces; few worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B23t—38 to 50 inches, red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; moderate, medium and fine, blocky and subangular blocky structure; very hard, firm; few fine root channels coated with calcium carbonate; few, thin, patchy clay films; few calcium carbonate concretions, less than 1 percent, by volume; calcareous; moderately alkaline; gradual, smooth boundary.

B31—50 to 62 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate, medium and coarse, subangular blocky structure; hard, friable; few roots; few fine pores; about 3 percent soft masses of calcium carbonate; few films and threads of calcium carbonate; worm casts; calcareous; moderately alkaline; diffuse, smooth boundary.

B32ca—62 to 72 inches, reddish-yellow (5YR 6/6) clay loam; yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure; hard, friable; few pores; about 8 to 10 percent soft masses of calcium carbonate; few concretions and films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

B33—72 to 85 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, subangular blocky structure; slightly hard, friable; few fine pores; about 3 to 5 percent soft masses and films and threads of calcium carbonate; calcareous; moderately alkaline.

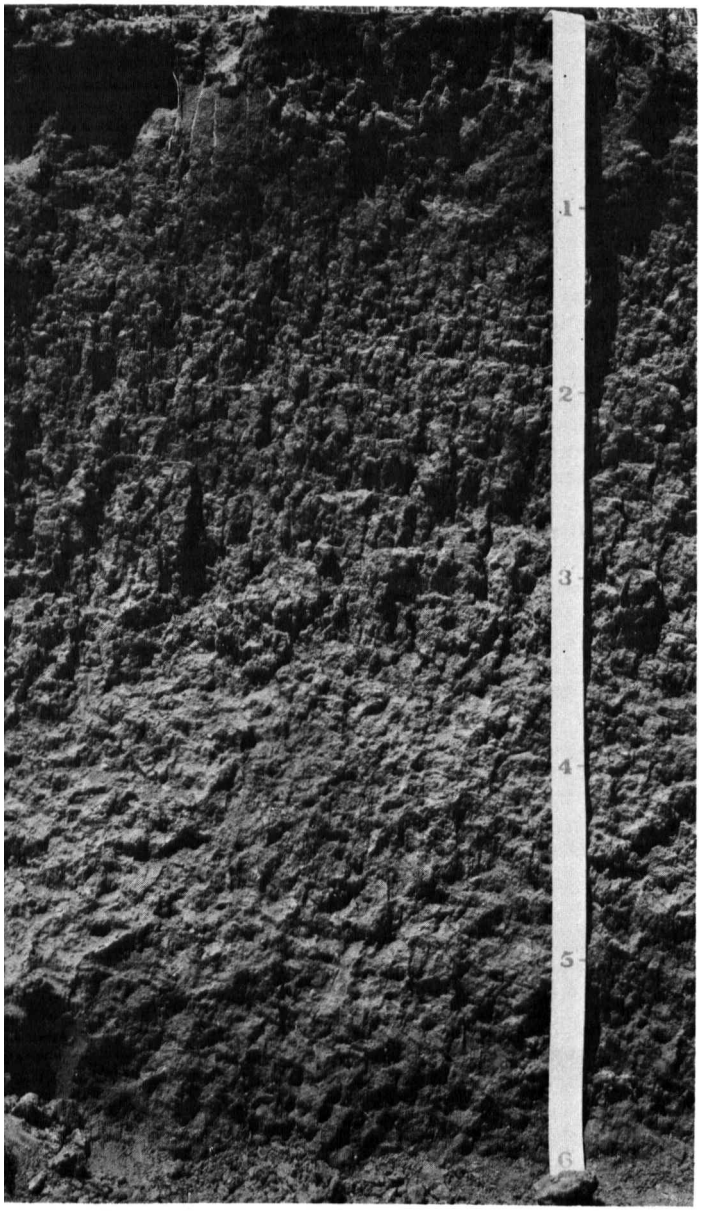

Figure 4.—**Representative profile of Frankirk loam, 0 to 1 percent slopes, showing blocky structure between depths of 8 and 38 inches.**

The solum ranges from 60 to 80 inches or more in thickness. Depth to secondary carbonates ranges from 30 to 48 inches.

The A horizon ranges from 5 to 9 inches in thickness. It is reddish brown or brown.

A B1 horizon as much as 11 inches thick is in some profiles. It has the same color range as the A horizon and is clay loam or sandy clay loam. The B2t horizon ranges from 20 to 44 inches in thickness. It is red, reddish-brown, or yellowish-red clay loam or clay. The B3 horizon is red, light-red, yellowish-red, or reddish-yellow clay loam or sandy clay loam. The content of calcium carbonate ranges from a few scattered slightly cemented concretions and films and threads to concentrations that make up as much as 10 percent of the mass.

Frankirk loam, 0 to 1 percent slopes (FrA).—This nearly level soil is on upland plains. Areas are irregular in shape and range from 15 to 500 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas of Bukreek, Sagerton, Abilene, Motley, Miles, and Paloduro soils. Also included are a few areas of Frankirk soils that have slopes of 1 to 3 percent.

The hazards of soil blowing and water erosion are slight.

Most areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the main crops. Maintaining tilth and fertility are the main concerns of management. Crop rotation, return of adequate crop residue to the soil for improvement and protection, and timely but limited tillage are needed practices. Terraces help in conserving water. Capability unit IIc–1; Clay Loam range site.

Frankirk loam, 1 to 3 percent slopes (FrB).—This gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to 400 acres in size.

The surface layer is reddish-brown loam about 8 inches thick. Below this layer is about 28 inches of reddish-brown, firm clay loam. The next layer is about 9 inches of reddish-brown, firm clay. Below this layer is about 20 inches of red, firm clay loam. The next layer is red, friable clay loam.

Included with this soil in mapping are some small areas of Bukreek, Motley, Sagerton, Miles, and Altus soils. Also included are some areas of Paloduro and Obaro soils.

The hazard of soil blowing is slight. The hazard of water erosion is moderate.

Most areas of this soil are cultivated. Wheat, cotton, and grain sorghum are the main crops. Reducing runoff, preserving tilth, and maintaining productivity are the needed conservation practices. Terraces, contour cultivation, and growing grain sorghum, small grain, or other crops that leave large amounts of residue help to control erosion. Capability unit IIe–2; Clay Loam range site.

Gageby Series

The Gageby series consists of deep, well-drained, moderately permeable, loamy soils on bottom lands. These soils formed in loamy alluvium of local streams.

In a representative profile the surface layer is brown clay loam about 18 inches thick. Below this layer is about 14 inches of reddish-brown, friable clay loam. The underlying material is friable silty clay loam; it is reddish brown in the upper part and yellowish red in the lower part.

Runoff is slow. Available water capacity is high.

Representative profile of Gageby clay loam, 8 miles southwest of Northfield, via Farm Road 94 and then 150 feet east in area of rangeland:

A11—0 to 4 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium and fine, granular structure; slightly hard, friable; few worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

A12—4 to 18 inches, brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; moderate, medium, granular structure and weak, medium, subangular blocky; hard, friable; few worm casts; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, smooth boundary.

B—18 to 32 inches, reddish-brown (5YR 4/3) clay loam, dark reddish brown (5YR 3/3) moist; weak, medium, subangular blocky structure and moderate, medium, granular; hard, friable; few fine pores; many worm casts; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C1—32 to 48 inches, reddish-brown (5YR 5/4) silty clay loam, dark reddish brown (5YR 3/4) moist; massive; hard, friable; few fine pores; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

C2—48 to 60 inches, yellowish-red (5YR 5/6) silty clay loam, yellowish red (5YR 4/6) moist; massive; hard, friable; few thin strata of silty clay, silt loam, loam, and fine sandy loam; calcareous; moderately alkaline.

The A horizon ranges from 12 to 26 inches in thickness. It is dark grayish brown, grayish brown, dark brown, or brown. Depth to secondary carbonates ranges from 0 to 15 inches.

The B horizon ranges from loam to silty clay loam. In places this horizon has stratified thin layers of fine sandy loam to silty clay. The B horizon is reddish brown or brown. It ranges from 10 to 20 inches in thickness.

The C horizon ranges from loam to silty clay loam, and it has strata of fine sandy loam to silty clay. It is reddish brown, yellowish red, or reddish yellow.

Gageby clay loam (Ga.)—This nearly level soil is on alluvial flood plains along the rivers and some of the smaller streams in the county. Slopes range from 0 to 1 percent but are dominantly less than 0.5 percent. Most areas are narrow and oblong and parallel stream channels. They range from 25 to 300 acres or more in size.

Included with this soil in mapping are some small areas of a soil that is stratified with distinct bedding planes. Also included are small areas of Yomont, Yahola, and Lincoln soils.

The hazards of soil blowing and water erosion are slight.

Some areas of this soil are cultivated. The main crops are wheat and cotton, but some grain sorghum is also grown. Some areas of this soil are occasionally overflowed. Crop rotation, protection of the areas with crop residue, and timely but limited tillage are needed practices. Capability unit IIw–1; Loamy Bottomland range site.

Heatly Series

The Heatly series consists of deep, well-drained, moderately permeable, sandy soils on uplands. These

soils formed in moderately sandy to sandy outwash or eolian material.

In a representative profile the surface layer is light-brown fine sand about 24 inches thick. Below this layer is about 34 inches of red sandy clay loam. The next layer is about 20 inches of yellowish-red friable sandy loam. Below this layer is red, firm sandy clay loam (fig. 5).

Runoff is very slow. Available water capacity is medium.

Representative profile of Heatly fine sand, 0 to 5 percent slopes, 3.5 miles east via Farm Road 684 from its intersection with Texas Highway 70; then 1.15 miles south on county road and 200 feet west, in a cultivated field:

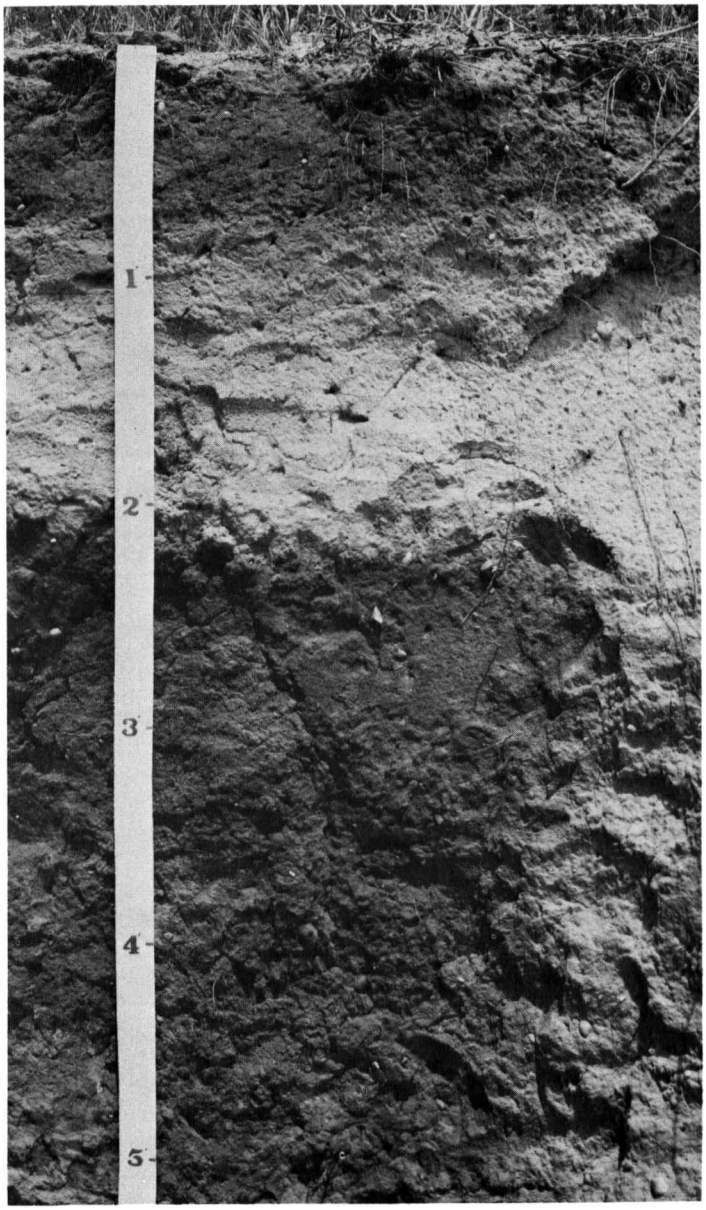

Figure 5.—**Profile of Heatly fine sand, 0 to 5 percent slopes, shows contact between fine sand surface layer and sandy clay loam subsoil at a depth of 24 inches.**

Ap—0 to 24 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; few roots; slightly acid; abrupt, smooth boundary.

B21t—24 to 40 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) moist; moderate, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; few roots; few thin clay films on ped surfaces; neutral; gradual, smooth boundary.

B22t—40 to 58 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; weak to moderate, medium, subangular blocky structure; slightly hard, friable; few roots; few pebbles; few thin clay films; neutral; gradual, smooth boundary.

A'1—58 to 78 inches, yellowish-red (5YR 5/6) sandy loam, yellowish red (5YR 4/6) moist; weak, medium, subangular blocky structure; slightly hard, friable; few pebbles; few pockets of clean sand grains; few bands of light-brown sandy clay loam material starting at a depth of 64 inches; neutral; gradual, smooth boundary.

B'2t—78 to 110 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; grayish and pale-red mottles in the lower 8 inches; moderate, medium, subangular blocky structure; hard, firm; neutral.

The A horizon ranges from 20 to 36 inches in thickness. It is light reddish brown, light yellowish brown, brown, or light brown, and the upper 4 to 6 inches is darker in undisturbed areas of rangeland. This horizon is slightly acid or neutral.

The B2t horizon ranges from sandy clay loam to sandy loam. It ranges from 18 to more than 40 inches in thickness, and it is reddish brown, yellowish red, red, or reddish yellow. This horizon ranges from slightly acid to mildly alkaline.

The A'1 horizon ranges from loamy sand to sandy loam. It has the same color range as the B2t horizon. The lower part has pockets of clean sand grains and bands or pockets of sandy clay loam material. This horizon ranges from slightly acid to mildly alkaline.

The B'2t horizon ranges from sandy loam to sandy clay. It is light red, red, reddish brown, reddish yellow, or yellowish red.

Heatly fine sand, 0 to 5 percent slopes (HeC).—This nearly level to gently undulating soil in on uplands. Areas are irregular in shape, and they range from 10 to more than 1,000 acres in size but are commonly larger than 300 acres.

Included with this soil in mapping are some areas of Nobscot, Delwin, Miles, and Devol soils. Also included are fence rows bordering cultivated fields that have accumulations of some sand 4 to 10 feet high.

The hazard of soil blowing is high.

Most areas of this soil are in range. This soil is better suited to range than to other uses. Many areas that were formerly cultivated are now idle or have been reseeded to grass. In places the soil has a billowy surface, with small dunes 2 to 3 feet high, because of shifting and blowing of the surface layer. Capability unit VIe–3; Sandy range site.

Hilgrave Series

The Hilgrave series consists of deep, well-drained, moderately rapidly permeable, gravelly soils on uplands. These soils formed in stratified gravelly and sandy outwash material.

In a representative profile the surface layer is reddish-brown, very gravelly sandy loam about 6 inches thick. Below this layer is about 12 inches of red, friable very gravelly sandy loam. The next layer is about 8 inches of red, friable very gravelly sandy clay loam.

Below this layer is about 14 inches of light reddish-brown, very friable gravelly loamy sand that has films and threads of calcium carbonate. The underlying material is reddish-yellow coarse sand.

Runoff is medium to rapid. Available water capacity is low.

Representative profile of Hilgrave gravelly sandy loam, 10 to 30 percent slopes, 9.5 miles east of Matador, via U.S. Highways 62 and 70; 5 miles northeast on ranch road; 3 miles northeast on ranch road to Tee Pee City; 4 miles northeast on ranch road; and then 0.35 mile north and 0.6 mile east of ranch road in area of rangeland:

A1—0 to 6 inches, reddish-brown (5YR 5/4) gravelly sandy loam, dark reddish brown (5YR 3/4) moist; weak, granular structure; soft, very friable; many grass roots; 65 percent waterworn siliceous gravel; slightly acid; clear, smooth boundary.

B21t—6 to 18 inches, red (2.5YR 5/6) very gravelly sandy loam, dark red (2.5YR 3/6) moist; weak, coarse, subangular blocky structure; soft, friable; common grass roots; 70 percent waterworn siliceous gravel; clay bridging between sand grains; slightly acid; gradual, smooth boundary.

B22t—18 to 26 inches, red (2.5YR 4/6) very gravelly sandy clay loam, dark red (2.5YR 3/6) moist; weak coarse, subangular blocky structure; slightly hard, friable; many grass roots; 70 percent waterworn siliceous gravel; evident clay films and bridging between sand grains; mildly alkaline; clear, smooth boundary.

B3ca—26 to 40 inches, light reddish-brown (5YR 6/4) gravelly loamy sand, reddish brown (5YR 5/4) moist; structureless; soft, very friable; few grass roots; 45 percent siliceous gravel, in upper part grading to 60 percent in lower part; few films and threads of calcium carbonate; some pebbles have thin coatings of calcium carbonate on lower side; calcareous, moderately alkaline; clear, smooth boundary.

C—40 to 60 inches, reddish-yellow (5YR 6/6) coarse sand, yellowish red (5YR 4/6) moist; structureless; soft, very friable; scattered gravel; few films and threads and calcium carbonate; most pebbles have patchy coatings of calcium carbonate on lower side; calcareous, moderately alkaline.

The A horizon ranges from 5 to 9 inches in thickness. It is light reddish brown, reddish brown, light brown, or brown. This horizon ranges from medium acid to moderately alkaline. It is noncalcareous, and the content of gravel ranges from 35 to 80 percent.

The Bt horizon ranges from 13 to 26 inches in thickness. It is red, reddish-brown, or yellowish-red gravelly sandy loam to very gravelly sandy clay loam. This horizon ranges from slightly acid to moderately alkaline. It is noncalcareous in the upper part, and the content of gravel ranges from 35 to 80 percent. The B3 horizon ranges from 6 to 15 inches in thickness. It ranges from noncalcareous to calcareous in the matrix and has segregated calcium carbonate in the form of films and threads or coatings of calcium carbonate on the pebbles.

Depth to the C horizon ranges from 20 to 50 inches. The C horizon ranges from gravel-free sand to highly stratified gravel beds that have strata of reddish material.

Hilgrave gravelly sandy loam, 10 to 30 percent slopes (HgF).—This soil is on dissected hilly areas on uplands that are mostly associated with the rivers in the county. Areas are irregular in shape, long and narrow, and 50 to 1,000 acres in size.

Included with this soil in mapping are areas of Miles and Devol soils, which are mainly on the outer edge of the areas and in some of the narrow valleys. Also included are a few areas of Woodward, Quinlan, and Flomot soils.

The hazard of water erosion is moderate.

All areas of this soil are in native range. Many gravel pits are in some areas. Capability unit VIs–1; Gravelly range site.

Latom Series

The Latom series consists of very shallow to shallow, moderately well drained, slowly permeable, loamy soils on uplands. These soils formed in material weathered from sandstone or conglomerate.

In a representative profile the surface layer is brown calcareous fine sandy loam about 9 inches thick. The underlying material is very pale brown, strongly cemented sandstone.

Runoff is medium. Available water capacity is very low.

Representative profile of Latom fine sandy loam, in an area of Latom-Rock outcrop complex, 3 to 12 percent slopes, 1 mile south of Whiteflat, via Texas Highway 70; 3.35 miles west along Farm Road 2999; 3.1 miles west on county road; then 1.3 miles north on ranch road and 150 feet east in area of rangeland:

A1—0 to 9 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) moist; weak, granular structure; soft, very friable; few roots; few small sandstone fragments in lower part; calcareous, moderately alkaline; clear, smooth boundary.

R—9 to 15 inches, very pale brown (10YR 8/3), strongly cemented, calcareous sandstone; thin coating of calcium carbonate in crevices.

The A horizon ranges from 4 to 20 inches in thickness. It is light reddish brown, reddish brown, brown, light brown, or pale brown. The R layer ranges from strongly cemented sandstone to conglomerate rock.

Latom-Rock outcrop complex, 3 to 12 percent slopes (LaE).—This complex consists of gently sloping to strongly sloping soils on rolling ridges and side slopes along drainageways. Areas are irregular in shape and ranges from 50 to several thousand acres in size (fig. 6).

This complex consists of soils and rock outcrops so intricately intermingled that they cannot be mapped separately. It is on the average about 50 percent Latom soils, 33 percent sandstone and conglomerate outcrop, and 27 percent other soils. The range in proportion from area to area is as follows: Latom soils from 40 to 57 percent, sandstone and conglomerate outcrops from 30 to 40 percent, and other soils from 3 to 30 percent.

Latom soils are on the ridgetops and on narrow benches or steps above sandstone ledges.

The sandstone and conglomerate outcrop occurs as ledges or rims and forms a stairstep topography. The layers of sandstone are from 4 to 30 feet thick and are underlain or interlayered with sandy and silty red beds.

Included with this complex in mapping are areas of Miles, Devol, Quinlan, Woodward, and Flomot soils. Also included are barren, exposed, sandy and silty red beds, some areas of soils that have slopes as much as 50 percent, and small areas of Hilgrave, Polar, and Potter soils.

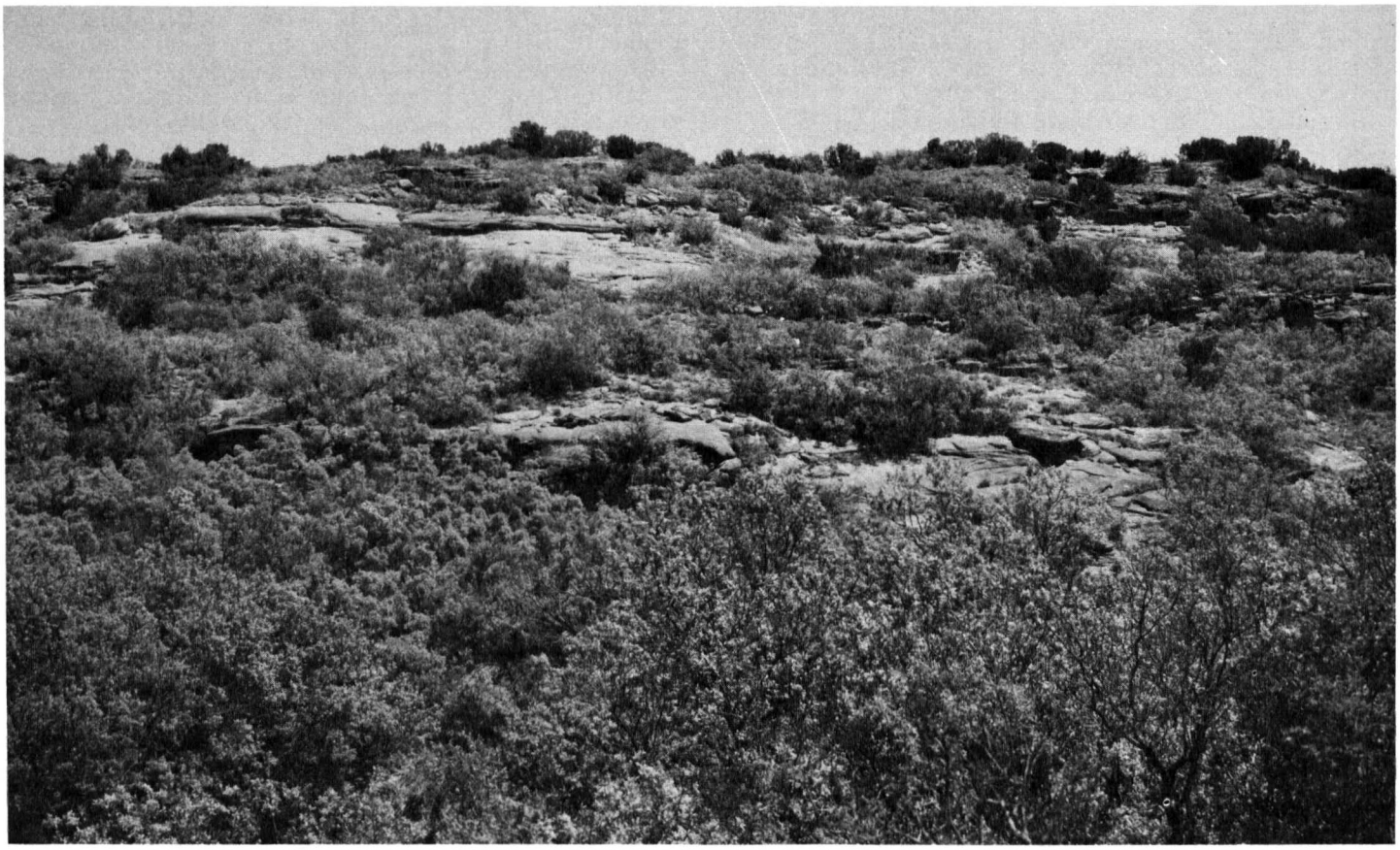

Figure 6.—**Typical area of Latom-Rock outcrop complex, 3 to 12 percent slopes.**

The hazard of water erosion is high.

All areas of this complex are used for range. The soils are suitable only for range, wildlife habitat, and recreational uses. Conservative use of grasses on these soils is essential to prevent erosion. Rest periods from grazing are needed if the vigor of grasses is low. Careful planning is also needed in locating roads and other improvements where traffic by livestock or vehicles is likely to increase the hazard of erosion. Capability unit VIIs–1; Very Shallow range site.

Lincoln Series

The Lincoln series consists of deep, somewhat excessively drained, rapidly permeable, sandy soils on bottom lands. These soils formed in calcareous, sandy alluvium.

In a representative profile the surface layer is yellowish-red fine sandy loam about 13 inches thick. The underlying material is pink fine sand that is stratified with silt loam, loamy sand, and fine sandy loam.

Runoff is slow. Available water capacity is low.

Representative profile of Lincoln fine sandy loam, in an area of Lincoln soils, 0.8 mile west of Northfield, via Farm Road 656; 1.8 miles north of private ranch road, and 0.7 mile east, in area of rangeland:

A1—0 to 13 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; single grained; soft, very friable; stratified with thin layers of loamy sand; calcareous, moderately alkaline; clear, smooth boundary.

C—13 to 60 inches, pink (5YR 8/4) fine sand, pink (5YR 7/4) moist; bedding planes evident; strata of silt loam, fine sandy loam, and loamy sand ⅛ inch to 4 inches thick; calcareous, moderately alkaline.

The A horizon ranges from 6 to 15 inches in thickness. It is fine sandy loam to loamy fine sand that is yellowish red, light reddish brown, reddish yellow, or light red.

The C horizon ranges from loamy fine sand to fine sand but has thin strata of silt loam, very fine sandy loam, fine sandy loam, and a few thin strata of fine gravel. This horizon is pink, reddish yellow, light reddish brown, or light red.

Lincoln soils (Ln).—These nearly level soils are on flood plains along the rivers and some of the major creeks in the county. Slopes are 0 to 1 percent. Areas range from 15 to 500 acres or more in size. They are narrow and are parallel to the stream channel.

These soils have the profile described as representative of the series.

Included with these soils in mapping are narrow bands of Yahola, Yomont, and Tivoli soils. Also included are some areas of Lincoln soils that have a surface layer of loamy fine sand. These areas occur without regularity.

The hazard of soil blowing is high.

Most areas of these soils are used as range, but a few areas are cultivated. In some areas the water table is at a depth of 3 to 6 feet during part of the year.

These soils are better suited to range, sites for recreation, or wildlife habitat than to other uses. They support a good growth of native grasses. Capability unit IVe–2; Sandy Bottomland range site.

Lincoln soils, frequently flooded (Lo).—These nearly level soils are on low flood plains along the major streams in the county. These soils are on the first bottom and are 1 to 4 feet above the stream channels (fig. 7). Areas are narrow and parallel the stream channel. They range from 25 to 1,000 acres. Slopes are 0 to 1 percent.

The surface layer is yellowish-red loamy fine sand about 6 inches thick. The underlying material is pink fine sand that has strata of silt loam, fine sandy loam, and loamy sand.

Included with these soils in mapping are areas of Yahola soils and a few small areas of Tivoli soils on ridges. Also included are some areas of Lincoln soils that have a surface layer of fine sandy loam. These areas occur without regularity.

These soils are not suited to crops. A water table is at a depth of 2 to 4 feet in many areas. Most areas flood during periods of heavy rainfall. These soils are better suited to range, sites for recreation, or wildlife habitat than to other uses. They support a good growth of native grasses. Capability unit Vw–2; Sandy Bottomland range site.

Lipan Series

The Lipan series consists of deep, poorly drained, very slowly permeable, clayey soils on uplands. These soils formed in calcareous clayey material.

In a representative profile the surface layer is dark-gray clay about 6 inches thick over gray, very firm, calcareous clay about 11 inches thick. Below this layer is about 33 inches of light-gray, very firm, calcareous clay. The underlying material is white, massive clay.

Runoff is slow. Available water capacity is high.

Representative profile of Lipan clay, depressional, 3.75 miles east of the courthouse in Matador, via U.S. Highways 62 and 70; then 1 mile south and 0.1 mile west on county road and 75 feet south in a cultivated field:

Ap—0 to 6 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate, fine and very fine, granular structure; hard, firm, sticky and very plastic; few pebbles; calcareous, moderately alkaline; abrupt, smooth boundary.

A1—6 to 17 inches, gray (10YR 5/1) clay, dark gray (10YR 4/1) moist; moderate, fine, blocky structure; extremely hard, very firm, sticky and plastic; few very fine pores; few small concretions of calcium carbonate; calcareous, moderately alkaline; gradual, smooth boundary.

AC—17 to 50 inches, light-gray (10YR 6/1) clay, gray (10YR 5/1) moist; weak, fine, irregular blocky structure; extremely hard, very firm; few fine concretions of calcium carbonate; calcareous, moderately alkaline; gradual, smooth boundary.

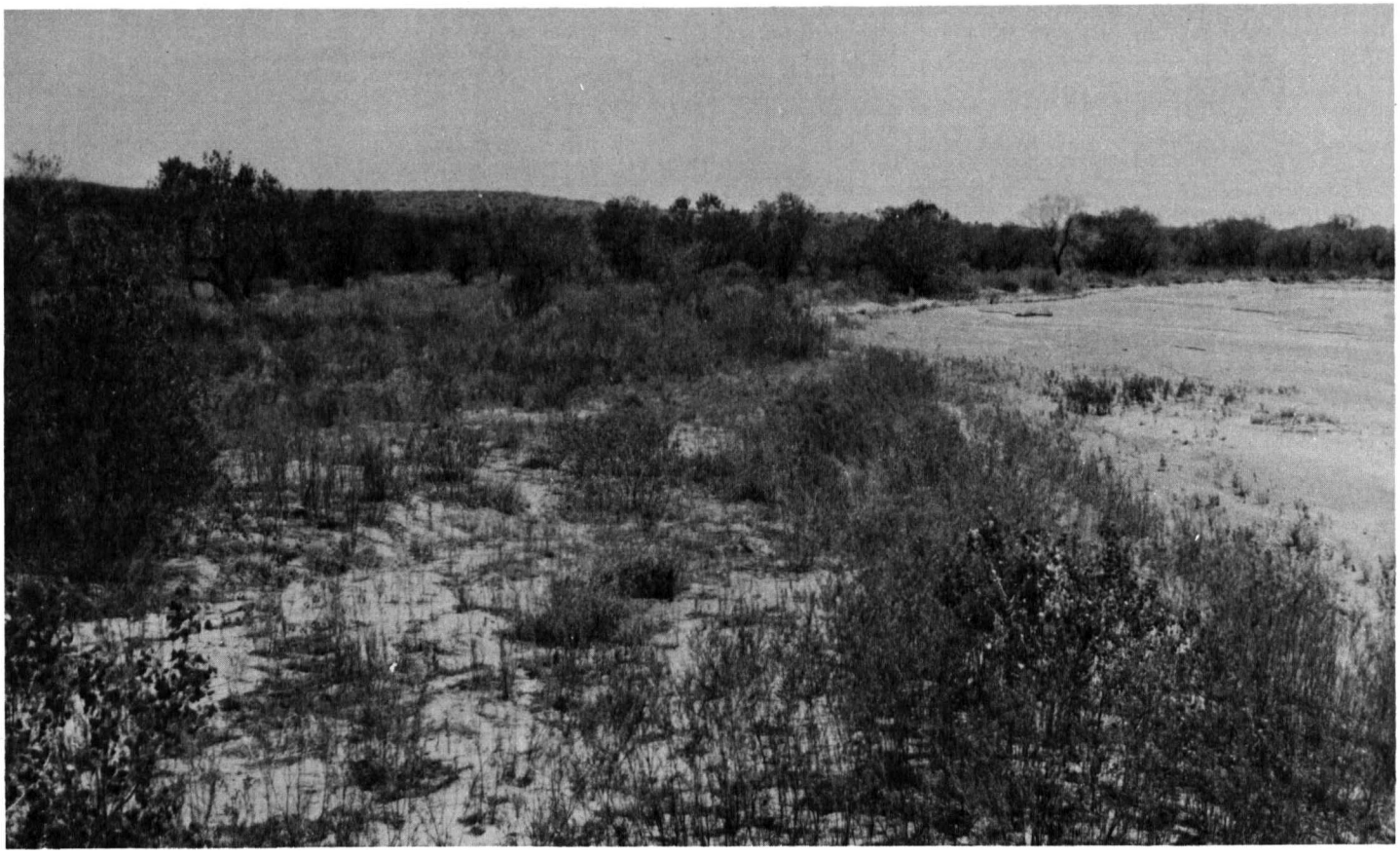

Figure 7.—An area of Lincoln soils, frequently flooded, near the Pease River channel.

C—50 to 60 inches, white (10YR 8/2) clay, light gray (10YR 7/2) moist; red mottles in lower part; massive; extremely hard, very firm; few concretions of calcium carbonate; calcareous, moderately alkaline.

The A horizon ranges from 13 to 26 inches in thickness. It is dark gray or gray. This horizon is mildly alkaline to moderately alkaline and is calcareous or noncalcareous in the upper part.

The AC horizon ranges from 25 to 36 inches in thickness. It is dark gray, gray, or light gray. The soils crack when drying. The cracks are as much as 1 to 2 inches wide at the surface and are 3 to 6 feet deep.

Depth to the C horizon ranges from 40 to 60 inches. This horizon has few to common concretions of calcium carbonate. It is gray, light gray, or white.

Lipan clay, depressional (Lp).—This nearly level soil is on smooth, slightly depressional basins on uplands. The areas are round to oval and range from 3 to 160 acres in size.

Included with this soil in mapping are some small areas of Abilene soils, which are in slightly higher spots or on the outer edges of the slightly depressional areas. A few areas along the marginal rims of the depressions have as much as 4 inches of overwash of medium-textured material from surrounding soils.

The hazards of soil blowing and water erosion are slight.

About 50 percent of the area of this soil is cultivated. Cotton, wheat, and grain sorghum are the principal crops. Water stands on the surface for extended periods following heavy rains. Planting and harvesting of crops are delayed because of excess water or wetness. Controlling excess water and maintaining tilth are the major concerns of management. Growing crops that add organic residue helps to reduce soil blowing and increases water intake. Capability unit IVw–1; Lakebed range site.

Mansker Series

The Mansker series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in calcareous, loamy material.

In a representative profile the surface layer is dark-brown and brown clay loam about 14 inches thick. The next layer is about 12 inches of pink, friable clay loam. Below this layer is about 22 inches of yellowish-red, friable clay loam. The next layer is reddish-yellow, friable clay loam.

Runoff is medium. Available water capacity is medium.

Those soils are mapped only in a complex with soils of the Posey series.

Representative profile of Mansker clay loam, in an area of Posey-Mansker complex, 3 to 5 percent slopes, 0.4 mile east of the Floyd-Motley County line via U.S. Highways 62 and 70 and 250 feet south in area of rangeland:

A11—0 to 10 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, coarse, prismatic structure parting to moderate, medium, granular; slightly hard, friable; common roots; many fine pores; few worm casts; calcareous; moderately alkaline; clear, smooth boundary.

A12—10 to 14 inches, brown (7.5YR 5/4) clay loam, brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, medium, granular; slightly hard, friable; common roots; many fine pores; many worm casts; common strongly cemented concretions and films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, wavy boundary.

B21ca—14 to 26 inches, pink (7.5YR 7/4) clay loam, light brown (7.5YR 6/4) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; few roots; few worm casts; about 50 percent calcium carbonate in the form of weakly cemented concretions, powdery masses, and a few strongly cemented concretions; calcareous; moderately alkaline; diffuse, wavy boundary.

B22tca—26 to 48 inches, yellowish-red (5YR 5/6) clay loam, yellowish red (5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; few faint clay films; about 40 percent calcium carbonate in form of weakly cemented masses and films and threads; calcareous; moderately alkaline; diffuse, wavy boundary.

B23tca—48 to 68 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate, medium, subangular blocky structure; hard, friable; few thin clay films on ped surfaces; about 20 percent weakly cemented concretions and soft powdery masses of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24tca—68 to 84 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate, medium, subangular blocky structure; hard, friable; few thin clay films on ped surfaces; about 5 percent weakly cemented concretions and soft powdery masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to the B2ca horizon ranges from 10 to 18 inches.

The A horizon is dark brown, grayish brown, brown, or dark grayish brown.

The B21ca horizon is light reddish-brown, pale-brown, or pink loam to clay loam. The content of calcium carbonate ranges from 40 to 65 percent. The B2t horizon is reddish-yellow, yellowish-red, red, or strong-brown sandy clay loam to clay loam. The content of calcium carbonate ranges from 15 to 40 percent.

Miles Series

The Miles series consists of deep, well-drained, moderately permeable, loamy and sandy soils on uplands. These soils formed in outwash or old alluvium.

In a representative profile the surface layer is reddish-brown fine sandy loam about 14 inches thick. Below this layer is 31 inches of reddish-brown, friable sandy clay loam. The next layer is yellowish-red, friable sandy clay loam that extends to a depth of 84 inches. This layer has calcium carbonate concretions in the lower part.

Runoff is slow to rapid. Available water capacity is medium.

Representative profile of Miles fine sandy loam, 1 to 3 percent slopes, 1.55 miles south of Whiteflat, via Texas Highway 70, and 150 feet west in a cultivated field:

Ap—0 to 14 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular structure; soft, very friable; few fine roots; neutral; abrupt, smooth boundary.

B21t—14 to 26 inches, reddish-brown (5YR 4/4) sandy clay loam; dark reddish brown (5YR 3/4) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few pores; few thin clay films on ped surfaces; neutral; gradual, smooth boundary.

B22t—26 to 45 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) moist; weak,

coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; few pores; few pebbles; few thin clay films on ped surfaces; neutral; gradual, smooth boundary.

B23t—45 to 59 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, medium, subangular blocky structure; slightly hard, friable; mildly alkaline; clear, smooth boundary.

B24t—59 to 75 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; few faint clay films on ped surfaces; few films and threads of calcium carbonate in lower part; calcareous; moderately alkaline; gradual, smooth boundary.

B25tca—75 to 84 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, friable; few faint clay films; many films and threads and few small concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to secondary carbonates is 38 to 75 inches.

The A horizon is reddish-brown, light reddish-brown, light-brown, or brown fine sandy loam or loamy fine sand. It ranges from 7 to 20 inches in thickness and is slightly acid to mildly alkaline.

The B21t and B22t horizons are reddish-brown, yellowish-red, or red fine sandy loam to sandy clay loam. The clay content averages 18 to 30 percent. These horizons are neutral or mildly alkaline. The lower part of the B2t horizon is red, yellowish-red, or reddish-yellow fine sandy loam to sandy clay loam. Reaction ranges from mildly alkaline to moderately alkaline.

Miles loamy fine sand, 0 to 3 percent slopes (MeB).—This nearly level to gently undulating soil is on uplands. Areas are irregular in shape and range from 25 to 1,000 acres in size. Slopes are dominantly 0.6 to 2 percent.

The surface layer is reddish-brown loamy fine sand about 17 inches thick. Below this layer is about 43 inches of reddish-brown, firm sandy clay loam. The next layer, extending to a depth of 80 inches, is red, friable sandy clay loam.

Included with this soil in mapping are small areas of Miles fine sandy loam and areas of Devol, Delwin, Woodward, and Flomot soils. A soil in which the surface layer is as much as 24 inches thick in a few areas because of deep plowing is included. Also included are small areas of eroded soils; in places a part of the surface layer has been lost through erosion, and the subsoil is exposed. Also included are fence rows along cultivated fields that have accumulations of sand 3 to 6 feet in height.

The hazard of soil blowing is high.

Most areas of this soil are cultivated. Cotton, guar, and grain sorghum are the main crops. A few areas that were formerly cultivated are seeded to native grass.

Management needs include rotation of crops and use of fertilizer. Leaving crop residue on the soil surface helps to control soil blowing. Deep plowing increases the clay content of the surface layer and reduces susceptibility to soil blowing. If the soils are deep plowed, cotton can be grown in alternate strips with sorghum. Tillage should be limited to that essential for crop production. Capability unit IIIe–7; Sandy Loam range site.

Miles loamy fine sand, 3 to 5 percent slopes (MeC).—This gently sloping and gently undulating soil is on convex ridges and side slopes along large drainageways. Most areas are less than 100 acres in size, but a few are as large as 300 acres.

The surface layer is brown loamy fine sand about 13 inches thick. Below this layer is about 44 inches of reddish-brown, friable sandy clay loam. The next layer is yellowish-red, friable sandy loam.

Included with this soil in mapping are some small areas of Devol, Heatly, Woodward, Flomot, Delwin, and Hilgrave soils. Also included are a few areas of soils that have slopes as much as 7 percent and a few areas of soils where some of the material in the surface layer has been lost through erosion, and in places the subsoil is exposed. Also included are small, crossable gullies as much as 3 feet deep and 5 to 15 feet wide. A few deep, uncrossable gullies are also included.

The hazard of soil blowing is high, and the hazard of water erosion is moderate.

About 35 percent of the area of this soil is cultivated. Cotton, guar, and grain sorghum are the main crops. Management needs include rotation of crops and use of fertilizer. Leaving crop residue on the surface of the soil helps to control soil blowing. Plowing deep increases the clay content of the surface layer and reduces susceptibility to soil blowing. If this soil is deep plowed, cotton can be grown in alternate strips with sorghum. Tillage should be limited to that essential for crop production. Capability unit IVe–5; Sandy Loam range site.

Miles fine sandy loam, 1 to 3 percent slopes (MfB).—This gently sloping soil is on plains on uplands. Slopes are dominantly about 2 percent. Soil areas are irregular in shape and range from 10 to several hundred acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Motley, Bukreek, Altus, Abilene, Delwin, Devol, Flomot, and Woodward soils. These soils make up less than 10 percent of the total acreage of this soil.

The hazards of soil blowing and water erosion are moderate.

Most areas of this soil are cultivated. Cotton and grain sorghum are the main crops. Occasional rills and gullies occur in some places. In some areas the surface layer is sandier because clay and silt particles have been removed by wind. Management of these soils includes growing cotton and sorghum in rotation along with some small grain. Growing alternate strips of cotton and sorghum in a regular pattern helps to reduce soil blowing. Leaving residue on the soil surface helps to control erosion. Contour farming and terracing help to control water erosion. In places diversions and grassed waterways are needed to intercept excess runoff. Capability unit IIIe–2; Sandy Loam range site.

Miles fine sandy loam, 3 to 5 percent slopes (MfC).—This gently sloping soil is on uplands mostly along drainageways. Areas are generally longer than they are wide and range from 10 to several hundred acres in size.

The surface layer is brown fine sandy loam about 8 inches thick. The upper part of the subsoil is about 12 inches of reddish-brown, firm sandy clay loam. The lower part of the subsoil is about 15 inches of yellowish-

red, friable sandy clay loam. Below this layer is red, friable sandy clay loam.

Included with this soil in mapping are some small areas, less than 5 acres in size, of eroded soils in narrow bands along drainageways. Also included are a few rounded hilltops, 3 to 5 acres in size, of Hilgrave soils, a few areas of soils that have slopes of 5 to 12 percent or 1 to 3 percent, and a few areas of Bukreek, Motley, Delwin, Devol, Flomot, and Woodward soils.

The hazards of soil blowing and water erosion are moderate.

About 30 percent of the area of this soil is cultivated. Cotton and grain sorghum are the main crops. Some winnowing of the silt and clay of the plowed layer in most cultivated areas has resulted in a sandier surface. A few shallow gullies, more than 300 feet apart and crossable with farm machinery, are in some places. This soil is better suited to crops such as small grain and sorghum, which give soil protection, than to other uses. Maintaining cover crops or protective residue on the soil surface and limiting tillage are necessary practices to conserve moisture and to control erosion. Terraces, including diversion terraces, are needed to help to control water erosion. Capability unit IIIe–2; Sandy Loam range site.

Miles fine sandy loam, 5 to 8 percent slopes (MfE).—This sloping soil is along small drainageways. Areas are 10 to several hundred acres in size, irregular in shape, and mostly parallel to drainageways.

The surface layer is reddish-brown fine sandy loam about 7 inches thick. The upper part of the subsoil is about 14 inches of reddish-brown, friable sandy clay loam. The lower part of the subsoil is about 16 inches of light reddish-brown, friable sandy clay loam. Below this layer is red, friable sandy clay loam.

Included with this soil in mapping are small areas of Miles fine sandy loam, 3 to 5 percent slopes, Miles loamy fine sand, and Hilgrave, Woodward, and Flomot soils. Also included are areas of soils that have layers of gravel at a depth of 2 to 4 feet and sandy red beds at a depth of 4 to 6 feet.

The hazard of soil blowing is moderate, and the hazard of water erosion is high.

All areas of this soil are in range. A few areas that were formerly cultivated are eroded. In these areas there are a few gullies. Capability unit IVe–3; Sandy Loam range site.

Mobeetie Series

The Mobeetie series consists of deep, well-drained, moderately rapidly permeable, loamy soils on uplands. These soils formed in recent, moderately sandy, calcareous material.

The surface layer is brown fine sandy loam about 9 inches thick. Below this layer is about 16 inches of brown, friable fine sandy loam. The next layer is about 23 inches of light reddish-brown, very friable fine sandy loam that has films and threads of calcium carbonate. The underlying material is light reddish-brown, very friable fine sandy loam.

Runoff is medium. Available water capacity is medium.

Representative profile of Mobeetie fine sandy loam, 3 to 5 percent slopes, 5.9 miles east of Flomot, via Farm Road 97; then 2.2 miles north on Texas Highway 70 and 0.25 mile west in a cultivated field:

Ap—0 to 9 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; slightly hard, friable; calcareous; moderately alkaline; clear, smooth boundary.

B2—9 to 25 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, friable; few pebbles; few faint films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3—25 to 48 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, coarse, prismatic structure; soft, very friable; calcium carbonate in form of films and threads and coatings on a few pebbles; calcareous; moderately alkaline; gradual, smooth boundary.

C—48 to 70 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 4/4) moist; weak, coarse, prismatic structure; soft, very friable; calcareous; moderately alkaline.

The A horizon is brown, light reddish brown, pale brown, reddish brown, or grayish brown. It ranges from 6 to 20 inches in thickness.

The B horizon ranges from fine sandy loam to loam. The content of clay is less than 18 percent. This horizon is light reddish brown, brown, light brown, reddish brown, grayish brown, or pale brown. The calcium carbonate ranges from films and threads to fine strongly cemented concretions.

The C horizon ranges from fine sandy loam to loam. It is light reddish brown, light brown, reddish yellow, or very pale brown. Depth to this horizon ranges from 24 to 50 inches. The content of calcium carbonate ranges from 1 to 10 percent.

Mobeetie fine sandy loam, 0 to 3 percent slopes (MoB).—This nearly level to gently sloping soil is on uplands in areas associated with the rivers and larger streams in the county. Areas range from 8 to 300 acres in size and are irregular and oblong in shape.

The surface layer is reddish-brown fine sandy loam 11 inches thick. Below this layer is 21 inches of light reddish-brown, very friable fine sandy loam. The underlying material is reddish-yellow fine sandy loam.

Included with this soil in mapping are some areas of Tivoli, Devol, Paloduro, and Yahola soils.

The hazard of soil blowing is moderate.

Most areas of this soil are cultivated. Cotton, grain sorghum, and bermudagrass are the main crops. Growing small grain and sorghum protects the soil from erosion and leaves adequate residue for soil protection. Contour farming of row crops is needed. Diversions and grassed waterways are needed in places to remove excess runoff. Capability unit IIIe–3; Mixedland Slopes range site.

Mobeetie fine sandy loam, 3 to 5 percent slopes (MoC).—This gently sloping soil is on foot slopes along the rivers and larger streams. Areas are irregular in shape and range from 10 to 150 acres.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some narrow bands of soils that have slopes of 1 to 3 percent. Also included are small areas of Miles, Motley, Polar, Mansker, Berda, and Flomot soils and some areas of Devol soils.

The hazard of soil blowing is moderate.

Most areas of these soils are used as range. Areas

used for crops are mostly planted to cotton or grain sorghum. Gullies form where water concentrates on unprotected areas. Some areas along drainageways are moderately eroded and have a few U-shaped gullies about 300 feet apart. The gullies are 1 to 5 feet deep and 4 to 12 feet wide. They are in some unprotected cultivated fields.

This soil is well suited to sorghum and small grain. These crops provide adequate residue to help control erosion. Contour farming helps to control water erosion. Capability unit IVe–7; Mixedland Slopes range site.

Mobeetie fine sandy loam, 5 to 12 percent slopes (MoE).—This sloping to strongly sloping soil is on uplands along the rivers. Slopes are mostly 5 to 8 percent, and areas are less than 100 acres in size.

The surface layer is brown fine sandy loam about 8 inches thick. Below this layer is about 40 inches of light-brown, friable fine sandy loam. The underlying material is light reddish-brown, friable fine sandy loam.

Included with this soil in mapping are areas of soils that have slopes of 3 to 5 percent and areas of Miles and Devol soils. Also included are a few areas of soils that have red beds at a depth of 30 to 60 inches.

The hazards of soil blowing and water erosion are moderate. Areas of this soil are used as range. A few gullies are in areas of this soil along drainageways. The gullies are 3 to 10 feet deep and 10 to 30 feet wide. Capability unit VIe–1; Mixedland Slopes range site.

Motley Series

The Motley series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in loamy calcareous material of alluvial origin.

In a representative profile the surface layer is reddish-brown loam about 9 inches thick. The next layer is about 21 inches of reddish-brown sandy clay loam; the upper 8 inches is friable, and the lower part is firm. The next 26 inches is red firm sandy clay loam. Below this layer is light-red, friable sandy clay loam.

Runoff is slow. Available water capacity is medium.

Representative profile of Motley loam, 0 to 1 percent slopes, 6.5 miles southeast via county road from the Q.A.&P. Railroad, Russelville shipping point, to the South Pease River bridge; then 1.5 miles south on county road and 0.3 mile south on private ranch road in area of rangeland:

A1—0 to 9 inches, reddish-brown (5YR 4/3) loam, dark reddish brown (5YR 3/3) moist; weak, fine, granular and subangular blocky structure; slightly hard, very friable; many roots; few fine siliceous pebbles; neutral; gradual, smooth boundary.

B1t—9 to 17 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) moist; compound weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; many roots; few thin clay films; few worm casts; few small siliceous pebbles; neutral; gradual, smooth boundary.

B21t—17 to 30 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) moist; compound weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; few roots; common very fine pores; few fine siliceous quartz pebbles; few thin clay films on ped surfaces; mildly alkaline; gradual, smooth boundary.

B22t—30 to 43 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) moist; compound weak, coarse, prismatic and moderate, medium, subangular blocky structure; very hard, firm; few fine roots; few fine pores; few quartz pebbles; few thin clay films on ped surfaces; mildly alkaline; gradual, smooth boundary.

B23t—43 to 56 inches, red (2.5YR 4/6) sandy clay loam, red (2.5YR 4/6) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; very hard, firm; few fine roots; few siliceous quartz pebbles as much as 1 inch in diameter; few films and threads of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24t—56 to 84 inches, light-red (2.5YR 6/6) sandy clay loam, red (2.5YR 4/6) moist; weak, subangular blocky structure; slightly hard, friable; few films, threads, and small soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to secondary carbonates ranges from 36 to 65 inches.

The A horizon is reddish-brown, grayish-brown, or brown. It ranges from 6 to 14 inches in thickness.

The B1t horizon is reddish-brown or brown loam to sandy clay loam. The B2t horizon above the level of secondary lime is reddish brown, yellowish red, or red. It is sandy clay loam that is 25 to 35 percent clay. Reaction is neutral or mildly alkaline. The calcareous part of the B2t horizon is reddish-brown, yellowish-red, reddish-yellow, red, or light-red sandy clay loam or loam. Carbonates range from thin, soft coatings to vertical stringers containing cemented concretions. The content of calcium carbonate ranges from 2 to 10 percent in most profiles.

Motley loam, 0 to 1 percent slopes (MtA).—This nearly level soil is on plains on uplands. Areas are irregular in shape and range from 10 to several hundred acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas of Motley loam, 1 to 3 percent slopes, and areas of Bukreek, Frankirk, Miles, Abilene, Altus, and Woodward soils.

The hazards of soil blowing and water erosion are slight.

About 50 percent of the area of this soil is cultivated. Cotton, wheat, and grain sorghum are the main crops. Conserving moisture, preserving tilth, and maintaining productivity are the main concerns of management. A suitable cropping system includes sorghum, small grain, and other crops that leave large amounts of residue. Terracing and contour farming help to conserve water. Capability unit IIc–2; Mixedland range site.

Motley loam, 1 to 3 percent slopes (MtB).—This gently sloping soil is on plains on uplands. Most areas are less than 75 acres in size but range from 10 to 100 acres. They are irregular in shape.

The surface layer is brown loam about 8 inches thick. Below this layer is about 6 inches of brown, firm sandy clay loam. The next 28 inches is reddish-brown, firm sandy clay loam. Below this layer is about 22 inches of yellowish-red, friable sandy clay loam. The next layer is reddish-yellow, friable loam.

Included with this soil in mapping are small areas, less than 5 acres in size, of Motley loam, 0 to 1 per-

cent slopes, and areas of Miles, Bukreek, Frankirk, and Sagerton soils.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

Most areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the main crops. Suitable management practices include crop rotation, use of crop residue for erosion control and soil improvement, and limited but timely tillage. Contour farming and terracing are needed to help control water erosion. Diversion terraces and grassed waterways are needed in places for safe disposal of runoff water. Capability unit IIe–2; Mixedland range site.

Nobscot Series

The Nobscot series consists of deep, well-drained, moderately rapidly permeable, sandy soils on uplands. These soils formed in eolian sands.

In a representative profile the surface layer is brown fine sand about 6 inches thick. Below this layer is about 20 inches of light-brown fine sand. The next layer is about 30 inches of yellowish-red fine sandy loam that has bands of reddish-brown sandy clay loam. Below this layer is about 24 inches of yellowish-red sandy loam that has bands and splotches of reddish-brown sandy clay loam. The underlying material is reddish-yellow, loose loamy sand.

Runoff is very slow. Available water capacity is low.

Representative profile of Nobscot soils, 3 to 12 percent slopes, 0.1 mile south via Texas Highway 70 from the Motley-Hall County line, and then 1,000 feet east in area of rangeland:

A1—0 to 6 inches, brown (7.5YR 5/2) fine sand, dark brown (7.5YR 4/2) moist; single grained; loose; slightly acid; clear, smooth boundary.

A2—6 to 26 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) moist; single grained; loose; slightly acid; gradual, wavy boundary.

B21t—26 to 56 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; reddish-brown (5YR 4/4) sandy clay loam in bands ⅛ inch to ½ inch thick and about 4 to 8 inches apart throughout; weak, coarse, prismatic structure; pockets and streaks of clean sand grains; neutral; gradual, wavy boundary.

B22t&B3—56 to 80 inches, yellowish-red (5YR 5/6) sandy loam; yellowish red (5YR 4/6) moist; about 20 percent bands and splotches of reddish-brown (5YR 5/4) sandy clay loam; weak, coarse, prismatic structure; pockets and streaks of clean sand grains; neutral; gradual, wavy boundary.

C—80 to 90 inches, reddish-yellow (7YR 7/6) loamy sand, strong brown (7.5YR 5/6) moist; single grained; loose; neutral.

The combined thickness of the A1 and A2 horizon ranges 20 to 40 inches. Those horizons are brown, light brown, or reddish yellow. Reaction is slightly acid or neutral. They range from fine sand to loamy fine sand.

The B2t and B3 horizons are yellowish red, reddish brown, reddish yellow, red, or light red. They are fine sandy loam or sandy loam, and some profiles have bands of clayey material. Reaction is slightly acid or mildly alkaline. The B3 horizon is fine sandy loam to loamy fine sand, and some profiles have bands of clayey material. Reaction is neutral or mildly alkaline.

The C horizon is very pale brown, reddish-yellow, or light-red fine sand or loamy sand. Reaction is neutral or mildly alkaline.

Nobscot soils, 3 to 12 percent slopes (NoE).—This gently undulating to rolling soil is on uplands. Areas are irregular in shape and range from 20 to 1,000 acres in size.

Included with these soils in mapping are some areas of soils that are similar to Nobscot soils, but the upper part of the subsoil is slightly coarser textured. Also included are areas of Devol, Heatly, Delwin, and Miles soils; small spots of Tivoli soils; and some small areas of blowouts. A few areas of wind-deposited soil accumulations, from 1 to several feet in height, are along fence rows or other obstructions in most cultivated or formerly cultivated fields.

The hazard of soil blowing is high.

Most areas of this soil are used as range. Fields that were formerly cultivated have reverted to grass. This soil is not well suited to cultivation. It is well suited to range, wildlife, or recreational uses. Capability unit VIe–3; Sandy range site.

Obaro Series

The Obaro series consists of moderately deep to deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in material weathered from weakly cemented, fine-grained, calcareous sandstone.

In a representative profile the surface layer is reddish-brown loam about 7 inches thick. Below this layer is about 8 inches of reddish-brown, friable loam. The next layer is red, very friable loam about 12 inches thick. The underlying material is light-red, weakly cemented, fine-grained sandstone.

Runoff is medium to very rapid. Available water capacity is medium.

Representative profile of Obaro loam, 3 to 5 percent slopes, 6.4 miles west of Motley-Cottle County line via U.S. Highways 62 and 70, then 0.9 mile south on private road, and 25 feet east in pit:

A1—0 to 7 inches, reddish-brown (5YR 5/4) loam, dark reddish brown (5YR 3/4) moist; weak granular and weak subangular blocky structure; soft, very friable; many roots; few worm casts; few concretions of calcium carbonate on surface and in horizon; calcareous; moderately alkaline; gradual, smooth boundary.

B2—7 to 15 inches, reddish-brown (5YR 5/4) loam; dark reddish brown (5YR 3/4) moist; weak to moderate, medium, subangular blocky structure; slightly hard, friable; few roots; few fine pores; common worm casts; common films, threads, and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—15 to 27 inches, red (2.5YR 5/6) loam, red (2.5YR 4/6) moist; weak granular and weak subangular blocky structure; soft, very friable; few roots; about 8 to 10 percent films and concretions of calcium carbonate; calcareous; moderately alkaline; diffuse, smooth boundary.

C—27 to 75 inches, light-red (2.5YR 6/6) weakly cemented, fine-grained sandstone, red (2.5YR 4/6) moist; massive; common, small, intermingled blue-green spots; calcareous; moderately alkaline.

The A horizon ranges from 5 to 9 inches in thickness. It is reddish brown or brown, and ranges from loam to sandy clay loam.

The B2 horizon ranges from 8 to 22 inches in thickness and from loam to sandy clay loam. It is reddish brown, light reddish brown, light red, red, or reddish yellow. Few to many films, soft masses, or hard concretions of calcium carbonate are in this horizon.

The B3 horizon ranges from 5 to 14 inches in thickness. It is red, light red, reddish brown, or reddish yellow. It has

a few to common films, threads, soft masses, or hard concretions of calcium carbonate.

The C horizon is at a depth of 20 to 48 inches. It consists of weakly cemented sandstone to strongly cemented sandstone or silty red beds. In places this material is intermingled with blue-green spots.

Obaro loam, 1 to 3 percent slopes (ObB).—This gently sloping soil is on uplands. Areas are irregular in shape and range from 10 to 400 acres in size.

The surface layer is reddish-brown loam about 8 inches thick. Below this layer is about 8 inches of reddish-brown, friable loam. The next layer is about 11 inches of reddish-yellow, friable loam that is about 10 percent concretions of calcium carbonate. The underlying material is light-red, weakly cemented, fine-grained sandstone.

Included with this soil in mapping are some small areas of Sagerton, Frankirk, Aspermont, and Woodward soils. Also included are a few areas of soils that have slopes of 3 to 5 percent.

The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

About 20 percent of the area of this soil is cultivated. The crops are mainly cotton, wheat, and grain sorghum. The main concern of management is controlling erosion and maintaining tilth. Growing crops in the rotation, leaving adequate residue on the surface of the soil, stripcropping, timely but limited tillage, and farming on the contour and terracing are suitable management practices. Diversion terraces and grassed waterways are needed in places to intercept excess runoff. Capability unit IIIe–5; Mixedland range site.

Obaro loam, 3 to 5 percent slopes (ObC).—This gently sloping soil is on uplands knolls and ridges. Areas are irregular in shape and range from 10 to 300 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some areas, less than 5 acres in size, of Sagerton, Frankirk, Aspermont, and Woodward soils. Also included are a few areas of soils that have slopes of 1 to 3 percent or that have slopes of more than 5 percent.

The hazard of water erosion is moderate.

Most areas of this soil are in range. If this soil is used for crops, good management practices include rotation of crops, management of crop residue for erosion control and soil improvement, and limited but timely tillage. Contour farming and terracing are needed to help control water erosion. Diversion terraces and grassed waterways are needed in places for safe disposal of runoff. Capability unit IVe–9; Mixedland range site.

Obaro-Burson complex, 3 to 12 percent slopes (OcE).—The gently sloping to strongly sloping soils in this complex are on uplands. Most areas of this complex are long, narrow, and irregular in shape and 10 to 500 acres in size (fig. 8).

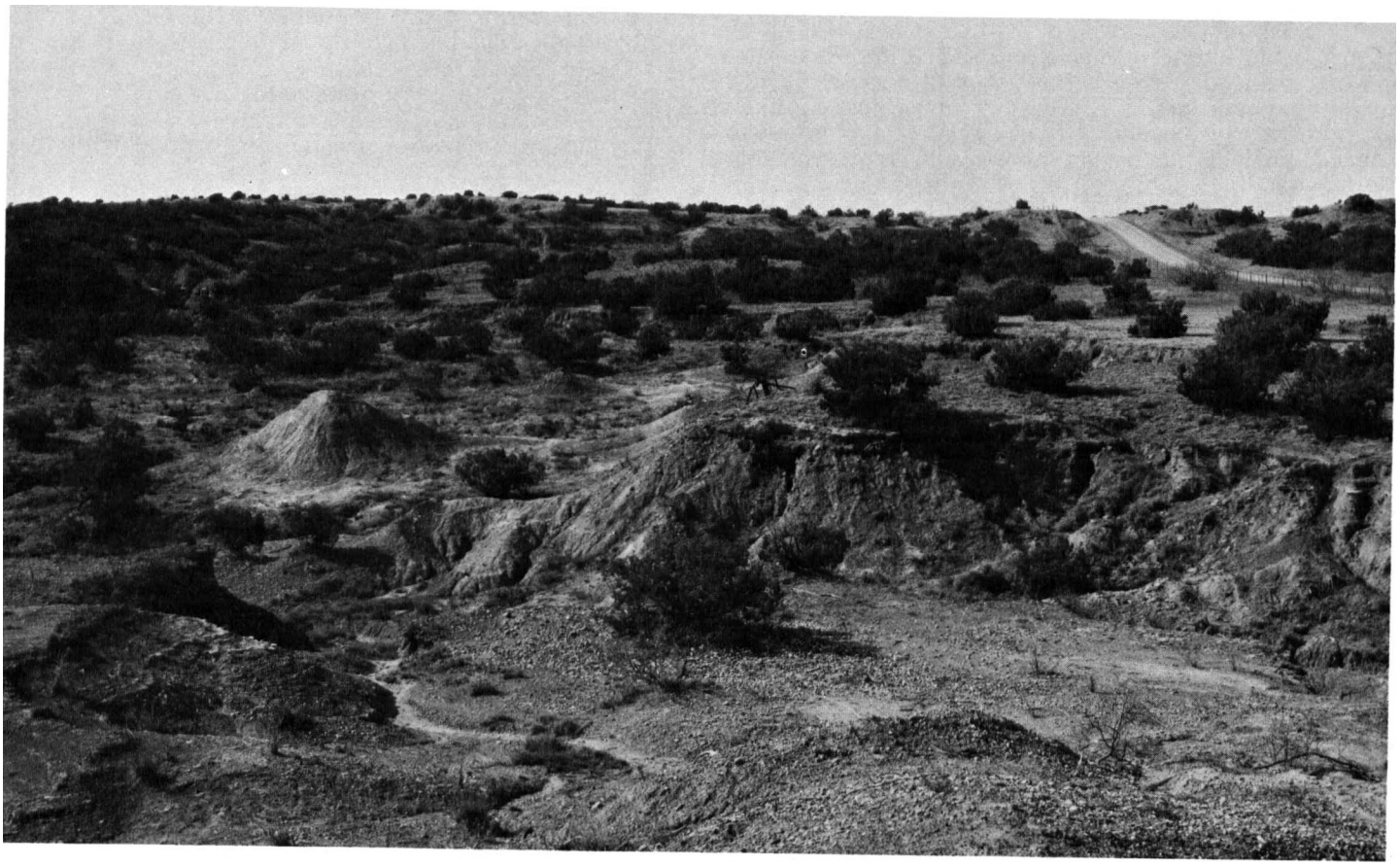

Figure 8.—**Typical area of Obaro-Burson complex, 3 to 12 percent slopes.**

This complex consists of soils so intricately intermingled that they cannot be mapped separately. It is on the average 46 percent Obaro soils, 35 percent Burson soils, and 19 percent other soils and land types. The range in proportion from area to area is as follows: Obaro soils from 30 to 55 percent, Burson soils from 25 to 40 percent, and other soils from 5 to 35 percent.

Obaro soils are mainly on foot slopes or benches below areas of Burson soils. Areas of Obaro soils are 20 to 300 feet wide and several hundred feet long. Slopes are less than 8 percent in most places. The surface layer is reddish-brown loam about 7 inches thick. Below this layer is about 21 inches of reddish-brown, friable loam. The next layer is red, very friable loam about 12 inches thick. The underlying material is weakly cemented very fine sandy loam.

Burson soils are mainly on foot slopes below short steep scarps, but in places they are on ridgetops. Areas of this soil are irregular in shape, and most of them are capped with a thin layer of gravel.

Included with this complex in mapping are areas of Quinlan, Woodward, Aspermont, and Sagerton soils. Also included are steep escarpments that have slopes of 12 to 75 percent, and small areas of soils where the siltstone and sandstone are exposed or areas where this soil is less than 3 inches thick.

The hazard of water erosion is high on this soil complex. Runoff is medium to very rapid. Some small areas support little or no vegetation. Recovery of vegetation is very slow.

All areas of this complex are in range. Careful use of grasses is essential in controlling erosion. Restricted grazing is needed where the vigor of grasses is low. In areas where traffic by livestock or vehicles is likely to increase the hazard of erosion, careful planning is needed in locating roads and other improvements. Both soils in capability unit VIIs–1; Obaro part in Mixedland range site; Burson part in Very Shallow range site.

Paloduro Series

The Paloduro series consists of deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in calcareous loamy material, mainly of local alluvium.

In a representative profile the surface layer is brown loam about 16 inches thick. Below this layer is about 22 inches of brown, friable clay loam. The next layer is light-brown, friable clay loam.

Runoff is slow to medium. Available water capacity is medium.

Representative profile of Paloduro loam, 1 to 3 percent slopes, 2.6 miles west via Farm Road 97 from Flomot, then 0.15 mile north in a cultivated field:

Ap—0 to 6 inches, brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, very friable; few roots; few pebbles; few scattered concretions of calcium carbonate on the surface; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 16 inches, brown (7.5YR 4/2) loam, dark brown (7.5YR 3/2) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; slightly hard, friable; few roots; many worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

B21—16 to 38 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 4/4) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; hard, friable; many worm casts; few pebbles; many films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, smooth boundary.

B22—38 to 82 inches, light-brown (7.5YR 6/4) clay loam, brown (7.5YR 5/4) moist; weak, medium, subangular blocky structure; slightly hard; friable; few fine roots; few films and threads of calcium carbonate in upper part; calcareous; moderately alkaline.

The solum ranges from 40 to more than 80 inches in thickness.

The A horizon ranges from 10 to 20 inches in thickness. It is grayish brown, dark grayish brown, dark brown, or brown.

The B2 horizon ranges from loam to clay loam and is 18 to 35 percent clay. It is light reddish brown, reddish brown, light brown, light yellowish brown, brown, or yellowish brown. This horizon ranges from 20 to more than 60 inches in thickness. The content of calcium carbonate ranges from a few films, threads, and concretions to about 10 percent of the mass.

The C horizon, where it occurs, is at a depth of more than 40 inches. It contains a few films, threads, or concretions of calcium carbonate. It ranges from fine sandy loam to clay loam.

Paloduro loam, 0 to 1 percent slopes (PaA).—This nearly level soil is on weakly concave areas or foot slopes. Areas are irregular in shape and range from 25 to 300 acres in size.

The surface layer is brown loam about 15 inches thick. Below this layer is about 30 inches of brown, friable loam. The underlying material is light-brown fine sandy loam.

Included with this soil in mapping are small areas of Motley, Flomot, and Mobeetie soils.

The hazards of water erosion and soil blowing are slight.

About 60 percent of the area of this soil is cultivated. Cotton and grain sorghum are the main crops. Management of crop residue on the surface of the soil helps to control erosion and to maintain good tilth.

Contour farming of row crops is needed. In places diversions and grassed waterways are needed to intercept excess runoff. Capability unit IIIc–1; Hardland Slopes range site.

Paloduro loam, 1 to 3 percent slopes (PaB).—This gently sloping soil is on concave areas or foot slopes. Areas range from 20 to 200 acres in size and are irregular in shape.

This soil has the profile described as representative of the series.

Included with this soil in mapping are small areas, less than 5 acres in size, of Motley, Miles, Polar, Mansker, Flomot, and Mobeetie soils.

The hazard of water erosion is moderate.

About 40 percent of the area of this soil is cultivated. Cotton and grain sorghum are the main crops. Careful management of adequate residue is needed to control water erosion. Tillage should be held to a minimum. Terraces are needed to support contour farming. Diversion terraces and grassed waterways are needed in places to safely dispose of water from adjacent areas or of excess accumulations. Capability unit IIIe–6; Hardland Slopes range site.

Polar Series

The Polar series consists of excessively drained, moderately rapidly permeable, gravelly soils on uplands. The soils are very shallow and shallow to gravel and sand. They formed in waterlain deposits of stratified gravel and sandy material.

In a representative profile (fig. 9) the surface layer is brown gravelly sandy loam about 7 inches thick. The underlying material is pink very gravelly sandy loam; the upper 20 inches is about 20 percent calcium carbonate, in the form of a coating on pebbles.

Runoff is rapid. Available water capacity is low.

Representative profile of Polar gravelly sandy loam, in an area of Polar-Mobeetie association, hilly, 10.1 miles west via U.S. Highways 62 and 70 at the intersection of Texas Highway 70 in Matador, then 1.8 miles north on private ranch road, and 100 feet east, in area of rangeland:

A—0 to 7 inches, brown (7.5YR 5/4) gravelly sandy loam, dark brown (7.5YR 3/4) moist; weak, fine, granular structure; slightly hard, very friable; few roots; calcium carbonate coating on lower side of some pebbles; estimated 35 percent of mass is larger than 2 millimeters; calcareous; moderately alkaline; clear, wavy boundary.

Cca—7 to 27 inches, pink (7.5YR 8/4) very gravelly sandy loam, light brown (7.5YR 6/4) moist; massive; hard, firm; few scattered roots; estimated 70 percent of mass is larger than 2 millimeters; 20 percent calcium carbonate; most pebbles are entirely coated with calcium carbonate; calcareous; alkaline; diffuse, wavy boundary.

C—27 to 60 inches, pink (7.5YR 7/4) very gravelly sandy loam; brown (7.5YR 5/4) moist; massive; soft, very friable; estimated 70 percent of material is larger than 2 millimeters; estimated 5 percent calcium carbonate; coating of calcium carbonate on pebbles; strata of cross-bedded sand and gravel; calcareous; moderately alkaline.

The A horizon ranges from 5 to 14 inches in thickness above a distinct zone of an accumulation of calcium carbonate. It ranges from gravelly loam to gravelly sandy clay loam and is reddish brown, light reddish brown, light brown, or brown. Between depths of 10 and 40 inches is 35 to more than 70 percent gravel and rock fragments that range from 2 millimeters to 10 millimeters in diameter.

The Cca horizon is reddish brown, light reddish brown, light brown, pale brown, brown, or pink. It is mostly very

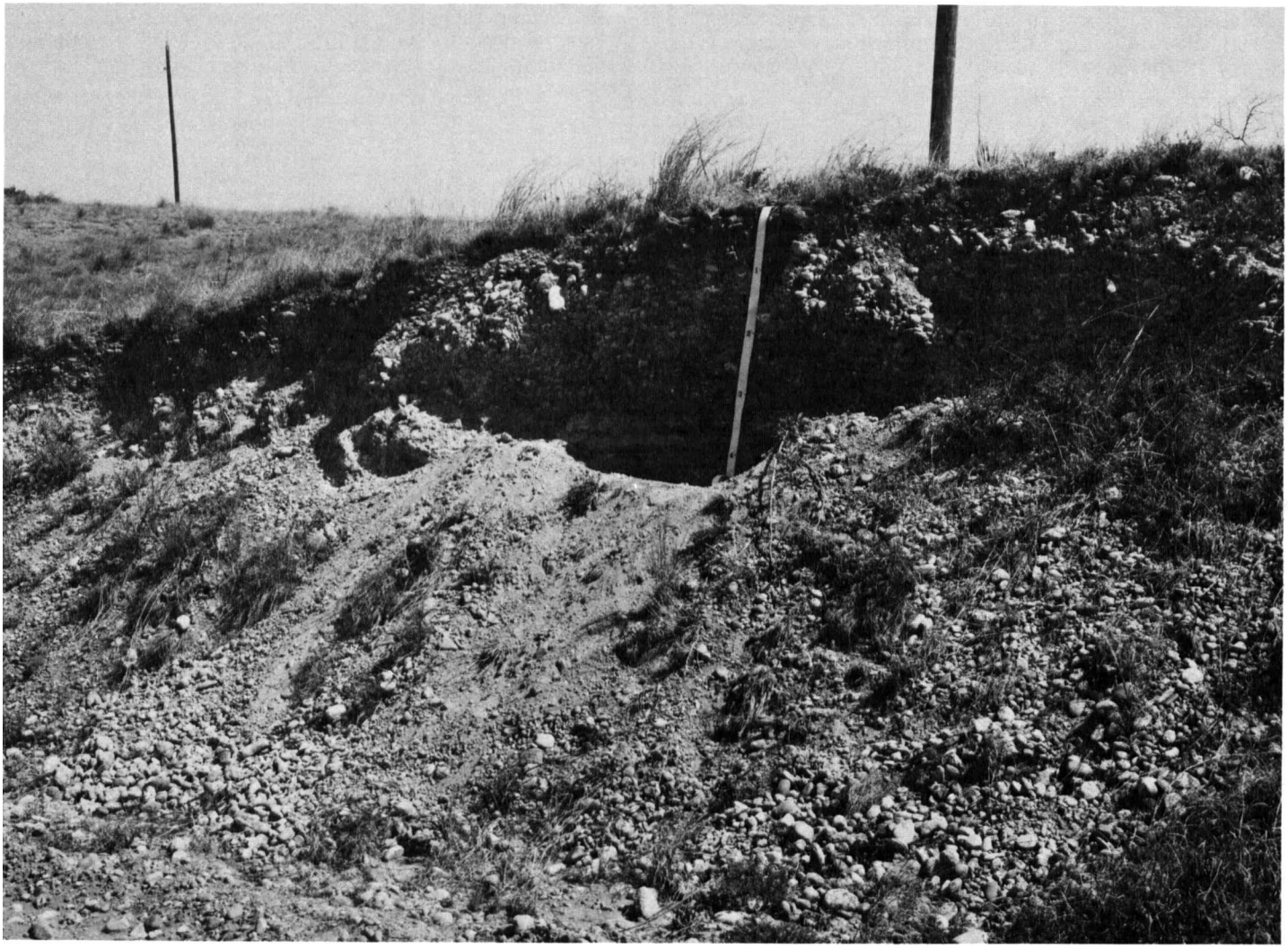

Figure 9.—**Roadside cut showing profile of a Polar gravelly sandy loam.**

gravelly sandy loam but ranges to very gravelly sandy clay loam. The content of calcium carbonate ranges from 15 to more than 40 percent in some profiles and is at least 5 percent more than that in the C horizon. The C horizon is reddish brown, brown, pink, reddish yellow, or yellowish red.

Polar-Mobeetie association, hilly (PME).—This mapping unit is on hilly dissected uplands. Areas of this association are irregular in shape and range from 25 to 2,000 acres or more in size. Slopes are 10 to 30 percent.

This association consists of soils that could be mapped separately but for the use of the survey it was not feasible to do so. It is on the average about 58 percent Polar soils, 23 percent Mobeetie soils, and about 19 percent other soils. The range in proportion from area to area is as follows: Polar soils 45 to 65 percent, Mobeetie soils 15 to 30 percent, and other soils 8 to 30 percent (fig. 10). These mapped areas are mostly larger than those of other areas of soils in the survey area, and the composition of the areas is more variable. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

Polar soils are on dissected hills and convex ridges. Slopes are 10 to 30 percent, but most slopes average less than 15 percent.

Mobeetie soils are in valleys or in concave areas between hills and ridges of Polar soils. Slopes range from 10 to 12 percent. The surface layer is brown fine sandy loam 8 inches thick. Below this layer is 24 inches of light-brown, very friable fine sandy loam. The upper 19 inches of the underlying material is light-brown, and the lower part is reddish yellow.

Included with this association in mapping are some small areas of Miles, Devol, Flomot, Hilgrave, Paloduro, Berda, and Mansker soils. Also included are a few areas of soils that have slopes of more than 30 percent and some areas that have slopes of less than 10 percent.

The hazard of water erosion is moderate. Runoff is medium to rapid.

All of this association is in range. Good grazing practices are needed, including conservative use of grass forage and some rest periods during the growing season. Grass production is limited, but production can be increased by control of undesirable brushy species. Both soils in capability unit VIs–1; Polar part in Gravelly range site; Mobeetie part in Mixedland Slopes range site.

Posey Series

The Posey series consists of deep, well-drained, moderately permeable, loamy soils on uplands. The soils formed in calcareous loamy material.

In a representative profile the surface layer is brown loam about 12 inches thick. The next 5 inches is red, firm clay loam. The next layer is about 14 inches of

Figure 10.—Area of Polar-Mobeetie association, hilly.

reddish-yellow, friable clay loam. Below this layer is red, firm clay loam.

Runoff is medium. Available water capacity is medium.

Representative profile of Posey loam, in an area of Posey-Mansker complex, 3 to 5 percent slopes, 0.4 mile east of the Floyd-Motley county line via U.S. Highways 62 and 70 and 300 feet south in area of rangeland:

A1—0 to 12 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, medium, subangular blocky structure parting to moderate, medium, granular; slightly hard, friable; common roots; few worm casts; few concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B21t—12 to 17 inches, red (2.5YR 4/6) clay loam, dark red (2.5YR 3/6) moist; moderate, medium, subangular blocky structure; very hard, firm; few roots; few thin clay films; scattered small concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B22tca—17 to 31 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; moderate, medium, subangular blocky structure; hard, friable; few roots; about 25 percent soft masses and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, wavy boundary.

B23tca—31 to 84 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; moderate, medium, subangular blocky structure; hard, firm; few thin clay films on ped surfaces; estimated 15 percent calcium carbonate in slightly cemented masses; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Accumulations of carbonate are at a depth of 12 to 21 inches.

The A horizon is 5 to 15 inches thick and is reddish brown, light reddish brown, light brown, or brown. It ranges from loam to clay loam.

The B21t and B22tca horizons are mainly clay loam but range to loam. They are red, light red, reddish yellow, or yellowish red. The visible content of calcium carbonate in the B22tca horizon ranges from 20 to 50 percent. The B23tca horizon is red, light red, reddish yellow, or yellowish red.

Posey-Mansker complex, 3 to 5 percent slopes (PnC).—The gently sloping soils in this complex are on uplands above the High Plains escarpment. Areas are long and mostly narrow. Most areas are convex, and small drainageways are between the knolls (fig. 11).

This complex consists of soils that are too intricately intermingled to be mapped separately. It is on the average 31 percent Posey soils, 25 percent Mansker soils, and 44 percent other soils. The range in proportion from area to area is as follows: Posey soils 25 to 40 percent, Mansker soils 15 to 35 percent, and other soils 25 to 48 percent.

Posey soils are on side slopes and in the lower positions of the areas. Mansker soils are mostly on the top of small knolls and in small convex areas between knolls.

Included with this complex in mapping are small areas of Potter and Pullman soils and small spots of raw caliche outcrop.

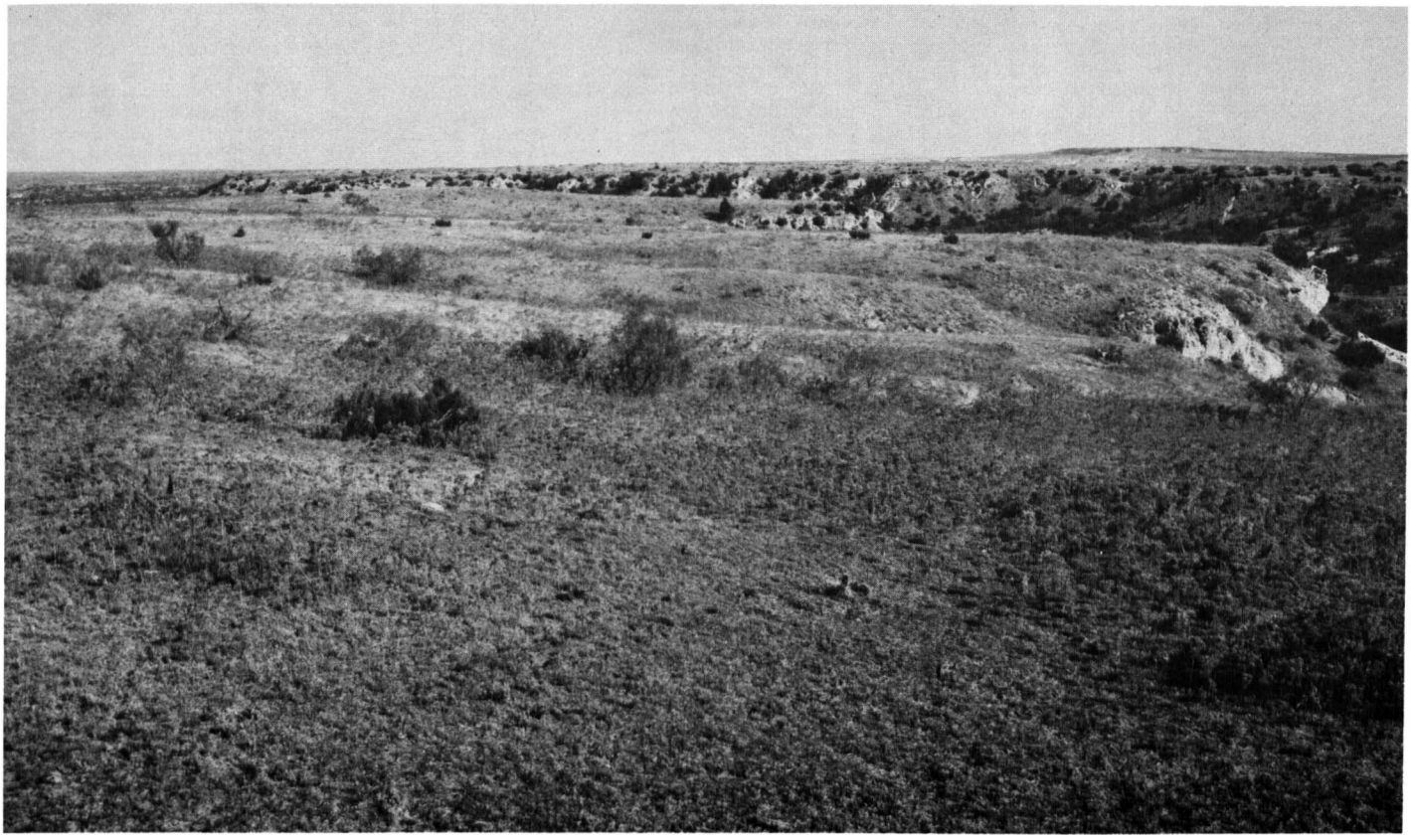

Figure 11.—**Typical area of the Posey-Mansker complex, 3 to 5 percent slopes.**

The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

Most areas of this complex are used as range. If the soils are cultivated, suitable management practices consist of using close-spaced or drilled sorghum and small grain to protect and maintain the soils. Limited tillage and conservation of residue during critical periods conserve moisture and reduce erosion. Contour farming and terraces help to control erosion. Constructing diversions helps to divert runoff received from adjacent areas. Capability unit IVe–4; Hardland Slopes range site.

Potter Series

The Potter series consists of very shallow to shallow, well-drained, moderately permeable, loamy soils on uplands. The soils formed in thick caliche beds.

The surface layer is brown loam about 6 inches thick. The underlying material is pale-brown loam in the upper 7 inches and is about 40 percent concretions of calcium carbonate. Below a depth of 13 inches, the underlying material is pinkish-white platy caliche.

Runoff is medium to rapid. Available water capacity is very low.

Representative profile of Potter loam, 3 to 20 percent slopes, 2.5 miles east of the Floyd-Motley county line via Farm Road 684 and 50 feet south in area of rangeland:

A1—0 to 6 inches, brown (10YR 5/3) loam, dark brown (10YR 4/3) moist; weak, medium, subangular blocky and weak, fine, granular structure; slightly hard, friable; many fine roots; few small pores; many worm casts; many calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

C1ca—6 to 13 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard; friable; many fine roots; few worm casts; about 40 percent calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

C2ca—13 to 80 inches, pinkish-white (7.5YR 8/2) about 70 percent calcium carbonate having hardness of less than 3, Mohs' scale; about 20 percent weakly cemented and powdery caliche; plates of caliche range from 1 to 3 inches on the long axis; few roots between plates and soil pockets; few reddish pockets of soil intermingled in the caliche.

The A horizon ranges from 4 to 12 inches in thickness. It is 0 to 20 percent coarse fragments of hard caliche. This horizon is light brown, brown, pale brown, or grayish brown. It ranges from fine sandy loam to clay loam and is 18 to 35 percent clay.

Depth of the C2ca horizon ranges from 7 to 20 inches. This horizon ranges from hard platy caliche to soft caliche and intermingled pockets of pinkish loamy material.

Potter loam, 3 to 20 percent slopes (PoD).—This gently sloping to moderately steep soil is on uplands above the High Plains escarpment. Areas range from 20 to several hundred acres in size and are irregular in shape.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas, less than 5 acres in size, of Flomot, Berda, Granfield, Posey, and Mansker soils.

The hazard of water erosion is moderate.

This soil is not suited to cultivation. It is used as range. Capability unit VIIs–1; Very Shallow range site.

Pullman Series

The Pullman series consists of deep, well-drained, very slowly permeable, loamy soils on uplands. The soils formed in eolian material.

In a representative profile the surface layer is brown clay loam about 7 inches thick. The next 31 inches is brown, firm to very firm clay. The next layer is about 17 inches of reddish-brown, firm silty clay. Below this layer is about 23 inches of pink, friable clay loam that is about 30 to 40 percent calcium carbonate. The next layer is reddish-yellow, friable clay loam that is about 10 percent calcium carbonate.

Runoff is slow. Available water capacity is medium.

Representative profile of Pullman clay loam, 0 to 1 percent slopes, 0.2 mile east of the Motley-Floyd County line via Farm Road 684 and 100 feet north in a cultivated field:

Ap—0 to 7 inches, brown (10YR 5/3) clay loam, dark brown (10YR 3/3) moist; weak, fine, granular structure; slightly hard, friable; few fine roots; neutral; abrupt, smooth boundary.

B21t—7 to 17 inches, brown (7.5YR 5/2) clay, dark brown (7.5YR 3/2) moist; moderate, fine and medium, blocky structure; hard, firm; few fine roots; ped surfaces shiny; common pressure faces; mildly alkaline; gradual, smooth boundary.

B22t—17 to 30 inches, brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; strong, fine and medium, blocky structure; extremely hard, very firm; common wedge-shaped peds; common, shiny, smooth pressure faces; coatings on vertical cracks; calcareous at a depth of 21 inches; few strongly cemented concretions of calcium carbonate; moderately alkaline; gradual, smooth boundary.

B23t—30 to 38 inches, brown (7.5YR 5/4) clay, dark brown (7.5YR 3/4) moist; moderate, medium, blocky structure; very hard, firm; shiny ped faces; few fine pores and roots; few strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B24t—38 to 55 inches, reddish-brown (5YR 4/4) silty clay, dark reddish brown (5YR 3/4) moist; weak, medium, blocky structure; very hard, firm; few fine roots; few soft masses of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B25tca—55 to 78 inches, pink (5YR 7/4) clay loam, yellowish red (5YR 5/6) moist; weak, coarse, subangular blocky structure; hard, friable; 30 to 40 percent soft calcium carbonate concretions; calcareous; moderately alkaline; clear, wavy boundary.

B26tca—78 to 90 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, coarse, subangular blocky structure; hard, friable; few pores; about 10 percent calcium carbonate.

The solum ranges from 60 to more than 90 inches in thickness. Secondary soft lime is at a depth of 20 to 30 inches.

The A horizon is brown, grayish brown, or dark grayish brown. It is neutral to mildly alkaline.

The B21t horizon is grayish brown, brown, or dark grayish brown. It is clay that is 35 to 45 percent clay. It is mildly alkaline to moderately alkaline. The B22t horizon is grayish brown or brown. Cracks from ¼ inch to 1 inch wide extend below a depth of 20 inches and are at least 12 inches long.

The horizons below the B22t horizon, except the B2ca horizons, are brown, reddish-brown, or yellowish-red clay to clay loam.

The B2ca horizons are reddish-brown, pink, or reddish-yellow silty clay to clay loam. The content of calcium carbonate, as fine concretions and as chalky masses, ranges

from 20 to 70 percent. The calcic horizon is at a depth of 30 to 60 inches.

Pullman clay loam, 0 to 1 percent slopes (PuA).—This nearly level soil is on plains on uplands. Areas are irregularly shaped and range from 50 to 1,000 acres in size.

Included with this soil in mapping are some small areas, less than 5 acres in size, of Sagerton soils. Also included are a few spots of Randall soils and small areas of soils that have slopes of 1 to 2 percent.

The hazards of soil blowing and water erosion are slight.

Most areas of this soil are cultivated. Wheat, grain sorghum, and cotton are the principal crops. Stubble mulching and other practices that include use of crop residue, along with timely and minimum tillage, are essential for maintaining good growth of crops. Such practices help to control erosion and to conserve moisture. In the absence of sufficient residue to protect the surface, tillage methods should be used that will leave the surface rough and cloddy. Capability unit IIIe–4; Clay Loam range site.

Quinlan Series

The Quinlan series consists of shallow, well-drained, moderately rapidly permeable loamy soils on uplands. The soils formed in material weathered from soft calcareous sandstone or in packsand.

In a representative profile the surface layer is reddish-yellow loam about 5 inches thick. Below this layer is 8 inches of light-red, very friable loam. The underlying material is weakly cemented, calcareous, red, fine-grained sandstone.

Runoff is medium to rapid. Available water capacity is low.

Representative profile of vuinlan loam, in an area of Woodward-Quinlan association, rolling, 3.75 miles south via Farm Road 94 from Northfield, then 5.45 miles east on county road and 50 feet south in area of rangeland:

A1—0 to 5 inches, reddish-yellow (5YR 6/6) loam, yellowish red (5YR 4/6) moist; weak, granular structure; soft, very friable; few roots; calcareous; moderately alkaline; abrupt, smooth boundary.

B2—5 to 13 inches, light-red (2.5YR 6/6) loam, red (2.5YR 4/6) moist; weak, granular structure parting to moderate, medium, subangular blocky; soft, very friable; few roots; few worm casts; few soft masses and cemented calcium carbonate concretions; calcareous; moderately alkaline; clear, smooth boundary.

C—13 to 60 inches, red (2.5YR 5/6) sandstone, red (2.5YR 4/6) moist; massive; soft, fine-grained sandstone with blue spots; few roots in upper part; calcareous; moderately alkaline.

The A horizon ranges from 4 to 8 inches in thickness. It is red, light red, reddish yellow, yellowish red, or reddish brown and is mildly alkaline or moderately alkaline.

The B horizon ranges from 6 to 12 inches in thickness. It is light-red, red, reddish-yellow, or yellowish-red loam to very fine sandy loam.

The C horizon ranges from soft, calcareous, weakly consolidated sandstone or siltstone to very fine grained packsand. Depth to the C horizon ranges from 10 to 20 inches.

Quinlan loam, 3 to 12 percent slopes (QuD).—This gently sloping to strongly sloping soil is along rivers. Areas are irregular in shape and generally follow the contour of the river. They range from 25 to 500 acres in size.

The surface layer is reddish-brown loam about 5 inches thick. Below this layer is about 10 inches of red, friable loam. The underlying material is red, weakly cemented sandstone.

Included with this soil in mapping are some small areas of Woodward, Obaro, Aspermont, Burson, Granfield, Devol, and Latom soils. Also included are small spots of sandstone outcrop.

The hazard of water erosion is high.

This soil is not suited to cultivation. Most areas are used as range. Capability unit VIe–2; Mixedland range site.

Randall Series

The Randall series consists of deep, somewhat poorly drained, very slowly permeable, clayey soils on uplands. The soils formed in calcareous clayey material.

In a representative profile, the surface layer is dark-gray clay about 20 inches thick. Below this layer is about 25 inches of gray, very firm clay. The underlying material is very firm clay; it is grayish brown in the upper part and yellowish red below.

Runoff is very slow. Available water capacity is high.

Representative profile of Randall clay, 0.3 mile east of the Motley-Floyd County line marker and 50 feet north in area of rangeland:

A1—0 to 20 inches, dark-gray (10YR 4/1) clay, very dark gray (10YR 3/1) moist; moderate to strong, medium, blocky structure; extremely hard, very firm; very sticky and plastic; shiny pressure faces on peds; mildly alkaline; gradual, smooth boundary.

AC—20 to 45 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate, fine and medium, blocky structure; wedge-shaped parallelepipeds have long axis tilted about 30 degrees from horizontal; distinct, coarse, intersecting slickensides; extremely hard, very firm, very sticky and plastic; few roots; shiny pressure faces on peds; sand grains on ped surfaces in large cracks; calcareous; moderately alkaline; gradual, smooth boundary.

C1—45 to 69 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) moist; massive; extremely hard, very firm, sticky and plastic; few fine pores; few, small, black concretions; few small calcium carbonate concretions; calcareous; moderately alkaline; diffuse, smooth boundary.

C2—69 to 92 inches, yellowish-red (5YR 5/6) clay, yellowish red (5YR 4/6) moist; distinct mottles of very dark grayish brown (10YR 3/2) moist; massive; few, small, dark concretions; less than 1 percent small, strongly cemented calcium carbonate concretions; calcareous; moderately alkaline.

Depth to the underlying loamy material is more than 40 inches. When the soils are dry, cracks occur that are 0.5 inch to 1.5 inches wide and more than 20 inches deep. The soils are flooded for 1 to 3 months in most years. Areas in rangeland have gilgai microrelief; knolls are 3 to 7 inches higher than the depressions, and the distances between the center of the knolls and the center of the depressions range from 5 to 10 feet. Intersecting slickensides and parallelepipeds begin at depths ranging from 20 to 30 inches below the surface.

The A horizon ranges from 12 inches in thickness in the center of knolls to as much as 22 inches in depressions. The A horizon is gray, dark gray, or very dark gray. It is neutral to moderately alkaline and calcareous.

The AC horizon is grayish brown, dark grayish brown, dark gray, or gray. It is neutral to moderately alkaline.

The C horizon is yellowish red, light gray, light brownish gray, grayish brown, or gray. It is generally mottled.

Randall clay (Ra).—This soil is in slightly depressed areas on uplands. Areas are round to oval in shape and range from 3 to 20 acres in size. Slopes range from 0.2 to about 0.8 percent.

Included with this soil in mapping are some small areas of Pullman and Sagerton soils, which occur in slightly higher spots than this soil or on the outer edges of depressions. Also included are a few areas of Mansker soils adjacent to Randall soils in depressions. Some areas that have an overwash of medium-textured material from surrounding soils are included.

The hazard of soil blowing is slight.

Some areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the principal crops. This soil receives runoff from surrounding areas and is ponded for extended periods following heavy rains, and planting and harvesting of crops are hindered because of wetness. Generally, water stands on the surface until it evaporates, but it enters the soil rapidly when the soil is dry and cracked. This soil is not suited to cultivation. In places this soil occurs in areas along with other soils that are well suited to cultivation and are mostly planted to crops. These areas provide food and cover for ducks and geese. Capability unit VIw–1; Lakebed range site.

Rock Outcrop

Sandstone and conglomerate outcrops occur as ledges or rims and form a stairstep topography. The layers of sandstone are 4 to 40 feet thick and are underlain or interlayered with sandy and silty red beds. Slopes are mostly 3 to 12 percent. The vertical rock ledges separate the various levels and give the area the stairstep effect.

Rock outcrop is mapped only in a complex with Latom soils (fig. 12).

Sagerton Series

The Sagerton series consists of deep, well-drained, moderately slowly permeable, loamy soils on uplands. These soils formed in clayey material.

In a representative profile the surface layer is dark-brown clay loam about 7 inches thick. Below this layer is 23 inches of dark-brown, firm clay. The next layer is reddish brown firm clay loam about 14 inches

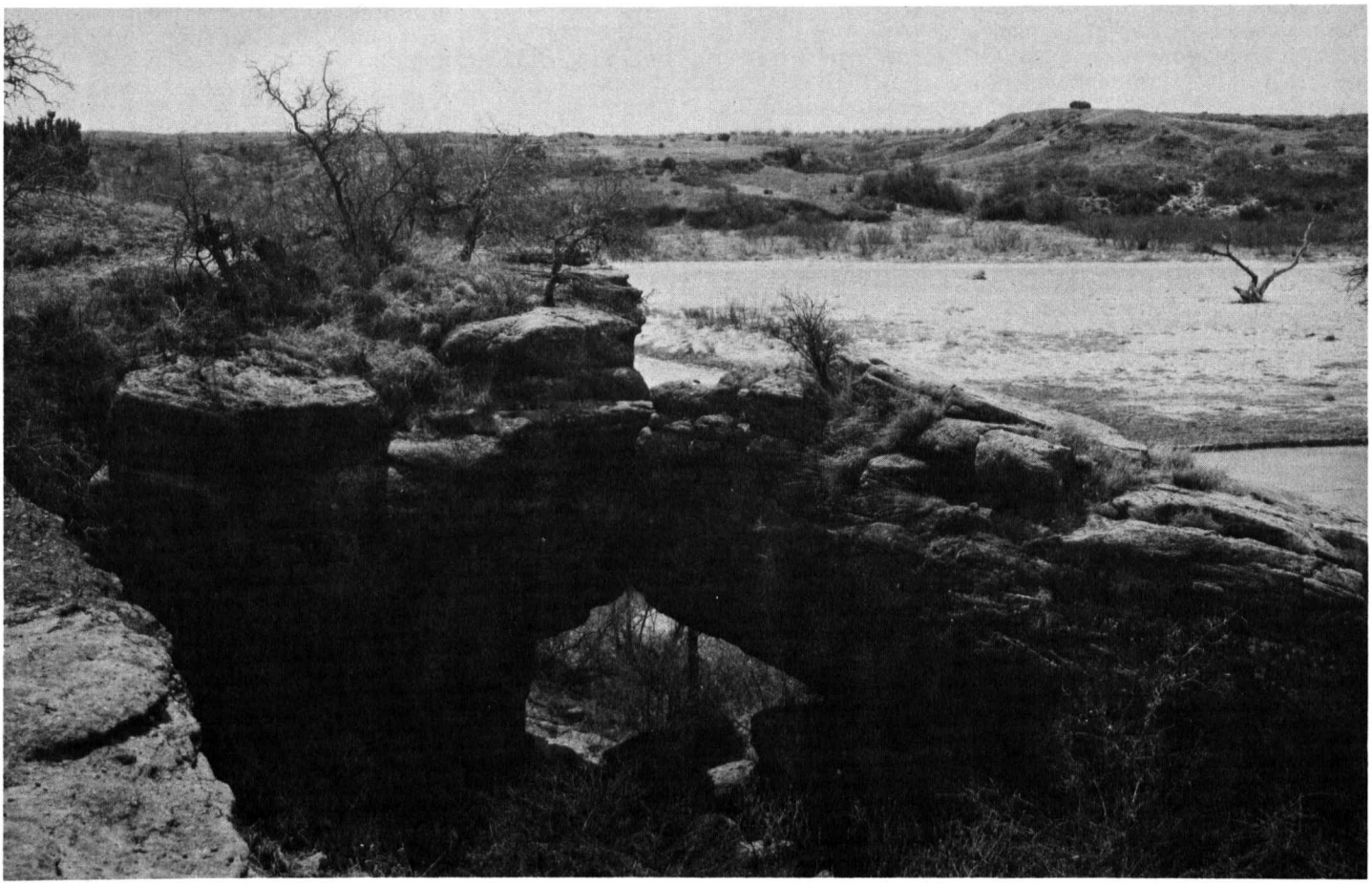

Figure 12.—**Unusual sandstone and conglomerate rock formation in the Latom-Rock outcrop complex, 3 to 12 percent slopes. South Pease River is in immediate background.**

thick. Below this layer is 22 inches of reddish-yellow, friable clay loam that is about 40 percent calcium carbonate. The next layer is red, firm clay loam that is about 5 percent calcium carbonate.

Runoff is slow to medium. Available water capacity is high.

Representative profile of Sagerton clay loam, 1 to 3 percent slopes, 3.7 miles east via U.S. Highways 62 and 70 from the courthouse in Matador, then 100 feet north in a cultivated field:

Ap—0 to 7 inches, dark-brown (7.5YR 4/2) clay loam, dark brown (7.5YR 3/2) moist; weak, fine, granular structure; slightly hard, friable; few fine roots; few pebbles; mildly alkaline; abrupt, smooth boundary.

B21t—7 to 17 inches, dark-brown (7.5YR 4/2) clay, dark brown (7.5YR 3/2) moist; moderate, medium and fine, subangular blocky structure; very hard, firm; few fine roots; common thin clay films on ped surfaces; mildly alkaline; gradual, smooth boundary.

B22t—17 to 30 inches, dark-brown (7.5YR 4/4) clay, dark brown (7.5YR 3/4) moist; moderate, medium, blocky structure; very hard, firm; few roots; few worm casts; common, thin, continuous clay films on ped surfaces; few films and threads of calcium carbonate in the lower part; noncalcareous; moderately alkaline; gradual, smooth boundary.

B23t—30 to 44 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) moist; moderate, medium, blocky structure; very hard, firm; clay films on ped surfaces; films and threads and few, small, strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; clear, smooth boundary.

B24ca—44 to 66 inches, reddish-yellow (5YR 6/6) clay loam, yellowish red (5YR 5/6) moist; weak, medium, subangular blocky structure; slightly hard, friable; 40 percent soft and strongly cemented concretions of calcium carbonate that are ⅛ to 1 inch in diameter; calcareous; moderately alkaline; clear, smooth boundary.

B25t—66 to 85 inches, red (2.5YR 5/6) clay loam, red (2.5YR 4/6) moist; weak, medium, subangular blocky structure; hard, firm; few pebbles; thin clay films on ped surfaces; 3 to 5 percent calcium carbonate concretions; calcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness. Depth to secondary carbonates ranges from 20 to 28 inches. Distinct horizons of carbonate accumulation are at a depth of 30 to 60 inches.

The A horizon is reddish brown, dark reddish brown, dark brown, or brown. Reaction is neutral to mildly alkaline.

The B21t horizon is dark reddish brown, reddish brown, dark brown, or brown. The B22t horizon is dark-brown, brown, reddish-brown, or light reddish-brown clay loam or clay. The B2ca horizon is pink, reddish yellow, yellowish red, or light reddish brown. The horizon of carbonate accumulation is about 20 to 50 percent calcium carbonate equivalent, mostly in the form of soft masses and concretions. The Bt horizon below the horizon of carbonate accumulation is red, light red, reddish yellow, yellowish red, or strong brown and ranges from clay loam to clay.

Sagerton clay loam, 0 to 1 percent slopes (SaA).—This soil has slopes dominantly of about 0.5 percent. Areas are irregular in shape and range from 15 to several hundred acres in size.

The surface layer is brown clay loam about 7 inches thick. Below this layer is brown, firm clay loam about 6 inches thick. The next layer is reddish-brown, firm clay loam about 12 inches thick. Below this layer is about 13 inches of yellowish-red, firm clay loam. The next layer is reddish-yellow, friable clay loam; it is about 45 percent calcium carbonate in the upper 30 inches and about 2 percent in the lower part.

Included with this soil in mapping are some small areas of Abilene, Frankirk, Bukreek, Motley, Obaro, Tulia, and Aspermont soils. Also included are a few areas of soils that have slopes of 1 to 3 percent.

The hazards of soil blowing and water erosion are slight.

Most areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the main crops. Using a crop rotation that includes crops that produce large amounts of residue, returning crop residue to the soil for improvement and protection, and timely but limited tillage are suitable practices. Capability unit IIc–1; Clay Loam range site.

Sagerton clay loam, 1 to 3 percent slopes (SaB).—This gently sloping soil is on plains on uplands. Areas are irregular in shape and range mainly from 10 to several hundred acres in size. In many places they are much longer than they are wide and follow the slope contour above drainageways.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some areas of Abilene, Frankirk, Bukreek, Motley, Tulia, Obaro, and Aspermont soils. Also included are small areas of Sagerton clay loam, 0 to 1 percent slopes, which is in flat areas near the head of drainageways.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

About 60 percent of the area of this soil is cultivated. Wheat, grain sorghum, and cotton are the major crops. A few shallow gullies, more than 300 feet apart and crossable with farm machinery, are in some unprotected cultivated areas.

Suitable management practices include crop rotation, leaving crop residue on the surface to control erosion and to maintain soil condition, and timely but limited tillage. Contour farming, along with use of terraces, diversions, and grassed waterways, is also an important conservation measure related to proper management. Capability unit IIe–2; Clay Loam range site.

Springer Series

The Springer series consists of deep, well-drained, moderately rapidly permeable, sandy soils on uplands. The soils formed in sandy eolian material or in alluvium reworked by wind.

In a representative profile the surface layer is brown loamy fine sand about 16 inches thick. Below this layer is about 14 inches of reddish-brown, very friable sandy loam. The next 18 inches is yellowish-red, very friable fine sandy loam. Below this layer is about 12 inches of yellowish-red, very friable sandy clay loam. The next layer is about 12 inches of reddish-brown loose loamy fine sand. Below this layer is yellowish-red, very friable sandy clay loam.

Runoff is slow. Available water capacity is medium.

Representative profile of Springer loamy fine sand, 0 to 3 percent slopes, 4.0 miles east of Flomot, via Farm Road 97; then 2.45 miles north on county road and 300 feet east in a cultivated field:

Ap—0 to 16 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) moist; single grained; loose; neutral; abrupt, smooth boundary.

B21t—16 to 30 inches, reddish-brown (5YR 5/4) sandy loam, reddish brown (5YR 4/4) moist; weak, coarse, prismatic structure parting to weak, medium, subangular blocky; slightly hard, very friable; mildly alkaline; gradual, smooth boundary.

B22t—30 to 48 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) moist; weak, coarse, prismatic structure; slightly hard, very friable; few clean sand grains and very thin strata of coarser and finer textured material in lower part; mildly alkaline; clear, smooth boundary.

B23t—48 to 60 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, coarse, prismatic structure; hard, very friable; sand grains bridged and coated; mildly alkaline; clear, smooth boundary.

A'1—60 to 72 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) moist; single grained; few pockets of clean sand grains; noncalcareous; moderately alkaline; clear, smooth boundary.

B'2t—72 to 84 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) moist; weak, coarse, prismatic structure; hard, very friable; sand grains bridged and coated; noncalcareous; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is light reddish brown, reddish brown, light brown, or brown. Reaction is neutral to mildly alkaline.

The B2t horizon is brown, reddish brown, yellowish red, or reddish yellow. It ranges from sandy loam to sandy clay loam. Reaction is neutral to moderately alkaline.

The A'1 horizon has the same colors as the B2t horizon. It ranges from loamy fine sand to fine sandy loam. Reaction ranges from neutral to moderately alkaline.

The B'2t horizons range from fine sandy loam to sandy clay loam. It has the same colors as the B2t horizon.

Springer loamy fine sand, 0 to 3 percent slopes (SpB).—This soil is nearly level to gently undulating and is on uplands. Slopes are mostly 1.0 to 2.5 percent. Areas are irregular in shape and range from 10 to 400 acres or more in size.

Included with this soil in mapping are some small areas of Miles, Mobeetie, and Delwin soils. Also included are areas of Devol soils. Some areas have gravelly strata and caliche layers at a depth of 3 to 4 feet.

The hazard of water erosion is slight, and the hazard of soil blowing is high.

Most areas of this soil are cultivated. Cotton, grain sorghum, and peanuts are grown. Soil accumulations, a few inches to several feet in height, occur along fence rows or other obstructions in some cultivated fields. Small duned and blowout areas occur in most fields. The blowouts are 1 to 3 feet deep, and the dunes are 2 to 5 feet high.

The cropping system should include only crops that leave large amounts of residue on the soil surface to control soil blowing. Among the crops are drilled or close-spaced sorghum, small grain, and grasses. Tillage needs to be held to a minimum. Stubble mulching is a preferred type of tillage. Some fertilizer is beneficial if judiciously used. Capability unit IVe–8; Sandy Loam range site.

Tivoli Series

The Tivoli series consists of deep, excessively drained, rapidly permeable, sandy soils on uplands. The soils formed in eolian sands bordering the larger streams in the county.

In a representative profile the surface layer is brown fine sand about 13 inches thick. The underlying material is reddish-yellow, loose fine sand.

Runoff is very slow. Available water capacity is low.

Representative profile of Tivoli fine sand, 0.8 mile west via Farm Road 656 from Northfield, then 1.9 miles north on private ranch road and 0.65 mile west in area of rangeland:

A1—0 to 13 inches, brown (7.5YR 5/4) fine sand, dark brown (7.5YR 4/4) moist; single grained; very friable; loose; mildly alkaline; clear, smooth boundary.

C—13 to 60 inches, reddish-yellow (5YR 6/6) fine sand; yellowish red (5YR 5/6) moist; single grained; loose; mildly alkaline.

The A1 horizon is reddish brown, light reddish brown, brown, or light brown. It is slightly acid to mildly alkaline. It ranges from 4 to 13 inches in thickness.

The C horizon is fine sand or loamy fine sand. It is slightly acid to mildly alkaline in the upper part and neutral to moderately alkaline below. This horizon is reddish brown, light reddish brown, reddish yellow, or yellowish red.

Tivoli fine sand (Tf).—This soil occupies dunes that are undulating to hilly. Slopes are 1 to 30 percent. Areas range from 10 to several hundred acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas of Mobeetie, Devol, and Lincoln soils. Active dunes 7 to 100 acres in size are included in places.

The hazard of soil blowing is high where the soil is not protected by vegetation.

All areas of this mapping unit are in range. Capability unit VIIe–1; Deep Sand range site.

Tulia Series

The Tulia series consists of deep, well-drained, moderately permeable, loamy soils on uplands. The soils formed in calcareous loamy material mostly of eolian origin.

In a representative profile the surface layer is brown loam about 5 inches thick. Below this layer is about 12 inches of brown, very friable loam. The next layer is about 16 inches of reddish-brown, friable loam that is about 50 percent calcium carbonate. The next layer, extending to a depth of 75 inches, is red, friable loam.

Runoff is medium. Available water capacity is high.

Representative profile of Tulia loam, 3 to 5 percent slopes, 1.2 miles east, 0.1 mile south, and 2.0 miles east of Whiteflat on county road and 0.1 mile north in a cultivated field:

Ap—0 to 5 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; weak, fine, granular structure; soft, very friable; few fine roots; few soft calcium carbonate concretions; calcareous; moderately alkaline; abrupt, smooth boundary.

B21ca—5 to 17 inches, brown (7.5YR 5/4) loam, dark brown (7.5YR 4/4) moist; moderate, subangular blocky structure; soft, very friable; few roots; few worm casts; about 35 percent soft masses of

calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B22ca—17 to 33 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak, subangular blocky structure; slightly hard, friable; few fine roots, few fine pores; about 50 percent soft masses and strongly cemented concretions of calcium carbonate; calcareous; moderately alkaline; diffuse, smooth boundary.

B23t—33 to 75 inches, red (2.5YR 4/6) loam, dark red (2.5YR 3/6) moist; weak, medium, subangular blocky structure; slightly hard, friable; few thin clay films on ped surfaces; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The A horizon ranges from 4 to 9 inches in thickness. It is light reddish brown, reddish brown, light brown, or brown.

The B2ca horizon ranges from 10 to 40 inches in thickness and from loam to clay loam in texture. It is light reddish brown, light brown, yellowish red, reddish yellow, or brown. Content of calcium carbonate ranges from 30 to 70 percent. Depth to the B23t horizon ranges from 26 inches to more than 50 inches. It is red, reddish-yellow, yellowish-red, or strong-brown loam to clay loam. The content of calcium carbonate ranges from 10 to 30 percent.

Tulia loam, 1 to 3 percent slopes (TuB).—This gently sloping soil is on ridges on uplands and on side slopes along natural drainageways. Areas are longer than they are wide where the soil occurs along natural drainageways and oval to irregular in shape in other places. Areas range from 10 to 100 acres in size but are mainly less than 50 acres.

The surface layer is reddish-brown loam about 6 inches thick. Below this layer is about 12 inches of yellowish-red, friable loam. The next layer is about 18 inches of reddish-yellow, friable loam that is about 40 percent calcium carbonate. Below this layer is red, friable loam.

Included with this soil in mapping are some small areas of Tulia loam, 3 to 5 percent slopes, and areas of Miles, Flomot, Abilene, Frankirk, and Woodward soils.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

About 45 percent of the area of this soil is cultivated, and wheat is the principal crop. Some cotton and grain sorghum are also grown. Suitable management practices include crop rotation and leaving crop residue on the soil surface to control erosion and to increase moisture of the soil. Timely but limited tillage is needed. Contour farming along with use of terraces, diversions, and grassed waterways are also important conservation measures related to proper management. Capability unit IVe–6; Hardland Slopes range site.

Tulia loam, 3 to 5 percent slopes (TuC).—This gently sloping soil is on ridges on uplands and on side slopes along natural drainageways. Areas are irregular in shape but are mostly long and narrow. They are 10 to 125 acres in size.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some small areas of Miles, Flomot, Bukreek, and Woodward soils. Also included are areas of Tulia loam, 1 to 3 percent slopes.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

About 40 percent of the areas of this soil are cultivated. Wheat, cotton, and grain sorghum are the main crops. Some areas that were formerly cultivated have reverted to native vegetation.

These soils need a rotation of residue-producing crops such as small grain and sorghum to protect the soil and to increase moisture of the soil. Limited tillage conserves residue and moisture. Contour farming of row crops and terraces are needed. In places diversion terraces and grassed waterways are also needed as part of a runoff disposal system. Capability unit IVe–1; Hardland Slopes range site.

Woodward Series

The Woodward series consists of moderately deep, well-drained, moderately permeable, loamy soils on uplands. These soils formed in calcareous, fine-grained, soft sandstone; packsand; or silty red-bed material.

In a representative profile the surface layer is reddish-brown loam about 6 inches thick. Below this layer is about 29 inches of yellowish-red, friable loam that is about 12 percent calcium carbonate in the lower part. The underlying material is red, weakly cemented, calcareous sandstone.

Runoff is medium. Available water capacity is high.

Representative profile of Woodward loam, in an area of Woodward-Quinlan association, rolling, 3.75 miles south via Farm Road 94 from Northfield, then 5.45 miles east on county road and 100 feet south in area of rangeland:

A1—0 to 6 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) moist; weak to moderate, medium, granular structure; slightly hard, friable; few calcium carbonate fragments on surfaces; calcareous; moderately alkaline; clear, smooth boundary.

B2—6 to 20 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak, fine to medium, subangular blocky structure; slightly hard, friable; many worm casts; few films and threads and concretions of calcium carbonate; calcareous; moderately alkaline; gradual, smooth boundary.

B3ca—20 to 35 inches, yellowish-red (5YR 5/6) loam, yellowish red (5YR 4/6) moist; weak, fine, subangular blocky structure; slightly hard, friable; about 12 percent calcium carbonate as films and threads, soft masses, and concretions; calcareous; moderately alkaline; gradual, wavy boundary.

C—35 to 80 inches, red (2.5YR 5/6), weakly cemented, calcareous sandstone, red (2.5YR 4/6) moist; small blue-gray specks.

The A horizon ranges from 6 to 12 inches in thickness. It is yellowish-red, reddish-yellow, reddish-brown, red, or light-red loam or very fine sandy loam.

The B2 horizon ranges from 7 to 30 inches in thickness. It is reddish-yellow, yellowish-red, reddish-brown, red, or light-red loam or very fine sandy loam.

The B3ca horizon ranges from 8 to 20 inches in thickness. It is light red, red, reddish brown, yellowish red, or reddish yellow. The content of calcium carbonate ranges from 5 to 14 percent. The B3ca horizon is loam or very fine sandy loam.

Depth to the C horizon ranges from 20 to 40 inches. The C horizon ranges from fine-grained, calcareous, soft sandstone or packsand to silty red beds.

Woodward loam, 1 to 3 percent slopes (WlB).—This gently sloping soil is on convex ridges, on hilltops, or on the side slopes flanking natural drainageways. Areas are irregular in shape and range mostly from 10 to 200 acres in size.

The surface layer is reddish-brown loam about 8 inches thick. Below this layer is 20 inches of reddish-brown, friable loam. The next layer is about 12 inches of reddish-yellow, friable loam that is about 10 percent calcium carbonate. The underlying material is red, weakly cemented sandstone.

Included with this soil in mapping are some small areas of Woodward loam, 3 to 5 percent slopes. Also included are areas of Miles, Frankirk, Obaro, Quinlan, Bukreek, and Aspermont soils and a few small areas of exposed gypsum rock.

The hazard of soil blowing is slight, and the hazard of water erosion is moderate.

Some areas of this soil are cultivated. Cotton, wheat, and grain sorghum are the main crops. A cropping system that includes high-residue-producing crops is needed. The management of crop residue on the soil surface, stripcropping, timely but limited tillage, and use of contour farming along with a system of terraces are effective in controlling erosion. In places diversion terraces and grassed waterways are needed to intercept excess runoff. Capability unit IIe–1; Mixedland range site.

Woodward loam, 3 to 5 percent slopes (WlC).—This soil is on uplands. Areas are irregular in shape and range from 10 to 1,000 acres in size, but they are dominantly less than 200 acres. They are mainly on side slopes above drainageways or on convex hilltops or ridges.

The surface layer is reddish-brown loam about 7 inches thick. Below this layer is about 20 inches of reddish-brown, friable loam. The next 11 inches is reddish-yellow, friable loam that is about 8 percent calcium carbonate. The underlying material is loamy red-bed material.

Included with this soil in mapping are some small areas of Woodward loam, 1 to 3 percent slopes. Also included are areas of Miles, Quinlan, Obaro, and Aspermont soils and a few small areas of gypsum rock outcrop.

The hazard of water erosion is moderate.

Most of this soil is in range, but some areas are cultivated. Cotton and grain sorghum are the main crops. Some areas that were formerly cultivated are seeded to grass.

Suitable management practices include crop rotation, management of residue for erosion control and soil improvement, and limited but timely tillage. Contour farming and terraces are necessary for water erosion control. Diversion terraces and grassed waterways are needed in places for safe disposal of runoff. Capability unit IIIe–1; Mixedland range site.

Woodward-Yomont complex, 0 to 15 percent slopes (WoD).—This mapping unit is along drainageways at the upper end of intermittent streams. It is on sides of valleys that have narrow bottoms. Most areas are several hundred acres in size. The areas are from 10 to 50 feet in depth and from 20 to 400 feet in width. The bottom ranges from 10 to 175 feet in width (fig. 13).

This complex consists of soils so intermingled that they cannot be mapped separately. It is on the average about 33 percent Woodward soils, 26 percent Yomont soils, and about 41 percent other soils. The range in proportion from area to area is as follows: Woodward soils 15 to 45 percent, Yomont soils 18 to 35 percent, and other soils 20 to 50 percent.

Woodward soils are on sloping to moderately steep valley sides. Slopes range from about 3 to 15 percent. The surface layer is reddish-brown loam about 8 inches thick. Below this layer is about 18 inches of reddish-brown, friable loam. The next 14 inches is red, friable loam. The underlying material is red, weakly cemented sandstone.

Yomont soils are on narrow flat bottoms in gullies. Slopes range from 0 to 3 percent. The surface layer is light reddish-brown very fine sandy loam about 7 inches thick. The underlying material is reddish-brown, very friable very fine sandy loam that has thin strata of silt loam and silty clay loam.

Included with these soils in mapping are areas of Quinlan, Obaro, and Burson soils that have slopes of 25 to 80 percent, gypsum outcrop, and exposed weakly cemented sandstone.

The hazard of water erosion is high.

These soils are suited only to range. Conservative use of grasses is essential to prevent erosion. Rest periods from grazing are needed if the vigor of grasses is low. Careful planning is also needed in locating roads and other improvements where traffic by livestock or vehicles is likely to increase the hazard of erosion. Both soils in capability unit VIe–2; Woodward part in Mixedland range site; Yomont part in Loamy Bottomland range site.

Woodward-Quinlan association, rolling (WQD).—This mapping unit is on uplands on side slopes above drainageways or on convex ridgetops. Areas are irregular in shape and from 25 to more than 2,000 acres in size. Slopes are mostly from 5 to 8 percent, but a few areas have slopes as much as 16 percent.

Areas of this association are fairly uniform in composition, and the soils could be mapped separately; but because the use and management of these soils are similar, it was not practical to separate them. This association is on the average 51 percent Woodward soils, 44 percent Quinlan soils, and 5 percent other soils. The range in proportion from area to area is as follows: Woodward soils 47 to 55 percent, Quinlan soils 38 to 52 percent, and other soils 3 to 15 percent. These mapped areas commonly are larger than those of other units in the survey area, and their composition generally is more variable. Mapping has been controlled well enough, however, for the anticipated use of the areas involved.

Woodward soils are on side slopes and between ridges. These soils are mostly the lesser sloping part of this association. They have the profile described as representative of the Woodward series.

Quinlan soils are generally on ridgetops. They make up most of the steeper areas in this unit. These soils have the profile described as representative of the Quinlan series.

Included with these soils in mapping are some areas of Aspermont, Cottonwood, Burson, Yahola, Yomont, and Obaro soils. Also included are small alabaster gypsum outcrops, mainly near ridgetops. A few gullies, 6 inches to 3 feet deep and more than 200 feet apart, along natural drainageways are included in places.

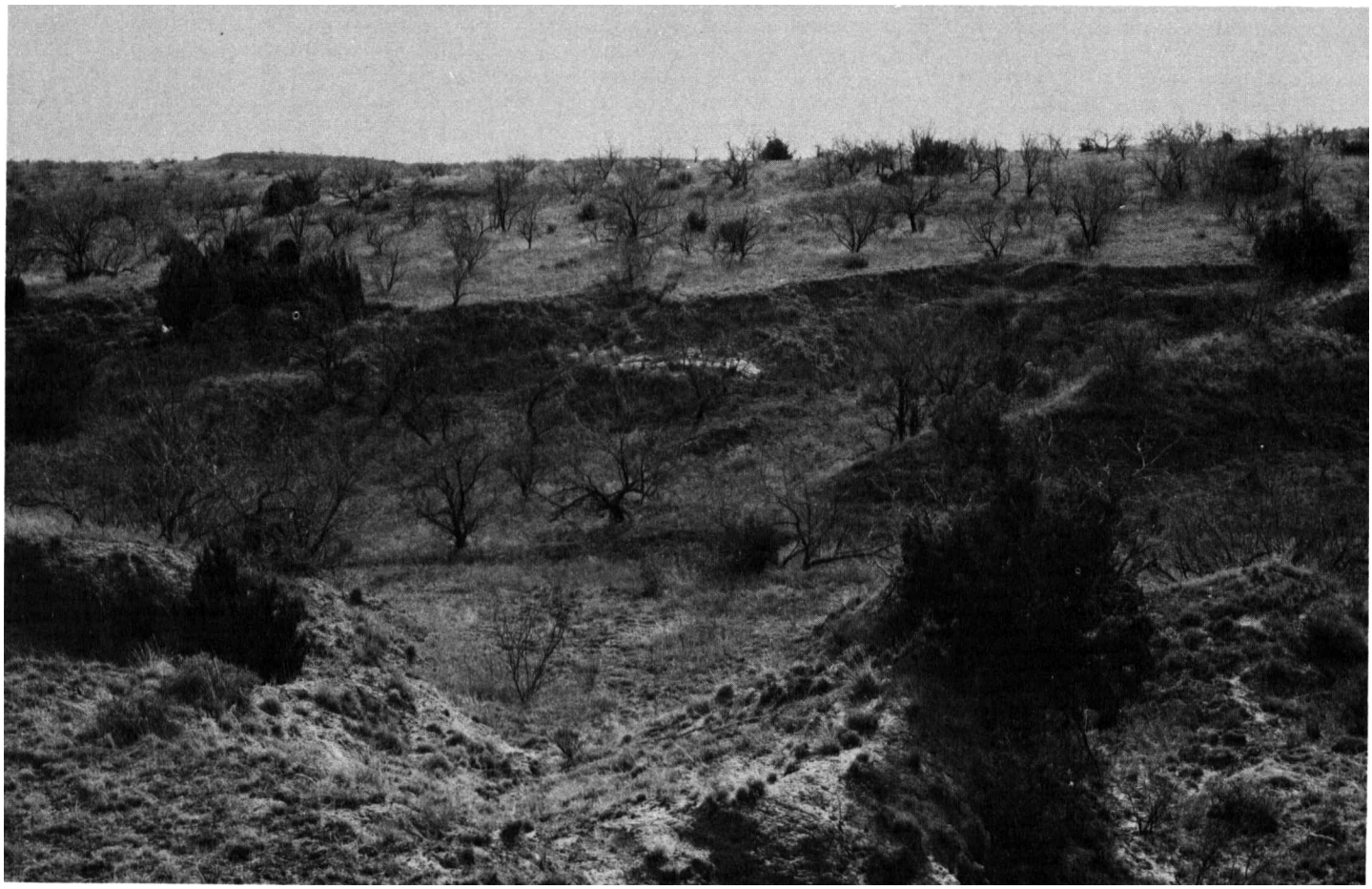

Figure 13.—**Typical area of Woodward-Yomont complex, 0 to 15 percent slopes.**

The hazard of water erosion is high.

This association is not suited to cultivation, and most of it has remained in range. The few areas that were formerly cultivated have reverted to native grass. Capability unit VIe–2; Mixedland range site.

Yahola Series

The Yahola series consists of deep, well-drained, moderately rapidly permeable, loamy soils on bottom lands. The soils formed in calcareous, loamy alluvium.

In a representative profile the surface layer is reddish-brown fine sandy loam about 7 inches thick. The next layer is about 35 inches of brown fine sandy loam that has thin strata of silt loam, loam, and loamy fine sand. The next 17 inches is light-brown loamy fine sand. The next layer, extending to a depth of 80 inches, is brown fine sandy loam.

Runoff is slow. Available water capacity is medium.

Representative profile of Yahola fine sandy loam, 2.6 miles west of Flomot, via Farm Road 97; 3.05 miles north on county road, 0.9 mile east on private ranch road, and 50 feet north in area of rangeland:

A1—0 to 7 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) moist; weak, fine, granular structure; slightly hard, friable; many roots; calcareous; moderately alkaline; clear, smooth boundary.

C1—7 to 42 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; few strata of silt loam, ¼ to ½ inch thick, in upper part and few strata of loamy fine sand, ¼ inch to 2 inches thick, in lower part; calcareous; moderately alkaline; gradual, smooth boundary.

C2—42 to 59 inches, light-brown (7.5YR 6/4) loamy fine sand, brown (7.5YR 5/4) moist; single grained; soft, very friable; calcareous; moderately alkaline; clear, smooth boundary.

C3—59 to 80 inches, brown (7.5YR 5/4) fine sandy loam, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; calcareous; moderately alkaline.

The A horizon ranges from 5 to 16 inches in thickness. It is light brown, brown, red, light red, or reddish brown.

The C horizon is brown, light brown, reddish brown, reddish yellow, yellowish red, red, or light red. Strata in this layer range from ¼ to 2 inches in thickness.

The horizon between depths of 10 to 40 inches is loam to fine sandy loam. The content of clay ranges from 8 to less than 18 percent. This horizon is more than 15 percent material coarser than very fine sand.

Yahola fine sandy loam (Ya).—This soil is on bottom lands of flood plains along the larger streams in the county. Slopes are 0 to 1 percent. Areas are long and narrow and generally parallel the stream channels. They range from 15 to several hundred acres in size.

Included with this soil in mapping are some narrow bands, less than 5 acres in size, of Yomont, Lincoln, and Gageby soils. Also included are sloping areas that separate different levels of flood plains.

The hazard of soil blowing is moderate. Some areas of this soil are occasionally flooded; however, some areas that occur on higher benches are seldom flooded.

Most areas of this soil are in range. Some areas are cultivated, and the principal crops are cotton, wheat, and grain sorghum. This soil is well suited to all crops grown in the area. Crop rotation, management of crop residue on the soil surface, and timely but limited tillage are needed practices. Capability unit IIw–1; Loamy Bottomland range site.

Yomont Series

The Yomont series consists of deep, well-drained, moderately rapidly permeable, loamy soils on bottom lands. These soils formed in calcareous loamy and silty alluvium.

In a representative profile the surface is reddish-brown very fine sandy loam about 12 inches thick. The underlying material is yellowish-red very fine sandy loam in the upper part and reddish-yellow fine sandy loam in the lower part.

Runoff is slow. Available water capacity is very high.

Representative profile of Yomont very fine sandy loam, 0.8 mile west of Northfield, via Farm Road 656; 1.7 miles north on private ranch road, and 0.7 mile east in a cultivated field:

Ap—0 to 6 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak, granular structure; soft, very friable; few roots; calcareous; moderately alkaline; abrupt, smooth boundary.

A1—6 to 12 inches, reddish-brown (5YR 5/4) very fine sandy loam, reddish brown (5YR 4/4) moist; weak, fine, granular and subangular blocky structure; soft, very friable; few fine roots; few worm casts; calcareous; moderately alkaline; gradual, smooth boundary.

C1—12 to 35 inches, yellowish-red (5YR 5/6) very fine sandy loam, yellowish red (5YR 4/6) moist; massive, breaking to blocky fragments with dull faces; soft, very friable; few worm casts; thin strata of silt loam; few faint bedding plains; few films and threads of calcium carbonate; calcareous; moderately alkaline; diffuse, smooth boundary.

C2—35 to 80 inches, reddish-yellow (5YR 6/6) fine sandy loam, yellowish red (5YR 5/6) moist; massive, breaking to granular fragments with dull faces; soft, very friable; thin strata of silt loam and very fine sandy loam; few faint bedding planes; calcareous; moderately alkaline.

Thin strata of different-textured material range from none to few throughout the profile. At a depth of 10 to 20 inches, the texture ranges from very fine sandy loam to silt loam.

The A horizon is reddish brown or light reddish brown. It ranges from 7 to 12 inches in thickness.

The C horizon is reddish brown, light reddish brown, reddish yellow, or yellowish red.

Yomont very fine sandy loam (Yo).—This nearly level soil is on bottom lands on the flood plains of the rivers and major streams. Areas are much longer than they are wide and parallel the stream channels. Slopes are 0 to 1 percent.

This soil has the profile described as representative of the series.

Included with this soil in mapping are some narrow bands of Lincoln, Yahola, and Gageby soils. Also included are bands of gently sloping soils on narrow benches separating different levels of the flood plains.

The hazards of soil blowing and water erosion are slight.

About 30 percent of the area of this soil is cultivated. Wheat, cotton, and grain sorghum are the principal crops. Some areas are occasionally overflowed; however, some areas on higher beaches are seldom, if ever, overflowed. The water table is at a depth below 6 feet in some places. These soils are well suited to all crops adapted to the area. Crop rotation, management of crop residue on the soil surface, and timely but limited tillage are needed management practices. Capability unit IIw–1; Loamy Bottomland range site.

Yomont and Lincoln soils (Ys).—These nearly level soils are on frequently flooded areas of bottom land along the rivers, creeks, and larger drainageways throughout the county. Areas are from 20 to several hundred acres in size and mostly parallel the stream channels (fig. 14). Slopes are 0 to 1 percent.

This mapping unit is variable, and the soil patterns are not uniform. It is on the average 52 percent Yomont soils, 28 percent Lincoln soils, and 20 percent other soils. The range in proportion from area to area is as follows: Yomont soils 28 to 65 percent, Lincoln soils 25 to 41 percent, and other soils 2 to 47 percent.

Yomont soils mostly occupy the higher positions on bottom lands. The surface layer is reddish-brown very fine sandy loam about 11 inches thick. The underlying material is very fine sandy loam; it is reddish brown in the upper part and yellowish red in the lower part.

Lincoln soils generally occupy lower positions on bottom lands. The surface layer is light reddish-brown fine sandy loam 13 inches thick. The underlying material is reddish-yellow fine sand.

Included with these soils in mapping are areas of Gageby, Yahola, and Woodward soils.

The hazard of soil blowing is moderate.

These soils are generally unsuited to cultivation because of susceptibility to flooding. They are suited to range, recreation, and wildlife habitat. They support a good growth of useful native grasses, trees, and shrubs. Woody species that are suitable for wildlife habitat need to be retained. Both soils in capability unit Vw–1; Yomont part in Loamy Bottomland range site; Lincoln part in Sandy Bottomland range site.

Use and Management of the Soils

The soils in Motley County are used for crops, as range, for engineering purposes, for recreational facilities, and as wildlife habitat. This section discusses the use and management of the soils for these purposes.

Crops

Management and treatment of soils modify the hazards involved in their use and affect the response of crops grown. Because of climate, the choice of crops

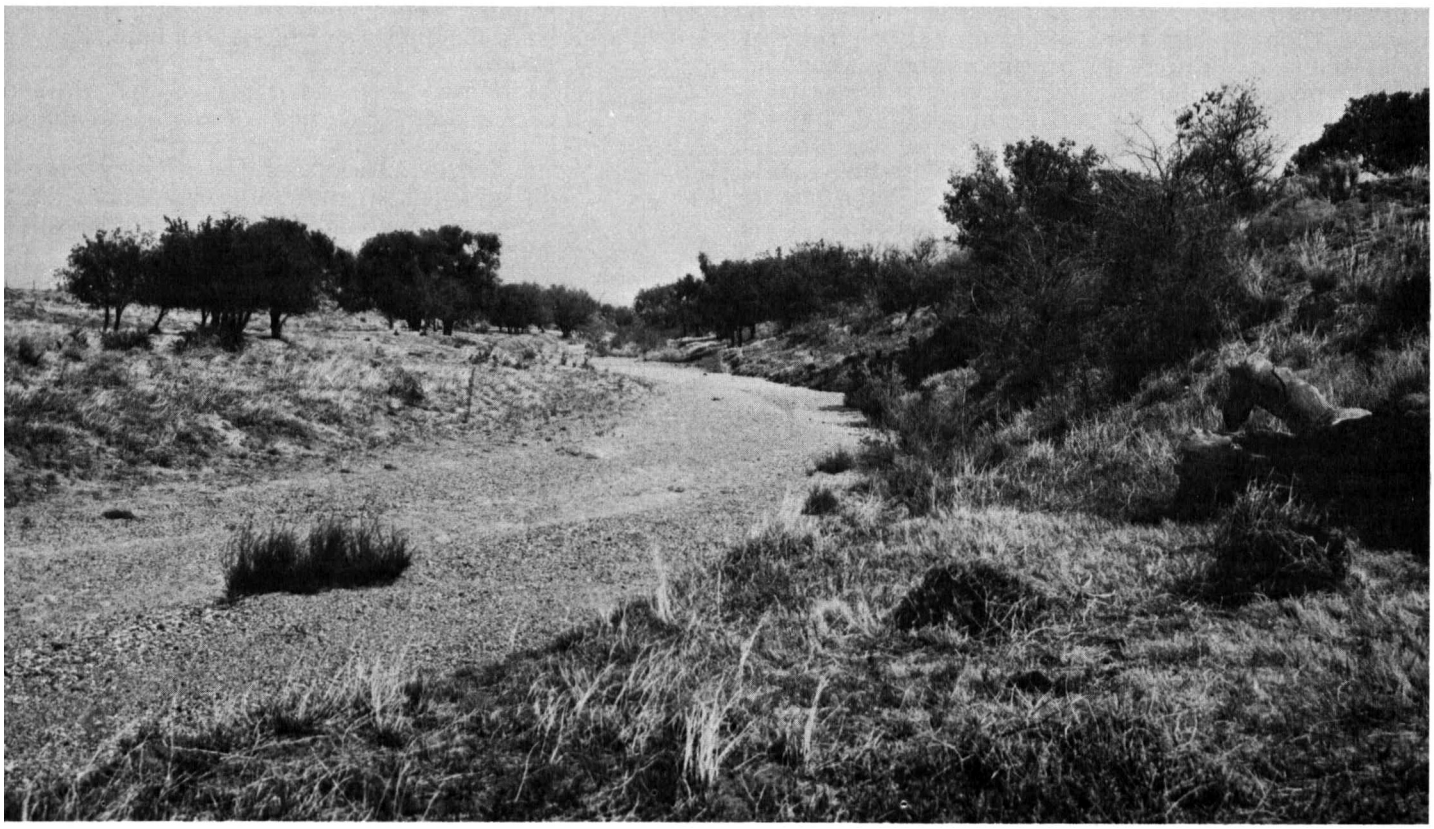

Figure 14.—Area of Yomont and Lincoln soils. Stream channel is only a few feet below surface of these soils.

is limited. Cotton, wheat, oats, barley, guar, peanuts, and most grain and forage sorghums are among the crops suited to both the soils and the climate of Motley County. All of these crops can be dryfarmed, but garden and orchard crops need to be irrigated. The chief limitations to farming the soils in Motley County are high winds, low annual rainfall, drought, and the high intensity of some rains. Management is needed to conserve moisture, protect the soils from soil blowing and water erosion, and improve tilth.

The system of classifying soils according to their suitability for use is explained in the following section. Also, a description of a high level of conservation management of cropland is given, and estimated yields for the major crops grown at this level of management are presented.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels: the class, the subclass, and the unit.

CAPABILITY CLASSES, the broadest grouping, are designated by Roman numerals I to VIII. In class I are the soils that have the fewest limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, forage, or wood products.

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 this county but not in all parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*,

because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–2 or IIIe–6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraphs; and the Arabic numeral specifically identifies the capability unit within each subclass.

The classes in the capability system and the subclasses and units in the county are briefly described in the list that follows. The capability unit into which each soil has been placed is given in the Guide to Mapping Units.

Class I. Soils that have few limitations that restrict their use. (None in Motley County.)

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

Subclass IIc. Soils that are moderately limited by dry climate.

Unit IIc–1. Deep, nearly level, well-drained loams and clay loams; on uplands.

Unit IIc–2. Deep, nearly level, well-drained loams and very fine sandy loams; on uplands.

Subclass IIe. Soils that are subject to slight or moderate erosion unless protected.

Unit IIe–1. Moderately deep, gently sloping, well-drained loams; on uplands.

Unit IIe–2. Deep, gently sloping, well-drained loams and clay loams; on uplands.

Subclass IIw. Soils that are moderately limited by excess water.

Unit IIw–1. Deep, nearly level, well-drained fine sandy loams, very fine sandy loams, and clay loams; on bottom lands.

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

Subclass IIIc. Soils that are severely limited by dry climate.

Unit IIIc–1. Deep, nearly level, well-drained loams that have medium available water capacity; on uplands.

Subclass IIIe. Soils that are subject to moderate or severe erosion if cultivated and not protected.

Unit IIIe–1. Moderately deep, gently sloping, well-drained loams that have high available water capacity; on uplands.

Unit IIIe–2. Deep, gently sloping, well-drained fine sandy loams that have medium available water capacity; on uplands.

Unit IIIe–3. Deep, nearly level to gently sloping, well-drained fine sandy loams that have medium available water capacity; on uplands.

Unit IIIe–4. Deep, nearly level, well-drained clay loams that have medium available water capacity; on uplands.

Unit IIIe–5. Deep, gently sloping, well-drained loams and silty clay loams that have very high to medium available water capacity; on uplands.

Unit IIIe–6. Deep, gently sloping, well-drained loams that have medium available water capacity; on uplands.

Unit IIIe–7. Deep, nearly level to gently undulating, well-drained loamy fine sands that have medium available water capacity; on uplands.

Unit IIIe–8. Deep, nearly level to gently sloping, well-drained fine sands that have medium available water capacity; on uplands.

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

Subclass IVe. Soils that are subject to severe erosion if they are cultivated and not protected.

Unit IVe–1. Deep, gently sloping, well-drained loams and silty clay loams; on uplands.

Unit IVe–2. Deep, nearly level, somewhat excessively drained fine sandy loams; on bottom lands.

Unit IVe–3. Deep, sloping, well-drained fine sandy loams; on uplands.

Unit IVe–4. Deep, gently sloping, well-drained fine sandy loams, loams, and clay loams; on uplands.

Unit IVe–5. Deep, gently sloping and gently undulating, well-drained loamy fine sands; on uplands.

Unit IVe–6. Very shallow to deep, nearly level to gently sloping, well-drained fine sandy loams and loams; on uplands.

Unit IVe–7. Deep, gently sloping, well-drained fine sandy loams; on uplands.

Unit IVe–8. Deep, nearly level and gently undulating, well-drained loamy fine sands; on uplands.

Unit IVe–9. Deep, gently sloping, well-drained loams; on uplands.

Unit IVe–10. Deep, gently sloping and undulating, well-drained fine sands; on uplands.

Subclass IVw. Soils that are severely limited because of excess water.

Unit IVw–1. Deep, nearly level, poorly drained clays; on uplands.

Class V. Soils that are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, or wildlife habitat.

Subclass Vw. Soils that are too wet for cultivation; drainage or protection not feasible.

Unit Vw–1. Deep, nearly level, well-drained

to somewhat excessively drained very fine sandy loams and fine sandy loams; on bottom lands.

Unit Vw–2. Deep, nearly level, somewhat excessively drained loamy fine sands; on bottom lands.

Class VI. Soils that have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, range, or wildlife habitat.

Subclass VIe. Soils that are severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIe–1. Deep, sloping to strongly sloping, well-drained fine sandy loams; on uplands.

Unit VIe–2. Shallow to deep, nearly level to moderately steep and rolling, well-drained very fine sandy loams, silty clay loams, and loams; on uplands.

Unit VIe–3. Deep, nearly level to gently sloping and gently undulating to rolling, well-drained loamy fine sands to fine sands; on uplands.

Subclass VIs. Soils that are severely limited by excess gravel.

Unit VIs–1. Very shallow to deep, hilly, well-drained to excessively drained fine sandy loams and gravelly sandy loams; on uplands.

Subclass VIw. Soils that are severely limited by excess water.

Unit VIw–1. Deep, nearly level, somewhat poorly drained clays; on uplands.

Class VII. Soils that have very severe limitations that make them unsuited to cultivation and restrict their use largely to range or wildlife habitat.

Subclass VIIe. Soils that are very severely limited, chiefly by risk of erosion, unless protective cover is maintained.

Unit VIIe–1. Deep, undulating to hilly, excessively drained fine sands; on uplands.

Subclass VIIs. Soils very severely limited by shallowness, low water capacity, rock outcrops, or other features.

Unit VIIs–1. Very shallow to deep, gently sloping to moderately steep and hilly, well-drained to excessively drained fine sandy loams and loams; on uplands.

Class VIII. Soils and landforms that have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes. (None in Motley County.)

Predicted yields

Table 2 lists predicted yields per acre of the principal crops grown in the county. The predictions are based on estimates made by farmers, soil scientists, and others who have knowledge of yields in the county and on information taken from research data. The predicted yields are average yields per acre that can be expected by good commercial farmers at a level of management that tends to produce the highest economic returns. The yields are given for dryland soils.

Crops other than those shown in table 2 are grown in the county, but their predicted yields are not included because their acreage is small or reliable data on yields are not available.

The predicted yields given in table 2 can be expected if—

1. Rainfall is effectively used and conserved.
2. Surface or subsurface drainage systems, or both, are installed as needed.
3. Crop residue is managed to maintain tilth.
4. Minimum but timely tillage is used.
5. Insect, disease, and weed-control measures are consistently used.
6. Fertilizer is applied according to soil tests and crop needs.
7. Suited crop varieties are used at the recommended seeding rate.

Range[2]

Native grass covers 507,000 acres of Motley County. The grasslands are used mainly for beef production, which contributes about 50 percent of the total farm income in the county. Motley County has 13 types of plant communities, which can be broadly grouped into communities that grow on loamy soils and communities that grow on sandy soils.

About 88 percent of these grasslands are loamy soils, which are found throughout the county. They are prairie soils where short and mid grasses grow. The clay loams of this group are droughty and are seasonal in production.

The sandy soils are scattered throughout the western, northern, and southern parts of the county, and mid and tall grasses interspersed with shin oak grow on these soils. These soils have low to medium available water capacity. Plants make efficient use of the moisture from light showers, and an abundance of vegetation grows. The vegetation is low in nutrient quality. These sandy soils are underlain by aquifers, which provide well water for livestock and irrigation.

Range sites and condition classes

Soils vary in their capacity to produce grass and other plants for grazing. Soils that produce about the same kinds and amounts of forage, if the range condition is similar, make up a range site.

Range sites are kinds of range that differ in their ability to produce vegetation. The soils of any one range site produce about the same kind of climax vegetation. Climax vegetation is the stabilized plant community. It reproduces itself and does not change as long as the environment remains unchanged. Throughout the prairie and the plains, the climax vegetation consists of the plants that were growing when the region was first settled. If cultivated crops are not grown, the most productive combination of forage plants on a range site is generally the climax vegetation.

Range condition is judged according to standards that apply to the particular range site. It expresses the

[2] By JON A. DARROW, range conservationist, Soil Conservation Service.

TABLE 2.—*Predicted yields per acre of principal crops under a high level of management*

[Absence of data indicates that the crop is not suited to the soil or is not commonly grown]

Soil	Cotton (lint)	Wheat	Grain sorghum
	Lb	*Bu*	*Bu*
Abilene clay loam, 0 to 1 percent slopes	300	25	35
Abilene clay loam, 1 to 3 percent slopes	250	20	30
Altus very fine sandy loam, 0 to 1 percent slopes	350	20	35
Aspermont silty clay loam, 1 to 3 percent slopes	200	15	25
Aspermont silty clay loam, 3 to 5 percent slopes	150	15	20
Aspermont silty clay loam, 5 to 12 percent slopes			
Berda and Potter soils, 5 to 20 percent slopes			
Bukreek loam, 0 to 1 percent slopes	280	20	30
Bukreek loam, 1 to 3 percent slopes	240	20	25
Cottonwood loam, 3 to 20 percent slopes			
Delwin fine sand, 0 to 3 percent slopes	200		25
Devol loamy fine sand, 3 to 8 percent slopes			
Devol and Tivoli soils, 1 to 8 percent slopes			
Flomot fine sandy loam, 1 to 3 percent slopes	150	15	15
Flomot fine sandy loam, 3 to 5 percent slopes	125	10	15
Flomot fine sandy loam, 5 to 12 percent slopes			
Flomot-Potter complex, 0 to 3 percent slopes	125	10	15
Frankirk loam, 0 to 1 percent slopes	250	20	25
Frankirk loam, 1 to 3 percent slopes	240	20	25
Gageby clay loam	300	20	30
Heatly fine sand, 0 to 5 percent slopes	140		15
Hilgrave gravelly sandy loam, 10 to 30 percent slopes			
Latom-Rock outcrop complex, 3 to 12 percent slopes			
Lincoln soils			
Lincoln soils, frequently flooded			
Lipan clay, depressional	150	15	15
Miles loamy fine sand, 0 to 3 percent slopes	250	15	25
Miles loamy fine sand, 3 to 5 percent slopes	150	10	20
Miles fine sandy loam, 1 to 3 percent slopes	250	20	30
Miles fine sandy loam, 3 to 5 percent slopes	200	15	20
Miles fine sandy loam, 5 to 8 percent slopes			
Mobeetie fine sandy loam, 0 to 3 percent slopes	200	15	20
Mobeetie fine sandy loam, 3 to 5 percent slopes	150		15
Mobeetie fine sandy loam, 5 to 12 percent slopes			
Motley loam, 0 to 1 percent slopes	280	20	30
Motley loam, 1 to 3 percent slopes	240	20	25
Nobscot soils, 3 to 12 percent slopes			
Obaro loam, 1 to 3 percent slopes	200	20	25
Obaro loam, 3 to 5 percent slopes	150	15	20
Obaro-Burson complex, 3 to 12 percent slopes			
Paloduro loam, 0 to 1 percent slopes	220	15	20
Paloduro loam, 1 to 3 percent slopes	180	10	15
Polar-Mobeetie association, hilly			
Posey-Mansker complex, 3 to 5 percent slopes			
Potter loam, 3 to 20 percent slopes			
Pullman clay loam, 0 to 1 percent slopes	200	15	15
Quinlan loam, 3 to 12 percent slopes			
Randall clay		10	15
Sagerton clay loam, 0 to 1 percent slopes	250	20	30
Sagerton clay loam, 1 to 3 percent slopes	240	20	25
Springer loamy fine sand, 0 to 3 percent slopes	150	15	20
Tivoli fine sand			
Tulia loam, 1 to 3 percent slopes	140	15	20
Tulia loam, 3 to 5 percent slopes		15	15
Woodward loam, 1 to 3 percent slopes	240	20	25
Woodward loam, 3 to 5 percent slopes	200	15	20
Woodward-Yomont complex, 0 to 15 percent slopes			
Woodward-Quinlan association, rolling			
Yahola fine sandy loam	325	20	30
Yomont very fine sandy loam	325	20	30
Yomont and Lincoln soils			

present kind and amount of vegetation in relation to the climax plant community for that site.

Four range condition classes are used to indicate the degree of departure from the potential, or climax, vegetation brought about by grazing or other uses. The classes show the present condition of the native vegetation on a range site in relation to the native vegetation that could grow on the site.

A range is in *excellent condition* if 76 to 100 percent of the vegetation is of the same kind as that in the climax stand; *good* if 51 to 75 percent; *fair* if 26 to 50 percent; and *poor* if less than 25 percent.

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

An important objective of good range management is to keep range in excellent or good condition. If this is done, water is conserved, yields are improved, and soils are protected. The problem is recognizing important changes in the kind of cover on a range site. These changes take place gradually and can be misinterpreted or overlooked. Growth encouraged by heavy rainfall may lead to the conclusion that the range is in good condition, when actually the cover is weedy, and the long-term trend is toward lower production. On the other hand, some rangeland that has been closely grazed for short periods, under the supervision of a careful manager, may have a degraded appearance that temporarily conceals its quality and ability to recover.

Descriptions of range sites

In the following pages the range sites of Motley County are described, and the climax plants and principal invaders on the sites are named. Also given is an estimate of the potential annual yield of air-dry herbage for each site when this site is in excellent condition. The soils in each site can be determined by referring to the "Guide to Mapping Units" at the back of this survey.

CLAY LOAM RANGE SITE

This site consists of nearly level to strongly sloping, deep loams, clay loams, and silty clay loams. Permeability is moderate to very slow. The hazard of soil blowing is slight, and the hazard of water erosion is slight to high. Surface crusting becomes a problem if the plant cover deteriorates.

The climax plant community is short and mid grasses. The approximate composition, by weight, of the climax plant community is 30 percent blue grama; 15 percent buffalograss; 15 percent tobosa; 10 percent vine-mesquite; 5 percent side-oats grama; 5 percent Arizona cottontop; 5 percent silver bluestem; 5 percent sand dropseed; 5 percent Wright and purple three-awn; and 5 percent woody species.

Under continued heavy grazing, the site deteriorates; buffalograss becomes dominant, and tobosagrass increases. With further deterioration, such grasses as red grama, purple three-awn, and hairy tridens become dominant, and mesquite, condalia, and prickly-pear invade.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,000 pounds to 2,000 pounds per acre, depending upon the amount of rainfall. About 95 percent of this production is forage for livestock.

DEEP SAND RANGE SITE

This site consists of gently sloping and undulating to hilly, deep, loose sand. Permeability is rapid. The hazard of soil blowing is high. Herbage is low in nutrient quality.

The climax plant community is a tall-grass prairie. The approximate composition, by weight, of the climax plant community is 20 percent indiangrass; 20 percent sand bluestem; 10 percent giant dropseed; 10 percent little bluestem; 5 percent switchgrass; 5 percent sand lovegrass; 5 percent silver bluestem; 10 percent side-oats grama, plains bristlegrass, and sand dropseed; 10 percent woody species; and 5 percent forbs.

Under continued heavy grazing, the site deteriorates, tall grasses decrease, and mid and short grasses increase. Shin oak and yucca are woody species that increase. Further deterioration of the site allows shin oak to dominate the site, and there is a grass understory of red lovegrass, gummy lovegrass, sand paspalum, hooded windmillgrass, and sand dropseed. Mesquite and pricklypear invade only to a limited extent.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,000 pounds to 2,000 pounds per acre, depending upon the amount of rainfall. About 85 percent of this production is forage for livestock.

GRAVELLY RANGE SITE

This site consists of very shallow to deep fine sandy loams and gravelly sandy loams. The soils are on hilly upland areas, mostly adjacent to streams. Permeability is moderately rapid. The hazard of water erosion is moderate.

The climax plant community is midgrasses interspersed with short and tall grasses. Vegetation is generally sparse. The approximate composition, by weight, of the climax plant community is 20 percent side-oats grama; 15 percent little bluestem; 10 percent black grama; 10 percent blue grama; 10 percent sand bluestem; 5 percent silver bluestem; 5 percent Arizona cottontop; 5 percent plains bristlegrass; 5 percent purple and Wright three-awn; 5 percent sand dropseed; 5 percent woody species; and 5 percent forbs.

Under continued heavy grazing, the site deteriorates; tall and mid grasses are grazed out, catclaw, yucca, shinoak, perennial three-awn, sand dropseed, and hairy grama increase, and mesquite, tasajillo, and agrito invade.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,100 pounds to 1,800 pounds per acre, depending upon the amount of rainfall. About 90 percent of this production is forage for livestock.

GYP RANGE SITE

This site consists of gently sloping to moderately steep, very shallow loams over chalky gyp beds. Per-

meability is moderate. The hazard of water erosion is high. Depth to raw gypsum limits the growth of herbage. Areas of gypsum outcrop occur throughout the site.

The climax plant community is midgrasses with scattered tall grasses growing in the areas of gyp outcrop. The approximate composition, by weight, of the climax plant community is 20 percent side-oats grama; 10 percent little bluestem; 5 percent sand bluestem; 5 percent indiangrass; 5 percent purple and Wright three-awn; 5 percent tobosa; 5 percent buffalograss; 5 percent rough tridens; 5 percent Arizona cottontop; 5 percent forbs; 5 percent woody species; and 25 percent other grasses.

Under continued heavy grazing, the site deteriorates, and tall grasses are grazed out. Little bluestem, side-oats grama, Arizona cottontop, and vine-mesquite are grazed out next, and buffalograss, hairy tridens, rough tridens, and purple and Wright three-awn become the primary herbage producers, while mesquite and picklypear invade. Redberry juniper increases to become the most prominent woody species.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 500 pounds to 1,000 pounds per acre, depending upon the amount of rainfall. About 90 percent of this production is forage for livestock.

Because the soils are very shallow to gypsum, and because there is gypsum outcrop, this site is less productive than some of the other sites. Mechanical means of brush control are not feasible, because gypsum can be brought to the surface, which makes revegetation difficult.

HARDLAND SLOPES RANGE SITE

This site consists of nearly level to gently sloping, deep loams and clay loams. Permeability is moderate. The hazard of soil blowing is slight, and the hazard of water erosion is slight to moderate.

The climax plant community is a mid-grass prairie. The approximate composition, by weight, of the climax plant community is 35 percent side-oats grama; 25 percent blue grama; 5 percent little bluestem; 5 percent buffalograss; 5 percent silver bluestem; 5 percent Wright and purple three-awn; 5 percent sand dropseed; 5 percent vine-mesquite; 5 percent woody species; and 5 percent forbs.

Under continued heavy grazing, the site deteriorates; side-oats grama and little bluestem decrease, and buffalograss and blue grama increase. Because of the high calcium content in the soils, side-oats grama remains an important grass in the plant community until the last stages of retrogression. If the site deteriorates, pricklypear, perennial broomweed, ragweed, sand dropseed, and three-awns dominate.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,300 pounds to 2,300 pounds per acre, depending upon the amount of rainfall. About 90 percent of this production is forage for livestock.

LAKEBED RANGE SITE

This site consists of deep clays on nearly level playa lakes 3 to 50 feet below the surrounding plain. Areas generally are less than 150 acres. Permeability is very slow. The site is subject to annual flooding, and when the soils dry, they develop large cracks. The hazards of soil blowing and water erosion are slight.

The climax plant community is highly variable. During a series of dry years grasses encroach from surrounding sites only to die out during wet periods. The community is under continual change from grass to forbs and back to grass. The approximate composition, by weight, of the climax plant community is 75 percent perennial forbs; 10 percent blue grama; 10 percent buffalograss; and 5 percent vine-mesquite.

Under continued heavy grazing the site deteriorates; plant vigor is reduced, and desirable forbs die. Vine-mesquite and blue grama die out and are replaced by buffalograss in the lakes that are infrequently flooded. Frequency and length of inundation determine the kind of vegetation. Perennial forbs dominate the sites that are inundated for long periods. Short and mid grasses dominate less frequently inundated sites.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 700 pounds to 2,000 pounds per acre, depending upon the amount of rainfall. About 50 percent of this production is forage for livestock.

LOAMY BOTTOMLAND RANGE SITE

This site consists of nearly level to gently sloping, deep fine sandy loams, very fine sandy loams, loams, and clay loams. The soils are on flood plains along streams. Permeability is moderate to moderately rapid. The hazard of soil blowing is slight to moderate, and the hazard of water erosion is slight to high.

The climax plant community is mid and tall grasses. The approximate composition, by weight, of the climax plant community is 20 percent side-oats grama; 10 percent vine-mesquite; 10 percent sand bluestem; 10 percent indiangrass; 5 percent switchgrass; 5 percent plains bristlegrass; 5 percent silver bluestem; 5 percent tobosa; 5 percent white tridens; 5 percent Texas wintergrass; 5 percent Arizona cottontop; 10 percent woody species; and 5 percent forbs.

Under continued heavy grazing, the site deteriorates, and the tall grasses and decreaser forbs are grazed out and are replaced by buffalograss, tobosa, and sand dropseed. Mesquite, pricklypear, and condalia invade readily. This site responds favorably to mechanical brush control and reseeding.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 2,000 to 4,500 pounds per acre, depending upon the amount of rainfall. About 90 percent of this production is forage for livestock.

MIXEDLAND RANGE SITE

This site consists of deep to moderately deep loams that are nearly level to moderately steep and hilly. Permeability is moderate to moderately rapid. The hazard of soil blowing is slight to moderate, and the hazard of water erosion is slight to high.

The climax plant community is a short-grass and mid-grass prairie. Scattered tall grasses grow in areas where moisture is favorable or where content of gypsum is high. The approximate composition, by weight,

of the climax plant community is 25 percent blue grama; 15 percent side-oats grama; 10 percent buffalograss; 5 percent plains bristlegrass; 5 percent Arizona cottontop; 5 percent black grama; 5 percent silver bluestem; 5 percent sand dropseed; 5 percent little bluestem; 5 percent Texas wintergrass; 5 percent Wright and purple three-awn; 5 percent woody species; and 5 percent forbs.

Under continued heavy grazing, the site deteriorates; blue grama and side-oats grama decrease, and buffalograss, sand dropseed, and three-awn increase. Further deterioration of the plant community allows mesquite, pricklypear, juniper, hairy tridens, red grama, and sand muhly to invade.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,500 pounds to 2,500 pounds per acre, depending upon the amount of rainfall. About 90 percent of this production is forage for livestock.

MIXEDLAND SLOPES RANGE SITE

This site consists of deep, nearly level to moderately steep and hilly fine sandy loams. Permeability is moderate to moderately rapid. The hazard of soil blowing is moderate, and the hazard of water erosion is moderate to high.

The climax plant community is a mid-grass and tall-grass prairie. The approximate composition, by weight, of the climax plant community is 30 percent side-oats grama; 20 percent blue grama; 15 percent little bluestem; 10 percent sand bluestem; 5 percent indiangrass; 5 percent buffalograss; 5 percent hairy grama; 5 percent woody species; and 5 percent perennial forbs.

Under continued heavy grazing, the site deteriorates, and blue grama and buffalograss increase and replace the tall and mid grasses. Mesquite, pricklypear, hairy tridens, sand dropseed, and western ragweed invade.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,400 pounds to 2,200 pounds per acre, depending upon the amount of rainfall. About 90 percent of this production is forage for livestock.

SANDY RANGE SITE

This site consists of nearly level to rolling, deep fine sands. Permeability is moderate to moderately rapid. The hazard of soil blowing is high, and the hazard of water erosion is slight to moderate.

The climax plant community is a tall-grass prairie that has scattered shin oak and hackberry. The approximate composition, by weight, of the climax plant community is 20 percent little bluestem; 20 percent sand bluestem; 10 percent indiangrass; 10 percent side-oats grama; 10 percent plains bristlegrass; 10 percent Arizona cottontop; 5 percent sand lovegrass; 10 percent perennial forbs; and 5 percent woody species.

Under continued heavy grazing, the site deteriorates; the tall grasses are grazed out, and sand sagebush and shin oak dominate. Sand paspalum, sand dropseed, hooded windmillgrass, and fall witchgrass become primary grasses under an overstory of shin oak and sand sagebush.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,400 pounds to 3,400 pounds per acre, depending upon the amount of rainfall. About 90 percent of this production is forage for livestock.

SANDY BOTTOMLAND RANGE SITE

This site consists of nearly level, deep alluvial fine sandy loams and loamy fine sands. The soils are on flood plains adjacent to creeks and rivers. Permeability is rapid. The hazard of water erosion is slight, and the hazard of soil blowing is high.

The climax plant community is tall grasses. The approximate composition, by weight, of the climax plant community is 20 percent indiangrass; 20 percent sand bluestem; 20 percent switchgrass; 10 percent little bluestem; 10 percent western wheatgrass; 5 percent Canada wildrye; 5 percent giant dropseed; 5 percent sand lovegrass; and 5 percent perennial forbs.

Under continued heavy grazing, the site deteriorates; the tall grasses are grazed out, and the mid and short grasses dominate. Little bluestem remains until the site is completely deteriorated. Baccharis, mesquite, and saltcedar are invading trees. Sand dropseed, alkali sacaton, prairie three-awn, hooded windmillgrass, and gummy lovegrass are invader grasses.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 2,000 pounds to 5,000 pounds per acre, depending upon the amount of rainfall. About 100 percent of this production is forage for livestock.

SANDY LOAM RANGE SITE

This site consists of nearly level to sloping and undulating, deep fine sandy loams, loamy fine sands, and very fine sandy loams. Permeability is moderate to moderately rapid. The hazards of soil blowing and water erosion are slight to high.

The climax plant community is a mid-grass prairie. The approximate composition, by weight, of the climax plant community is 20 percent side-oats grama; 20 percent blue grama; 10 percent little bluestem; 10 percent plains bristlegrass; 10 percent Arizona cottontop; 10 percent vine-mesquite; 5 percent hooded windmillgrass; 5 percent buffalograss; 5 percent forbs; and 5 percent woody species.

Under continued heavy grazing, the site deteriorates, and mesquite, pricklypear, yucca, and condalia invade. Sand dropseed, fall witchgrass, buffalograss, three-awn, and silver bluestem become primary grasses. The soils of this site respond favorably to brush control and range seeding.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 1,700 pounds to 2,700 pounds per acre, depending upon the amount of rainfall. About 95 percent of this production is forage for livestock.

VERY SHALLOW RANGE SITE

This site consists of gently sloping to moderately steep and rolling, very shallow to shallow loams and

fine sandy loams. Permeability is moderate to slow. The hazard of water erosion is moderate to high.

The climax plant community is mixed short grasses and mid grasses. The approximate composition, by weight, of the climax plant community is 30 percent side-oats grama; 15 percent little bluestem; 10 percent blue grama; 10 percent rough tridens; 5 percent buffalograss; 5 percent hairy grama; 5 percent silver bluestem; 5 percent woody species; and 15 percent forbs.

Under continued heavy grazing, the site deteriorates and is invaded by such plants as mesquite, redberry juniper, and catclaw acacia and by such grasses as Texas grama, hairy tridens, red grama, and sand dropseed. Invading brush is generally sparse and stunted in appearance.

If this site is in excellent condition, the annual production of air-dry herbage ranges from about 700 pounds to 1,200 pounds per acre, depending upon the amount of rainfall. About 85 percent of this production is forage for livestock.

Engineering Uses of the Soils[3]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils important in engineering are permeability, shear strength, compaction characteristics, compressibility, soil drainage condition, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table, depth to bedrock, and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

[3] JOHN ADAMS, civil engineer, Soil Conservation Service, assisted in preparation of this section.

Most of the information in this section is presented in tables 3, 4, and 5, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 4, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigation at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables, generally depths greater than 6 feet. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have different meanings in soil science than in engineering. The Glossary defines many of these terms as they are commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified soil classification system,[4] used by the SCS engineers, Department of Defense, and others, and the AASHTO system, adopted by the American Association of State Highway and Transportation Officials.[5]

In the Unified soil classification system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by a symbol for both classes; for example, CL–ML.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. As additional refinement, the engineering value of a soil material can be indicated by a group index number.

[4] United States Department of Defense. Unified soil classification system for roads, airfields, embankments, and foundations. MIL–STD–618B, 30 pp., illus. 1968.

[5] American Association of State Highway [and Transportation] Officials. Standard specifications for highway materials and methods of sampling and testing. Ed. 8, 2 v., illus. 1961.

Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers in parentheses, is shown in table 5; the estimated classification, without group index numbers, is given in table 3 for all soils mapped in the survey area.

Soil properties significant in engineering

Estimates of several soil properties significant in engineering are given in table 3. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 3.

Hydrologic soil groups give the potential runoff from rainfall. Four major soil groups are used. The soils are classified on the basis of intake of water at the end of long-duration storms occurring after prior wetting and opportunity for swelling, and without the protective effects of vegetation.

The major soil groups are as follows:

A. (Low runoff potential). Soils having high infiltration rates even when thoroughly wetted. These consist chiefly of deep, well-drained to excessively drained sands or gravels. These soils have a high rate of water transmission in that water readily passes through them.

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

C. Soils having slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impedes downward movement of water or soils that have moderately fine to fine texture. These soils have a slow rate of water transmission.

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

Depth to bedrock is distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

The depth to a seasonal high water table is not given, because a high water table is not significant in the soils of this county.

Soil texture is described in table 3 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 3, but in table 5 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 3 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts. This rating should not be equated to the coefficient "k" used by engineers.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH. The pH value and terms used to describe soil reaction are explained in the Glossary.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content; that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Corrosivity, as used in table 3, pertains to potential soil-induced chemical action that dissolves or weakens uncoated steel. Rate of corrosion of uncoated steel is related to soil properties such as drainage, texture, total acidity, and electrical conductivity of the soil material. Installations of uncoated steel that intersect soil boundaries or soil horizons are more susceptible to corrosion than installations entirely in one kind of soil or in one soil horizon. A corrosivity rating of *low* means that there is a low probability of soil-induced corrosion damage. A rating of *high* means that there is a high probability of damage, so that protective measures for steel should be used to avoid or minimize damage. A column for concrete was not included because all the soils of Motley County are rated low, except Cottonwood soils, which are rated moderate.

TABLE 3.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in that series is made up of two or more kinds of soil. The the instructions for referring to other series in the first column of

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		Inches	*Inches*				*Percent*
Abilene: AbA, AbB	C	>120	0–16	Clay loam	CL	A–4, A–6	
			16–53	Clay	CL	A–7–6	
			53–84	Clay loam	CL	A–6, A–7–6	
Altus: AcA	B	>120	0–8	Very fine sandy loam	CL–ML, ML	A–4	
			8–56	Sandy clay loam	SC, CL, SM–SC, CL–ML	A–4, A–6	
			56–80	Loamy fine sand	SM, SP–SM	A–2–4, A–3	
Aspermont: AsB, AsC, AsE	B	>60	0–60	Silty clay loam	CL	A–7–6, A–6	
*Berda: BpF For Potter part, see Potter series.	B	>120	0–7	Fine sandy loam	CL–ML, SM–SC, SM, ML	A–4	
			7–70	Loam	SC, CL	A–4, A–6	
Bukreek: BuA, BuB	B	>120	0–8	Loam	CL–ML, CL	A–4, A–6	
			8–82	Sandy clay loam	CL	A–4, A–6	
Burson Mapped only in a complex with Obaro soils.	C	3–12	0–6	Loam	ML, CL–ML, CL	A–4	
			6–36	Weakly cemented sandstone.			
Cottonwood: CoF	C	3–10	0–8	Loam	ML, CL–ML	A–4	
			8–36	Soft chalky gypsiferous material.			
Delwin: DeB	A	>120	0–17	Fine sand	SM, SP–SM	A–2–4	
			17–48	Sandy clay loam	SC	A–2–4, A–2–6, A–4, A–6	
			48–57	Loamy fine sand	SM	A–2, A–3	
			57–108	Sandy clay loam	SC	A–2–4, A–2–6, A–4, A–6	
*Devol: DoD, DtD For Tivoli part of DtD, see Tivoli series.	B	>120	0–15	Loamy fine sand	SM	A–2–4	
			15–52	Fine sandy loam	SM, SM–SC	A–2–4, A–4	
			52–75	Loamy fine sand	SM	A–2–4	
*Flomot: FmB, FmC, FmE, FpB. For Potter part of FpB, see Potter series.	B	>120	0–6	Fine sandy loam	SM, SM–SC	A–4, A–2–4	
			6–40	Loam	CL–ML, CL, SC, SM–SC	A–4, A–6	
			40–75	Loam	CL–ML, CL, SC, SM–SC	A–4, A–6	
Frankirk: FrA, FrB	C	>120	0–8	Loam	CL	A–6	
			8–62	Clay loam	CL	A–6	
			62–85	Clay loam	CL	A–6	
Gageby: Ga	B	>120	0–32	Clay loam	CL	A–6	
			32–60	Silty clay loam	CL	A–4, A–6	
Heatly: HeC	A	>120	0–24	Fine sand	SM, SP–SM	A–2–4, A–3	
			24–58	Sandy clay loam	SC	A–2–4, A–2–6, A–4, A–6	
			58–78	Sandy loam	SC, SM–SC	A–2–4	
			78–110	Sandy clay loam	SC	A–2–4, A–2–6, A–4,A–6	

significant in engineering

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully this table. The symbol > means more than; < means less than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
				Percent		*Inches per hour*	*Inches per inch of soil*	*pH*		
100	100	95–99	75–90	25–35	8–16	0.6–2.0	0.15–0.19	6.6–7.8	Moderate	Moderate.
100	100	95–99	90–95	42–50	23–31	0.2–0.6	0.14–0.18	7.4–8.4	Moderate	High.
100	90–100	90–98	70–80	35–45	16–27	0.6–2.0	0.12–0.16	7.9–8.4	Moderate	Moderate.
100	100	90–98	50–60	<25	[1] NP–6	0.6–2.0	0.10–0.13	6.6–7.8	Low	Low.
100	100	90–100	40–60	20–35	5–15	0.6–2.0	0.13–0.16	6.6–8.4	Low	Low.
100	95–100	70–85	8–25	<20	NP–4	2.0–6.0	0.06–0.10	7.9–8.4	Very low	Low.
100	95–100	90–98	75–90	30–42	12–22	0.6–2.0	0.16–0.20	7.9–8.4	Moderate	Moderate.
90–99	85–95	80–95	36–65	<25	NP–7	2.0–6.0	0.10–0.14	7.9–8.4	Very low	Moderate.
95–100	95–100	80–95	40–60	25–35	8–15	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
100	100	90–98	65–75	20–30	5–15	0.6–2.0	0.12–0.16	7.4–7.8	Low	Low.
90–100	85–100	80–95	55–80	26–40	10–20	0.6–2.0	0.12–0.17	7.4–8.4	Low	Moderate.
95–100	90–100	85–100	55–85	20–30	3–10	0.6–2.0	0.10–0.16	7.9–8.4	Low	Low.
100	100	90–100	65–75	<25	NP–7	0.6–2.0	0.11–0.14	7.9–8.4	Low	High.
100	100	85–100	10–20	<22	NP–4	6.0–20	0.05–0.08	6.1–7.3	Very low	Very low.
100	100	90–100	15–45	20–30	7–15	0.6–2.0	0.14–0.16	6.1–7.3	Low	Moderate.
100	100	60–75	15–25	<20	NP–4	6.0–20	0.06–0.10	7.4–8.4	Very low	Low.
100	100	90–100	15–45	20–30	7–15	0.6–2.0	0.14–0.16	7.4–8.4	Low	Moderate.
100	95–100	70–85	15–25	<20	NP–4	6.0–20	0.06–0.10	6.1–7.8	Very low	Low.
100	100	80–95	30–50	<22	NP–6	2.0–6.0	0.11–0.14	6.6–8.4	Low	Low.
100	100	70–85	15–25	<20	NP–3	6.0–20	0.06–0.10	7.4–8.4	Very low	Low.
95–100	95–100	85–95	30–50	<25	NP–7	2.0–6.0	0.10–0.14	7.9–8.4	Low	Moderate.
90–100	80–98	75–95	36–70	20–35	5–15	0.6–2.0	0.10–0.15	7.9–8.4	Low	Moderate.
95–100	90–100	80–95	40–75	20–35	5–15	0.6–2.0	0.10–0.16	7.9–8.4	Low	Moderate.
98–100	98–100	98–100	60–65	25–35	11–15	0.6–2.0	0.16–0.18	7.4–7.8	Low	Low.
95–100	95–100	95–100	70–80	35–40	18–22	0.2–0.6	0.15–0.18	7.4–8.4	Moderate	Moderate.
90–100	90–100	85–95	55–65	25–30	11–14	0.6–2.0	0.15–0.18	7.9–8.4	Low	Moderate.
100	100	95–98	80–90	30–40	12–25	0.6–2.0	0.16–0.20	7.9–8.4	Low	Moderate.
100	100	95–98	70–80	30–40	10–20	0.6–2.0	0.16–0.20	7.9–8.4	Low	Moderate.
100	100	85–100	10–20	----------	NP	6.0–20	0.05–0.09	6.1–7.3	Very low	Very low.
100	100	90–100	25–45	20–30	8–15	0.6–2.0	0.14–0.16	6.1–7.8	Low	Moderate.
100	100	90–100	25–35	<25	5–10	0.6–2.0	0.12–0.14	6.1–7.8	Low	Low.
100	100	90–100	25–45	20–30	8–15	0.6–2.0	0.14–0.16	6.6–7.3	Low	Moderate.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		Inches	*Inches*				*Percent*
Hilgrave: HgF	B	>120	0–18	Gravelly and very gravelly sandy loam.	GP–GM, SM, SP–SM, GM	A–1, A–2–4	0–5
			18–26	Very gravelly sandy clay loam.	GM–GC, GP–GM, SP–SM, SM, SM–SC, GM	A–1, A–2–4	0–5
			26–40	Gravelly loamy sand	SP–SM	A–1, A–2–4	
			40–60	Coarse sand	SM, SP–SM	A–1, A–2–4	
*Latom: LaE Rock outcrop part too variable to rate.	D	4–20	0–9 9–15	Fine sandy loam Strongly cemented sandstone.	SM, SM–SC	A–2–4	0–5
Lincoln: Ln, Lo	A	>120	0–13	Fine sandy loam	SM, SM–SC	A–4	
			13–60	Fine sand	SM	A–2–4	
Lipan: Lp	D	>120	0–60	Clay	CH, CL	A–7–6	
Mansker Mapped only in a complex with Posey soils.	B	>120	0–14	Clay loam	CL, CL–ML, SC, SM–SC	A–4, A–6	
			14–48	Clay loam	CL, SC	A–4, A–6	
			48–84	Clay loam	CL	A–4, A–6	
Miles:							
MeB, MeC	B	>120	0–17	Loamy fine sand	SM	A–2–4	
			17–18	Sandy clay loam	SC, CL, SM–SC, CL–ML	A–4, A–6	
MfB, MfC, MfE	B	>120	0–14	Fine sandy loam	SM–SC, SM	A–4, A–2–4	
			14–84	Sandy clay loam	SC, CL, CL–ML, SM–SC	A–4, A–6	
Mobeetie: MoB, MoC, MoE	B	>120	0–70	Fine sandy loam	CL–ML, ML	A–4	
Motley: MtA, MtB	B	>120	0–9	Loam	CL	A–4, A–6	
			9–43	Sandy clay loam	CL	A–6	
			43–84	Sandy clay loam	CL, SC	A–4, A–6	
Nobscot: NoE	A	>120	0–26	Fine sand	SP–SM	A–3	
			26–56	Fine sandy loam	SM, SM–SC, ML, CL–ML	A–2–4, A–4	
			56–80	Sandy loam	SM–SC, SC	A–2–4	
			80–90	Loamy sand	SM	A–2–4	
*Obaro: ObB, ObC, OcE For Burson part of OcE, see Burson series.	B	20–48	0–27	Loam	CL, CL–ML	A–4, A–6	
			27–75	Weakly cemented fine-grained sandstone.	CL–ML, ML	A–4	
Paloduro: PaA, PaB	B	>120	0–16	Loam	SC, CL, SM–SC, CL–ML	A–4, A–6	
			16–82	Clay loam	CL	A–4, A–6	
*Polar: PME For Mobeetie part of PME, see Mobeetie series.	B	>120	0–7	Gravelly sandy loam	SM, GM, GP–GM, SM–SC, SP–SM, GM–GC	A–1, A–2–4	0–20
			7–60	Very gravelly sandy loam.	SP–SM, GP–GM, GM, GM–GC, SM–SC, SM	A–1, A–2–4	0–15
*Posey: PnC For Mansker part of PnC, see Mansker series.	B	>120	0–12	Loam	CL–ML, CL, ML, SM, SM–SC, SC	A–4	
			12–17	Clay loam	SC, SM–SC, CL, CL–ML	A–4, A–6	
			17–31	Clay loam	CL, CL–ML	A–4, A–6	
			31–84	Clay loam	CL	A–4, A–6	

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
				Percent		*Inches per hour*	*Inches per inch of soil*	*pH*		
45–75	10–50	6–35	5–20	<25	NP–3	6.0–20	0.07–0.10	5.6–8.4	Very low	Low.
45–75	10–50	8–45	5–28	<25	NP–7	2.0–6.0	0.10–0.12	6.1–8.4	Very low	Low.
65–80	27–40	14–30	5–12	<20	NP–3	6.0–20	0.04–0.08	7.9–8.4	Very low	Low.
95–100	90–100	10–20	5–15		NP	6.0–20	0.04–0.08	7.9–8.4	Very low	Low.
90–100	85–95	80–90	25–35	<25	NP–7	0.6–2.0	0.10–0.14	7.9–8.4	Very low	Low.
100	100	50–90	36–45	<26	NP–6	6.0–20	0.11–0.15	7.9–8.4	Very low	Very low.
95–100	90–100	50–90	20–35		NP	6.0–20	0.04–0.06	7.9–8.4	Very low	Low.
95–100	95–100	90–100	80–95	40–70	20–45	<0.06	0.15–0.18	7.4–8.4	Very high	High.
95–100	95–100	80–95	36–70	20–35	5–15	0.6–2.0	0.14–0.18	7.9–8.4	Low	Moderate.
90–100	90–100	85–95	40–80	20–35	8–15	0.6–2.0	0.07–0.12	7.9–8.4	Low	Moderate.
98–100	95–100	90–98	51–80	25–40	10–22	0.6–2.0	0.14–0.16	7.9–8.4	Low	Moderate.
95–100	95–100	80–85	15–25	<20	NP–3	6.0–20	0.06–0.10	6.1–7.8	Very low	Moderate.
95–100	95–100	90–97	40–55	21–36	6–18	0.6–2.0	0.13–0.17	6.6–8.4	Low	Moderate.
95–100	95–100	90–97	30–50	<22	NP–6	2.0–6.0	0.11–0.14	6.6–7.8	Very low	Low.
95–100	95–100	90–97	40–55	21–36	6–18	0.6–2.0	0.13–0.17	6.6–8.4	Low	Moderate.
95–98	90–95	90–95	51–65	18–25	NP–7	2.0–6.0	0.10–0.14	7.9–8.4	Very low	Low.
100	100	90–98	65–75	20–30	8–15	2.0–6.0	0.12–0.14	6.6–7.3	Low	Low.
100	98–100	94–98	60–85	30–40	12–23	0.6–2.0	0.13–0.17	6.6–7.8	Low	Moderate.
90–100	88–100	80–90	45–65	20–35	8–15	0.6–2.0	0.12–0.15	7.9–8.4	Low	Moderate.
100	100	50–90	5–10		NP	6.0–20	0.04–0.06	6.1–7.3	Very low	Very low.
100	100	90–100	30–60	<26	NP–6	2.0–6.0	0.09–0.13	6.1–7.8	Low	Low.
100	100	90–100	25–35	<25	5–10	2.0–6.0	0.12–0.14	6.1–7.8	Low	Low.
100	100	60–90	15–25	<20	NP–3	6.0–20	0.06–0.10	6.6–7.8	Very low	Low.
95–98	92–97	90–96	75–86	25–35	7–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Low.
95–99	95–99	90–98	60–75	20–26	NP–6	0.6–2.0	0.04–0.08	7.9–8.4	Very low	Low.
95–100	95–100	80–95	40–60	20–30	5–15	0.6–2.0	0.12–0.14	7.9–8.4	Low	Low.
95–100	90–100	80–95	51–60	20–35	8–18	0.6–2.0	0.14–0.17	7.9–8.4	Low	Moderate.
45–75	35–50	30–40	10–25	<25	NP–7	2.0–6.0	0.04–0.09	7.9–8.4	Very low	Low.
45–55	31–50	20–45	5–20	<20	NP–5	2.0–6.0	0.03–0.07	7.9–8.4	Very low	Low.
98–100	95–100	85–95	36–70	20–35	NP–10	0.6–2.0	0.13–0.17	7.9–8.4	Low	Low.
85–100	90–98	85–95	45–70	20–35	5–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.
85–100	90–95	85–95	51–75	20–35	5–12	0.6–2.0	0.07–0.12	7.9–8.4	Low	Moderate.
95–100	90–95	85–95	51–75	25–40	8–20	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.

TABLE 3.—*Estimated soil properties*

Soil series and map symbols	Hydrologic group	Depth to bedrock	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches
					Unified	AASHTO	
		Inches	*Inches*				*Percent*
Potter: PoD	C	7–20	0–13	Loam	CL–ML, ML, CL	A–4, A–6	0–25
			13–80	Hard and soft caliche and loamy material.	GM, GC, SM, SC, SM–SC, GM–GC	A–1, A–2–4, A–2–6, A–4, A–6	5–15
Pullman: PuA	D	>120	0–7	Clay loam	CL	A–6, A–7–6	
			7–38	Clay	CL, CH	A–7–6	
			38–55	Silty clay	CL, CH	A–7–6	
			55–90	Clay loam	CL	A–6, A–7–6	
Quinlan: QuD	C	10–20	0–13	Loam	ML, CL, CL–ML	A–4, A–6	
			13–60	Soft, fine-grained sandstone.	ML, CL–ML	A–4	
Randall: Ra	D	>120	0–92	Clay	CH, CL	A–7–6	
Rock outcrop. Material too variable to rate. Mapped only in a complex with Latom soils.							
Sagerton: SaA, SaB	C	>120	0–7	Clay loam	CL	A–6, A–4	
			7–30	Clay	CL	A–6, A–7	
			30–85	Clay loam	CL	A–6	
Springer: SpB	B	>120	0–16	Loamy fine sand	SM, SP–SM	A–3, A–2–4	
			16–30	Sandy loam	SM, SM–SC	A–2–4	
			30–48	Fine sandy loam	SM, SM–SC	A–2–4	
			48–60	Sandy clay loam	SC, CL, SM–SC, CL–ML	A–6, A–2–4, A–2–6, A–4	
			60–72	Loamy fine sand	SM, SP–SM	A–3, A–2–4	
			72–84	Sandy clay loam	SC, CL, SM–SC, CL–ML	A–6, A–2–4, A–2–6, A–4	
Tivoli: Tf	A	>120	0–60	Fine sand	SP–SM, SM	A–2–4, A–3	
Tulia: TuB, TuC	B	>120	0–75	Loam	CL, CL–ML, SC, SM–SC	A–4, A–6	
Woodward: WiB, WiC, WoD, WQD. For Yomont part of WoD, see Yomont series. For Quinlan part of WQD, see Quinlan series.	B	20–40	0–35	Loam	CL, CL–ML, ML	A–4	
			35–80	Weakly cemented fine-grained sandstone.			
Yahola: Ya	B	>120	0–42	Fine sandy loam	SM, ML, ML–CL, SM–SC	A–2–4, A–4	
			42–59	Loamy fine sand	SM	A–2–4	
			59–80	Fine sandy loam	SM, ML, CL–ML, SM–SC	A–2–4, A–4	
*Yomont: Yo, Ys For Lincoln part of Ys, see Lincoln series.	B	>120	0–35	Very fine sandy loam	ML, CL–ML	A–4	
			35–80	Fine sandy loam	SM, ML, CL–ML, SM–SC	A–2–4, A–4	

[1] NP: nonplastic.

significant in engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential	Corrosivity to uncoated steel
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)							
				Percent		*Inches per hour*	*Inches per inch of soil*	*pH*		
80–95	70–90	60–85	51–70	25–35	5–15	0.6–2.0	0.12–0.16	7.9–8.4	Low	Moderate.
30–80	25–75	20–60	12–50	25–35	5–15	0.6–2.0	0.01–0.04	7.9–8.4	Very low	Moderate.
100	100	95–100	70–90	35–50	15–30	0.2–0.6	0.16–0.18	6.6–7.8	Moderate	Moderate.
100	100	95–100	80–95	45–60	25–35	<0.06	0.12–0.16	7.4–8.4	High	High.
100	100	95–100	80–95	45–60	25–35	<0.06	0.12–0.16	7.9–8.4	High	High.
95–100	90–100	90–100	80–95	35–50	15–30	0.06–0.2	0.12–0.16	7.9–8.4	Moderate	Moderate.
100	95–100	90–100	55–70	20–40	4–15	2.0–6.0	0.12–0.16	7.4–8.4	Low	Low.
95–100	95–100	85–95	50–65	15–20	NP–6	0.6–2.0	0.04–0.08	7.9–8.4	Very low	Low.
100	100	96–100	70–98	41–65	22–42	<0.06	0.14–0.18	6.6–8.4	High	Very high.
95–100	95–100	90–100	70–80	25–35	8–15	0.2–0.6	0.15–0.20	6.6–7.8	Low	Moderate.
95–100	95–100	90–100	75–90	35–50	15–30	0.2–0.6	0.15–0.20	6.6–8.4	Moderate	Moderate.
90–100	90–100	75–90	60–75	25–40	11–20	0.2–0.6	0.10–0.15	7.9–8.4	Low	Moderate.
100	95–100	70–85	8–25	<20	NP–4	6.0–20	0.06–0.10	6.6–7.8	Very low	Low.
100	95–100	80–95	11–35	<23	NP–7	2.0–6.0	0.09–0.14	6.6–8.4	Low	Low.
100	95–100	80–95	11–35	<23	NP–7	2.0–6.0	0.10–0.14	6.6–8.4	Low	Low.
100	95–100	90–97	33–62	<26	4–12	0.6–2.0	0.12–0.16	6.6–8.4	Low	Low.
100	95–100	70–85	8–25	<20	NP–4	6.0–20	0.06–0.10	6.6–8.4	Very low	Low.
100	95–100	90–97	33–62	<26	4–12	0.6–2.0	0.12–0.16	6.6–8.4	Low	Moderate.
100	100	85–95	9–20	----------	NP	6.0–20	0.05–0.06	6.1–7.8	Very low	Very low.
95–100	90–95	85–95	36–70	20–35	5–15	0.6–2.0	0.14–0.16	7.9–8.4	Low	Moderate.
100	100	90–100	60–75	20–30	2–10	0.6–2.0	0.14–0.18	7.9–8.4	Low	Low.
100	100	85–98	30–60	<26	NP–6	2.0–6.0	0.11–0.15	7.9–8.4	Low	Low.
100	100	90–98	13–30	----------	NP	2.0–6.0	0.07–0.11	7.9–8.4	Very low	Low.
100	100	85–98	30–60	<26	NP–6	2.0–6.0	0.11–0.15	7.9–8.4	Low	Low.
100	100	100	55–65	<25	NP–5	2.0–6.0	0.16–0.20	7.9–8.4	Very low	Low.
100	100	85–98	30–60	<26	NP–6	2.0–6.0	0.11–0.15	7.9–8.4	Low	Low.

TABLE 4.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in that series is made up of two or more kinds of soil. The instructions for referring to other

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Abilene: AbA, AbB	Severe: moderately slow permeability.	Slight	Severe: clay texture.	Moderate: moderate shrink-swell potential.	Moderate: clay texture.
Altus: AcA	Slight	Moderate: moderate permeability.	Slight	Slight	Slight
Aspermont: AsB, AsC	Moderate: moderate permeability.	Moderate: moderate permeability; slope.	Slight	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam texture.
AsE	Moderate: moderate permeability.	Severe: slope.	Slight	Moderate: moderate shrink-swell potential.	Moderate: silty clay loam texture.
*Berda: BpF For Potter part, see Potter series.	Moderate: slope.	Severe: slope.	Moderate: slope.	Moderate: slope.	Slight
Bukreek: BuA, BuB	Moderate: moderate permeability.	Moderate: moderate permeability.	Slight	Slight	Slight
Burson Mapped only in a complex with Obaro soils.	Moderate: slope.	Severe: slope; bedrock at a depth of 3 to 12 inches.	Moderate: bedrock at a depth of 3 to 12 inches; slope.	Moderate: bedrock at a depth of 3 to 12 inches; slope.	Severe: bedrock at a depth of 3 to 12 inches.
Cottonwood: CoF	Severe: bedrock at a depth of 3 to 10 inches.	Severe: bedrock at a depth of 3 to 10 inches; slope.	Moderate: bedrock at a depth of 3 to 10 inches; slope.	Moderate: bedrock at a depth of 3 to 10 inches; slope.	Severe: bedrock at a depth of 3 to 10 inches.
Delwin: DeB	Slight	Moderate: moderate permeability.	Slight	Slight	Slight
*Devol: DoD, DtD For Tivoli part of DtD, see Tivoli series.	Slight[1]	Severe: moderately rapid permeability.	Severe: loamy fine sand texture.	Slight	Severe: moderately rapid permeability.
*Flomot: FmB, FmC, FpB For Potter part of FpB, see Potter series.	Slight	Moderate: moderate permeability.	Slight	Slight	Slight

interpretations of the soils

soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the series in the first column of this table]

Degree and kind of limitations for—continued				Suitability as source of—		Soil features affecting—	
Local roads and streets	Light industry	Pond reservoir areas	Embankments, dikes, and levees	Road fill	Topsoil	Irrigation	Terraces and diversions
Severe: low strength.	Moderate: moderate shrink-swell potential.	Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Poor: low strength.	Fair: clay loam texture.	Low intake rate.	All features favorable.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Slight	Fair: low strength.	Fair: 6 to 10 inches of very fine sandy loam.	All features favorable.	All features favorable.
Severe: low strength.	Moderate: moderate shrink-swell potential.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Poor: low strength.	Fair: silty clay loam texture.	Hazard of water erosion; slope.	Slope; hazard of water erosion.
Severe: low strength.	Severe: slope.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Poor: low strength.	Fair: silty clay loam texture.	Not applicable	Slope; hazard of water erosion.
Moderate: low strength; slope.	Severe: slope.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Not applicable	Not applicable.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: 5 to 12 inches of loam.	All features favorable.	All features favorable.
Moderate: bedrock at a depth of 3 to 12 inches; slope.	Moderate: bedrock at a depth of 3 to 12 inches; slope.	Severe: bedrock at a depth of 3 to 12 inches.	Severe: 3 to 12 inches of borrow material.	Poor: 3 to 12 inches of borrow material.	Fair: 3 to 12 inches of loam.	Not applicable	Not applicable.
Moderate: bedrock at a depth of 3 to 10 inches; slope.	Severe: slope.	Severe: bedrock at a depth of 3 to 10 inches.	Severe: 3 to 10 inches of borrow material.	Poor: 3 to 10 inches of borrow material.	Fair to poor: 3 to 10 inches of loam.	Not applicable	Not applicable.
Slight	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Good	Poor: fine sand texture.	High intake rate.	Not applicable.
Slight	Moderate: slope.	Severe: moderately rapid permeability.	Moderate: slope stability; fair resistance to piping and erosion.	Good	Poor: loamy fine sand texture.	High intake rate.	Hazard of soil blowing; loamy fine sand texture.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Fair: low strength.	Good	Hazard of soil blowing and water erosion; slope.	Hazard of soil blowing; slope.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Flomot—Continued					
FmE	Moderate: slope.	Severe: slope	Moderate: slope.	Moderate: slope.	Slight
Frankirk: FrA, FrB	Severe: moderately slow permeability.	Slight	Moderate: clay loam texture.	Moderate: moderate shrink-swell potential.	Moderate: clay loam texture.
Gageby: Ga	Moderate: flooding hazard; moderate permeability.	Moderate: moderate permeability.	Moderate: flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard.
Heatly: HeC	Slight	Moderate: moderate permeability.	Moderate: sloughing of fine sand surface.	Slight	Slight
Hilgrave: HgF	Severe: slope.	Severe: moderately rapid permeability; slope.	Severe: very gravelly sandy loam texture; slope.	Severe: slope.	Severe: moderately rapid permeability.
*Latom: LaE Rock outcrop part too variable to rate.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.
Lincoln: Ln, Lo	Severe: flooding hazard.	Severe: rapid permeability.	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.
Lipan: Lp	Severe: very slow permeability.	Slight	Severe: clay texture.	Severe: flooding hazard; very high shrink-swell potential.	Severe: clay texture.
Mansker Mapped only in a complex with Posey soils.	Slight	Moderate: moderate permeability; slope.	Moderate: clay loam texture.	Moderate: low strength.	Moderate: clay loam texture.
Miles:					
MeB, MeC	Slight	Moderate: moderate permeability; slope.	Slight	Slight	Slight
MfB, MfC	Slight	Moderate: moderate permeability; slope.	Slight	Slight	Slight

of the soils—Continued

Degree and kind of limitations for—continued				Suitability as source of—		Soil features affecting—	
Local roads and streets	Light industry	Pond reservoir areas	Embankments, dikes, and levees	Road fill	Topsoil	Irrigation	Terraces and diversions
Moderate: low strength.	Severe: slope.	Moderate: moderate permeability.	Moderate: poor resistance to piping and erosion.	Fair: low strength.	Fair: slope	Not applicable.	Not applicable.
Moderate: low strength.	Moderate: moderate shrink-swell potential.	Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: 5 to 9 inches of loam.	All features favorable.	All features favorable.
Moderate: flooding hazard; low strength.	Severe: flooding hazard.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Poor: low strength.	Fair: clay loam texture.	Flooding hazard.	Flooding hazard.
Slight	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Good	Poor: fine sand texture.	Soil blowing hazard; high intake rate.	Not applicable.
Severe: slope.	Severe: slope.	Severe: moderately rapid permeability.	Moderate: moderately rapid permeability.	Good	Poor: coarse fragments.	Not applicable.	Not applicable.
Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: bedrock at a depth of 4 to 20 inches.	Severe: 4 to 20 inches of borrow material.	Poor: 4 to 20 inches of borrow material.	Fair: 4 to 20 inches of fine sandy loam.	Not applicable.	Not applicable.
Severe: flooding hazard.	Severe: flooding hazard.	Severe: rapid permeability.	Severe: poor resistance to piping and erosion.	Good	Fair: 6 to 15 inches of fine sandy loam.	Flooding hazard; low available water capacity; high intake rate.	Not applicable.
Severe: very high shrink-swell potential.	Severe: very high shrink-swell potential; flooding hazard.	Slight	Moderate: very high shrink-swell potential; fair stability.	Poor: very high shrink-swell potential.	Poor: clay texture.	Drainage; very low intake rate.	Not applicable.
Moderate: low strength.	Moderate: low strength.	Moderate: moderate permeability.	Moderate: fair stability; fair resistance to piping and erosion.	Fair: low strength.	Fair: clay loam texture.	Water erosion hazard; slope.	Slope.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Poor: loamy fine sand texture.	Soil blowing hazard; high intake rate.	Hazard of soil blowing.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: 7 to 20 inches of fine sandy loam.	Soil blowing hazard.	Soil blowing hazard.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Miles—Continued MfE	Slight	Moderate: moderate permeability; slope.	Slight	Slight	Slight
Mobeetie: MoB, MoC	Slight	Severe: moderately rapid permeability.	Slight	Slight	Severe: moderately rapid permeability.
MoE	Slight	Severe: moderately rapid permeability.	Slight	Slight	Severe: moderately rapid permeability.
Motley: MtA, MtB	Moderate: moderate. permeability.	Moderate: moderate permeability.	Slight	Moderate: low strength.	Slight
Nobscot: NoE	Slight [1]	Severe: moderately rapid permeability.	Moderate: sloughing of fine sand surface.	Slight	Severe: moderately rapid permeability.
*Obaro: ObB, ObC	Severe: bedrock at a depth of 20 to 48 inches.	Severe: bedrock at a depth of 20 to 48 inches.	Moderate: bedrock at a depth of 20 to 48 inches.	Slight	Moderate: bedrock at a depth of 20 to 48 inches.
OcE For Burson part, see Burson series.	Severe: bedrock at a depth of 20 to 48 inches.	Severe: bedrock at a depth of 20 to 48 inches.	Moderate: bedrock at a depth of 20 to 48 inches.	Slight	Moderate: bedrock at a depth of 20 to 48 inches.
Paloduro: PaA, PaB	Slight	Moderate: moderate permeability.	Moderate: clay loam texture.	Slight	Moderate: clay loam texture.
*Polar: PME For Mobeetie part, see Mobeetie series.	Moderate: slope.	Severe: moderately rapid permeability; slope.	Moderate: gravelly sandy loam texture.	Moderate: slope.	Severe: moderately rapid permeability.
*Posey: PnC For Mansker part, see Mansker series.	Slight	Moderate: moderate permeability.	Moderate: clay loam texture.	Slight	Moderate: clay loam texture.
Potter: PoD	Moderate: moderate permeability; slope.	Severe: seepage into caliche.	Moderate: hard caliche at a depth of 7 to 20 inches; slope.	Moderate: hard caliche at a depth of 7 to 20 inches; slope.	Severe: hard caliche at a depth of 7 to 20 inches.
Pullman: PuA	Severe: very slow permeability.	Slight	Severe: clay texture.	Severe: high shrink-swell potential.	Severe: clay texture.

of the soils—Continued

Degree and kind of limitations for—continued				Suitability as source of—		Soil features affecting—	
Local roads and streets	Light industry	Pond reservoir areas	Embankments, dikes, and levees	Road fill	Topsoil	Irrigation	Terraces and diversions
Moderate: low strength.	Moderate: slope.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: 7 to 20 inches of fine sandy loam.	Soil blowing hazard; slope.	Soil blowing hazard; slope.
Moderate: low strength.	Slight	Severe: moderately rapid permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Soil blowing hazard.	Soil blowing hazard.
Moderate: low strength.	Moderate: slope.	Severe: moderately rapid permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Soil blowing hazard; slope.	Soil blowing hazard; slope.
Moderate: low strength.	Moderate: low strength.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Poor: low strength.	Fair: 6 to 14 inches of loam.	All features favorable.	All features favorable.
Slight	Moderate: slope.	Severe: moderately rapid permeability.	Severe: slope stability; poor resistance to piping and erosion.	Good	Poor: fine sand texture.	Soil blowing hazard; high intake rate; low available water capacity.	Not applicable.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Water erosion hazard.	All features favorable.
Moderate: low strength.	Moderate: slope.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Not applicable.	Not applicable.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Water erosion hazard.	All features favorable.
Moderate: slope.	Severe: slope.	Severe: moderately rapid permeability.	Moderate: moderately rapid permeability.	Good	Poor: coarse fragments.	Not applicable.	Not applicable.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: 5 to 15 inches of loam.	Water erosion hazard.	All features favorable.
Moderate: hard caliche at a depth of 7 to 20 inches; slope.	Severe: slope.	Severe: unsuitable material at a depth of 7 to 20 inches.	Severe: 7 to 20 inches of borrow material.	Fair: low strength.	Poor: coarse fragments; 7 to 20 inches of loam.	Not applicable.	Not applicable.
Severe: high shrink-swell potential.	Severe: high shrink-swell potential.	Slight	Moderate: fair resistance to piping and erosion.	Poor: high shrink-swell potential.	Fair: clay loam texture.	Low intake rate.	All features favorable.

TABLE 4.—*Engineering interpretations*

Soil series and map symbols	Degree and kind of limitations for—				
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill
Quinlan: QuD	Severe: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches; moderately rapid permeability.	Moderate: bedrock at a depth of 10 to 20 inches.	Moderate: bedrock at a depth of 10 to 20 inches.	Severe: moderately rapid permeability.
Randall: Ra	Severe: very slow permeability; flooding hazard.	Slight	Severe: clay texture; flooding hazard.	Severe: high shrink-swell potential; flooding hazard.	Severe: clay texture; flooding hazard.
Rock outcrop. Mapped only in a complex with Latom soils. Material too variable to rate.					
Sagerton: SaA, SaB	Severe: moderately slow permeability.	Slight	Moderate: clay loam texture.	Moderate: moderate shrink-swell potential.	Moderate: clay loam texture.
Springer: SpB	Slight[1]	Severe: moderately rapid permeability.	Severe: sloughing of loamy fine sand surface.	Slight	Severe: moderately rapid permeability.
Tivoli: Tf	Moderate: slope.[1]	Severe: rapid permeability.	Severe: fine sand.	Moderate: slope.	Severe: rapid permeability.
Tulia: TuB, TuC	Slight	Moderate: moderate permeability.	Slight	Slight	Slight
*Woodward: WlB, WlC, WQD. For Quinlan part of WQD, see Quinlan series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches.	Slight	Moderate: bedrock at a depth of 20 to 40 inches.
WoD. For Yomont part of WoD, see Yomont series.	Severe: bedrock at a depth of 20 to 40 inches.	Severe: bedrock at a depth of 20 to 40 inches.	Moderate: bedrock at a depth of 20 to 40 inches.	Moderate: slope.	Moderate: bedrock at a depth of 20 to 40 inches.
Yahola: Ya	Severe: flooding hazard.	Severe: moderately rapid permeability.	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.
*Yomont: Yo, Ys. For Lincoln part of Ys, see Lincoln series.	Severe: flooding hazard.	Severe: moderately rapid permeability.	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.

[1] Septic tank effluent is a pollution hazard to ground water.

of the soils—Continued

Degree and kind of limitations for—continued				Suitability as source of—		Soil features affecting—	
Local roads and streets	Light industry	Pond reservoir areas	Embankments, dikes, and levees	Road fill	Topsoil	Irrigation	Terraces and diversions
Moderate: bedrock at a depth of 10 to 20 inches.	Moderate: bedrock at a depth of 10 to 20 inches.	Severe: bedrock at a depth of 10 to 20 inches.	Severe: 10 to 20 inches of borrow material.	Fair: low strength.	Fair: 10 to 20 inches of loam.	Not applicable.	Not applicable.
Severe: high shrink-swell potential; flooding hazard.	Severe: high shrink-swell potential; flooding hazard.	Slight	Moderate: high shrink-swell potential; slope stability.	Poor: high shrink-swell potential.	Poor: clay texture.	Drainage; very low intake rate.	Not applicable.
Severe: low strength.	Moderate: moderate shrink-swell potential.	Moderate: moderately slow permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Fair: clay loam texture.	Low intake rate.	All features favorable.
Slight	Slight	Severe: moderately rapid permeability.	Moderate: slope stability; fair resistance to piping and erosion.	Good	Poor: loamy fine sand texture.	High intake rate.	Hazard of soil blowing.
Moderate: slope.	Severe: slope.	Severe: rapid permeability.	Severe: slope stability; rapid permeability.	Good	Poor: fine sand.	Not applicable.	Not applicable.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Water erosion hazard.	All features favorable.
Moderate: low strength.	Slight	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Water erosion hazard.	All features favorable.
Moderate: low strength; slope.	Severe: slope.	Moderate: moderate permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Not applicable.	Not applicable.
Severe: flooding hazard.	Severe: flooding hazard.	Severe: moderately rapid permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Flooding hazard.	Flooding hazard.
Severe: flooding hazard.	Severe: flooding hazard.	Severe: moderately rapid permeability.	Moderate: fair resistance to piping and erosion.	Fair: low strength.	Good	Flooding hazard.	Flooding hazard.

TABLE 5.—*Engineering*

Soil name and location	Parent material	Report No.	Depth	Soil shrinkage		
				Shrinkage limit	Shrinkage ratio	Lineal shrinkage
			Inches	*Percent*	*Percent*	*Percent*
Obaro loam: 6.4 miles west of Motley-Cottle County line via U.S. Highways 62 and 70, then 0.9 miles south on private road, and 25 feet east into pit. (Modal)	Weakly consolidated, fine-grained Permian sandstone.	68–518–R	0–7	19	1.75	5.0
		68–519–R	7–15	19	1.75	6.5
		68–520–R	27–75	20	1.68	2.3
Motley loam: 2 miles east of Flomot, Tex., via Farm Road 97, then 0.5 mile south on Farm Road 2009, and 0.175 mile west of Farm Road 2009 into field. (Modal)	Loamy outwash material.	68–521–R	0–9	15	1.88	7.3
		68–522–R	9–18	12	1.98	13.5
		68–523–R	18–38	16	1.87	7.5
		68–524–R	64–76	12	1.95	5.8

[1] Tests performed by Texas Highway Department, Austin, Tex.

[2] Mechanical analyses according to the AASHTO Designation T 88 (see footnote 5, p. 46). Results by this procedure may differ somewhat from the results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHTO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is

Engineering interpretations of the soils

The estimated interpretations in table 4 are based on the engineering properties of soils shown in table 3, on test data for soils in this survey area and others nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Motley County. In table 4, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than for irrigation and terraces and diversions. For these particular uses, table 4 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties generally are favorable for the rated use or, in other words, that limitations are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation, special designs, or intensive maintenance.

Soil suitability is rated by the terms *good, fair,* and *poor,* which have, respectively, meanings approximately parallel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 4.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil material from a depth of 18 inches to 6 feet is evaluated. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs.

Sewage lagoons are shallow ponds constructed to hold sewage within a depth of 2 to 5 feet long enough for bacteria to decompose the solids. A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, organic-matter content and slope; and, if the floor needs to be leveled, depth to bedrock becomes important. The soil properties that affect the embankment are the engineering properties of the embankment material as interpreted from the Unified soil classification and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations are those that require digging or trenching to a depth of less than 6 feet, as for example, excavations for pipelines, sewerlines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrops or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 4, are not more than

test data [1]

Mechanical analysis [2]								Liquid limit	Plasticity index	Classification [3]	
Percentage passing sieve—					Percentage smaller than—						
⅜-in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm	0.005 mm	0.002 mm			AASHTO [4]	Unified [5]
								Percent			
99	98	97	96	81	60	15	11	29	9	A–4(8)	CL
97	95	94	92	86	70	21	13	31	12	A–6(9)	CL
----------	99	99	98	71	47	5	2	24	4	A–4(7)	CL–ML
----------	----------	----------	96	65	52	23	18	28	14	A–6(8)	CL
----------	----------	----------	97	73	66	35	31	40	23	A–6(13)	CL
----------	----------	99	94	60	51	26	23	30	17	A–6(8)	CL
96	90	88	81	45	40	25	18	23	11	A–6(2)	SC

analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from the calculations of grain-size fractions. The mechanical analyses data used in this table are not suitable for use in naming textural classes of soil.

[3] Unified and AASHTO classifications made by SCS personnel.

[4] Based on AASHTO Designation M 145–49 (see footnote 5, p. 46).

[5] Based on the Unified soil classification system (see footnote 4, p. 46).

three stories high, are supported by foundation footings placed in undisturbed soil, and lack basements. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated the ratings in table 4 apply only to a depth of about 6 feet, and therefore limitation ratings of *slight* or *moderate* may not be valid if trenches are to be much deeper than that. For some soils, reliable predictions can be made to a depth of 10 to 15 feet, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 4, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep.

Soil properties that most affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHTO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones or organic material in a soil are among factors that are unfavorable.

Road fill is soil material used in embankments for roads. The suitability ratings reflect (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 4 provide guidance about where to look for probable sources. A

soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit. Only a few soils in Motley County are sources of sand and gravel. Hilgrave and Polar soils, and deep strata under Lincoln, Yahola, and Yomont soils, are sources of sand and gravel supplies. A column was not included in the table.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, or soil blowing; soil texture; content of stones; accumulations of salts and alkali; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

Terraces and diversions are embankments, or ridges, constructed across the slope to intercept runoff so that it soaks into the soil or flows slowly to a prepared outlet. Features that affect suitability of a soil for terraces are uniformity and steepness of slopes; depth to bedrock or other unfavorable material; presence of stones; permeability; and resistance to water erosion, soil slipping, and soil blowing. A soil suitable for these structures provides outlets for runoff and is not difficult to vegetate.

Test data

Table 5 contains engineering test data for some of the major soil series in Motley County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods.

Shrinkage limit is the percentage of moisture at which shrinkage of the soil material stops.

Shrinkage ratio is the relation of change in volume of the soil material to the water content of the soil material when at the shrinkage limit. The change in volume is expressed as a percentage of the air-dry volume of the soil material, and the water content is expressed as a percentage of the weight of the soil material when oven-dry.

Linear shrinkage is the decrease in one dimension, expressed as a percentage of the original dimension, of the soil mass when the moisture content is reduced from the given value to the shrinkage limit.

Recreation

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 6 the soils are rated according to limitations that affect their suitability for camp areas, playgrounds, picnic areas, and paths and trails.

In table 6 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they easily can be overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry; are free of flooding during the season of use; do not have slopes or stoniness that greatly increases cost of leveling sites or of building access roads.

Playgrounds are areas used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils have a nearly level surface free of coarse fragments and rock outcrops, good drainage, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Wildlife

The principal kinds of wildlife in Motley County are white-tailed deer, desert mule deer, turkey, bobwhite quail, scaled (blue) quail, dove, cottontail rabbits, jackrabbits, and numerous kinds of nongame birds. Also present are raccoons, fox, ringtail cats, skunks, opossum, and furbearers. The common predators are bobcats and coyotes. Intermittent lakes, streams, ponds, and grain fields attract ducks and geese during migration. Most farm and ranch ponds

TABLE 6.—*Interpretations for recreational uses of the soils*

[An asterisk in the first column indicates that at least one mapping unit in that series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series in the first column of this table]

Soil series and map symbols	Degree of limitation and soil features affecting—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Abilene: AbA, AbB	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.
Altus: AcA	Slight	Slight	Slight	Slight.
Aspermont: AsB, AsC	Moderate: silty clay loam texture.	Moderate: silty clay loam texture.	Moderate: silty clay loam texture; slope.	Moderate: silty clay loam texture.
AsE	Moderate: silty clay loam texture.	Moderate: silty clay loam texture.	Severe: slope	Moderate: silty clay loam texture.
*Berda: BpF. For Potter part, see Potter series.	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Bukreek: BuA, BuB	Slight	Slight	Slight	Slight.
Burson. Mapped only in a complex with Obaro soils.	Moderate: slope	Moderate: slope	Severe: 3 to 12 inches to bedrock.	Slight.
Cottonwood: CoF	Moderate: slope	Moderate: slope	Severe: 3 to 10 inches to bedrock; slope.	Slight.
Delwin: DeB	Moderate: fine sand texture.	Moderate: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.
*Devol: DoD, DtD. For Tivoli part of DtD, see Tivoli series.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture; slope.	Moderate: loamy fine sand texture.
*Flomot: FmB, FmC, FpB. For Potter part of FpB, see Potter series.	Slight	Slight	Moderate: slope	Slight.
FmE	Moderate: slope	Moderate: slope	Severe: slope	Slight.
Frankirk: FrA, FrB	Moderate: moderately slow permeability.	Slight	Moderate: moderately slow permeability.	Slight.
Gageby: Ga	Severe: flooding hazard.	Moderate: flooding hazard; clay loam texture.	Moderate: flooding hazard; clay loam texture.	Moderate: flooding hazard; clay loam texture.
Heatly: HeC	Moderate: fine sand texture.	Moderate: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.
Hilgrave: HgF	Severe: coarse fragments.	Severe: coarse fragments.	Severe: coarse fragments; slope.	Severe: coarse fragments.
*Latom: LaE. For Rock outcrop part, see Rock outcrop.	Slight	Slight	Severe: 4 to 20 inches to bedrock.	Slight.
Lincoln: Ln, Lo	Severe: flooding hazard.	Severe: flooding hazard.	Severe: flooding hazard.	Moderate: flooding hazard.
Lipan: Lp	Severe: very slow permeability; clay texture.	Severe: clay texture.	Severe: very slow permeability; clay texture.	Severe: clay texture.
Mansker. Mapped only in a complex with Posey soils.	Moderate: clay loam texture.	Moderate: clay loam texture.	Moderate: clay loam texture; slope.	Moderate: clay loam texture.

TABLE 6.—*Interpretations for recreational uses of the soils*—Continued

Soil series and map symbols	Degree of limitation and soil features affecting—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Miles:				
MeB, MeC	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.
MfB, MfC	Slight	Slight	Moderate: slope	Slight.
MfE	Slight	Slight	Severe: slope	Slight.
Mobeetie:				
MoB, MoC	Slight	Slight	Moderate: slope	Slight.
MoE	Slight	Slight	Severe: slope	Slight.
Motley: MtA, MtB	Slight	Slight	Slight	Slight.
Nobscot: NoE	Moderate: fine sand texture.	Moderate: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.
*Obaro: ObB, ObC, OcE For Burson part of OcE, see Burson series.	Slight	Slight	Moderate: bedrock at a depth of 20 to 48 inches; bedrock, slope.	Slight.
Paloduro: PaA, PaB	Slight	Slight	Slight	Slight.
*Polar: PME For Mobeetie part, see Mobeetie series.	Moderate: coarse fragments.	Moderate: coarse fragments.	Severe: coarse fragments; slope.	Moderate: coarse fragments; slope.
*Posey: PnC For Mansker part, see Mansker series.	Slight	Slight	Moderate: slope	Slight.
Potter: PoD	Moderate: slope	Moderate: slope	Severe: hard caliche at a depth of 7 to 20 inches.	Slight.
Pullman: PuA	Moderate: clay loam texture: slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; very slow permeability.	Moderate: clay loam texture.
Quinlan: QuD	Slight	Slight	Severe: bedrock at a depth of 10 to 20 inches.	Slight.
Randall: Ra	Severe: wet; clay texture; flooding hazard.	Severe: clay texture.	Severe: wet; clay texture; flooding hazard.	Severe: clay texture.
Rock outcrop. Properties too variable to rate. Mapped only in a complex with Latom soils.				
Sagerton: SaA, SaB	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.	Moderate: clay loam texture; moderately slow permeability.	Moderate: clay loam texture.
Springer: SpB	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.	Moderate: loamy fine sand texture.
Tivoli: Tf	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.	Severe: fine sand texture.
Tulia: TuB, TuC	Slight	Slight	Moderate: slope	Slight.
*Woodward:				
WlB, WlC, WQD	Slight	Slight	Moderate: bedrock at a depth of 20 to 40 inches; slope.	Slight.
For Quinlan part of WQD, see Quinlan series.				
WoD	Moderate: slope	Moderate: slope	Severe: slope	Slight.
For Yomont part, see Yomont series.				

TABLE 6.—*Interpretations for recreational uses of the soils*—Continued

Soil series and map symbols	Degree of limitation and soil features affecting—			
	Camp areas	Picnic areas	Playgrounds	Paths and trails
Yahola: Ya	Severe: flooding hazard.	Moderate: flooding hazard.	Severe: flooding hazard.	Slight.
*Yomont: Yo, Ys For Lincoln part of Ys, see Lincoln series.	Severe: flooding hazard.	Moderate: flooding hazard.	Severe: flooding hazard.	Slight.

are stocked with channel catfish, black bass, and sunfish. Several farmers and ranchers in Motley County are finding wildlife and fish resources to be profitable when properly managed.

Soils directly influence kinds and amounts of vegetation and amounts of water available, and in this way they indirectly influence the kinds of wildlife that can live in an area. Soil properties that affect the growth of wildlife habitat are thickness of soil useful to crops, surface texture, available water capacity to a 40-inch depth, wetness, surface stoniness or rockiness, flood hazard, slope, and permeability.

In table 7 soils of this survey area are rated for producing eight elements of wildlife habitat and for three groups, or kinds, of wildlife. The ratings indicate relative suitability for various elements. A rating of *good* means the element of wildlife habitat, and habitat generally, are easily created, improved, and maintained; few or no limitations affect management in this category, and satisfactory results are expected when the soil is used for the prescribed purpose. A rating of *fair* means the element of wildlife habitat, and habitat generally, can be created, improved, or maintained in most places; moderate intensity of management and fairly frequent attention may be required for satisfactory results, however. A rating of *poor* means limitations for the designated use are rather severe; habitat can be created, improved, or maintained in most places, but management is difficult and requires intensive effort. A rating of *very poor* means limitations for the designated use are very severe and that unsatisfactory results are to be expected; it is either impossible or impractical to create, improve, or maintain habitats on soils in this category.

Each soil is rated in table 7 according to its suitability for producing various kinds of plants and other elements that make up wildlife habitats. The ratings take into account mainly the characteristics of the soils and closely related natural factors of the environment. They do not take into account climate, present use of soils, or present distribution of wildlife and people. For this reason, selection of a site for development as a habitat for wildlife requires inspection at the site.

The significance of each subheading in table 7 under "Elements of Wildlife Habitat" and "Kinds of Wildlife" is given in the following paragraphs.

Grain and seed crops are annual grain-producing plants, such as corn, sorghum, millet, and soybeans.

Grasses and legumes are domestic grasses and legumes that are established by planting. They provide food and cover for wildlife. Grasses include dallisgrass, kleingrass, sand lovegrass, and panicgrass; legumes include annual lespedeza, shrub lespedeza, and other clovers.

Wild herbaceous upland plants are native or introduced perennial grasses, forbs, and weeds that provide food and cover for upland wildlife. Beggarweed, perennial lespedeza, wild bean, pokeweed, and cheatgrass are typical examples. On rangeland, typical plants are bluestem, grama, perennial forbs, and legumes.

Shrubs are plants that produce wildlife food in the form of twigs, bark, buds, foliage or browse. Such plants commonly grow in their natural environment, but they may be planted and developed through wildlife management programs. Typical species in this category are shinnery oak, mesquite, catclaw, sagebrush, and mountain-mahogany.

Wetland food and cover plants are annual and perennial herbaceous plants that grow wild on moist and wet sites. They furnish food and cover mostly for wetland wildlife. Typical examples of plants are smartweed, wild millet, spikerush and other rushes, sedges, burreed, tearthumb, and aneilema. Submerged and floating aquatics are not included in this category.

Shallow water developments are impoundments or excavations for controlling water, generally not more than 5 feet deep, to create habitats that are suitable for waterfowl. Some are designed to be drained, planted, and then flooded; others are permanent impoundments that grow submersed aquatics.

Table 7 rates soils according to their suitability as habitat for the three kinds of wildlife in the county—openland, rangeland, and wetland wildlife. These ratings are related to ratings made for the elements of habitat. For example, soils rated unsuited to shallow water developments are rated unsuited to wetland wildlife.

Openland wildlife consists of birds and mammals that normally live in meadows, pastures, and open areas where grasses, herbs, and shrubby plants grow. Quail, doves, meadowlarks, field sparrows, cottontail rabbits, and fox are typical examples of open-land wildlife.

Rangeland wildlife consists of birds and mammals of natural rangelands. Antelope, white-tailed deer, desert mule deer, chukar, scaled quail, sage grouse,

TABLE 7.—*Interpretations for elements of wildlife habitat and kinds of wildlife*

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow water developments	Openland	Rangeland	Wetland
Abilene: AbA, AbB	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Altus: AcA	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Aspermont:									
AsB, AsC	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
AsE	Fair	Good	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Berda: BpF. For Potter part, see Potter series.	Poor	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Bukreek: BuA, BuB	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
Burson. Mapped only in a complex with Obaro soils.	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Cottonwood: CoF	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Delwin: DeB	Poor	Poor	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Devol: DoD, DtD. For Tivoli part of DtD, see Tivoli series.	Poor	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Flomot:									
FmB, FmC, FpB. For Potter part of FpB, see Potter series.	Fair	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
FmE	Fair	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Frankirk: FrA, FrB	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
Gageby: Ga	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Heatly: HeC	Poor	Poor	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
Hilgrave: HgF	Poor	Poor	Poor	Poor	Poor	Very poor.	Poor	Poor	Very poor.
Latom: LaE. Rock outcrop part too variable to rate.	Very poor.	Very poor.	Poor	Fair	Very poor.	Very poor.	Very poor.	Poor	Very poor.
Lincoln: Ln, Lo	Very poor.	Poor	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Lipan: Lp	Poor	Fair	Poor	Very poor.	Good	Good	Poor	Very poor.	Good.

TABLE 7.—*Interpretations for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow water developments	Openland	Rangeland	Wetland
Mansker Mapped only in a complex with Posey soils.	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Miles:									
MeB, MeC	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
MfB, MfC, MfE	Fair	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Mobeetie:									
MoB, MoC	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
MoE	Poor	Fair	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Motley: MtA, MtB	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
Nobscot: NoE	Poor	Poor	Good	Good	Poor	Very poor.	Poor	Good	Very poor.
Obaro: ObB, ObC, OcE For Burson part of OcE, see Burson series.	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
Paloduro: PaA, PaB	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Polar: PME For Mobeetie part of PME, see Mobeetie series.	Poor	Poor	Poor	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Posey: PnC For Mansker part, see Mansker series.	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
Potter: PoD	Very poor.	Very poor.	Poor	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.	Very poor.
Pullman: PuA	Fair	Good	Fair	Fair	Poor	Very poor.	Fair	Fair	Very poor.
Quinlan: QuD	Poor	Fair	Fair	Fair	Very poor.	Very poor.	Fair	Fair	Very poor.
Randall: Ra	Poor	Poor	Poor	Very poor.	Good	Good	Poor	Very poor.	Good.
Rock outcrop. Mapped only in a complex with Latom soils. Material too variable to rate.									
Sagerton: SaA, SaB	Good	Good	Fair	Fair	Poor	Very poor.	Good	Fair	Very poor.
Springer: SpB	Fair	Fair	Good	Good	Poor	Very poor.	Fair	Good	Very poor.
Tivoli: Tf	Very poor.	Very poor.	Fair	Fair	Very poor.	Very poor.	Poor	Fair	Very poor.
Tulia: TuB, TuC	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.

TABLE 7.—*Interpretations for elements of wildlife habitat and kinds of wildlife*—Continued

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous upland plants	Shrubs	Wetland food and cover plants	Shallow water developments	Openland	Rangeland	Wetland
Woodward:									
WlB	Good	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
WlC, WQD	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
For Quinlan part of WQD, see Quinlan series.									
WoD	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Fair	Very poor.
For Yomont part, see Yomont series.									
Yahola: Ya	Good	Good	Good	Good	Good	Very poor.	Good	Good	Very poor.
Yomont: Yo, Ys	Good	Good	Good	Good	Good	Very poor.	Good	Good	Very poor.
For Lincoln part of Ys, see Lincoln series.									

meadowlark, and lark bunting are examples of rangeland wildlife.

Wetland wildlife consists of birds and mammals that normally live in wet areas, marshes, and swamps. Ducks, geese, rails, shore birds, herons, mink, and muskrat are typical examples of wetland wildlife.

Formation and Classification of the Soils

This section explains how soils form and discusses the factors that are involved in their formation. It describes briefly the system of soil classification used in the United States and places the soils of Motley County in some categories of the classification system.

Factors of Soil Formation

Soil is the product of the interaction of the five major factors of soil formation: climate; living organisms, especially vegetation; parent material; topography; and time. If a factor such as climate or vegetation is varied, a different soil forms.

Several processes were involved in the formation of the soils in Motley County. Three main processes are accumulation of organic matter, leaching of calcium carbonates and bases, and formation and translocation of silicate clay minerals. These processes actively form horizons.

Accumulation of organic matter in the upper part of the profile to form an A1 horizon has been important. The soils of Motley County range from medium to low in content of organic matter.

Leaching of carbonates and bases has occurred in nearly all of the soils. Most of the soils of the county are moderately leached, and this has contributed to the development of horizons. Calcium carbonate has been leached from the upper horizons of most of the soils. The amount of rainfall, however, has not been great enough to leach the carbonates entirely from the soil, and many of the soils have a layer in which calcium carbonate has accumulated.

In several soils of Motley County, the downward translocation of clay minerals has contributed to horizon development. In these soils, the Bt horizon contains appreciably more silicate clay than the A horizon. These soils were probably leached of carbonates and soluble salts to a considerable extent before translocation of silicate clays took place. Leaching of bases and translocation of silicate clays are among the more important processes in horizon differentiation in the soils of Motley County. Abilene, Bukreek, Sagerton, and Miles soils are examples of soils that have translocated silicate clays accumulated in the Bt horizon.

Climate

Motley County has a warm-temperate, subtropical climate. The climate is characterized by dry winters and long, humid summers. Because of high winds, evaporation is high and rainwater seldom moves below the normal rooting zone. Calcium carbonate has been leached from the upper horizons of about half of the soils in the county. Sagerton, Miles, Nobscot, Heatly, and Springer soils, for instance, have been so leached. Calcium carbonate has accumulated in layers in many of the soils. As the carbonates were being leached, clay particles were also being moved down into the subsoil, where they accumulated to form a less permeable horizon. Sagerton and Abilene soils have been affected by this process. The wide variation in

temperature has favored the weathering of parent materials to form soils.

Wind has a marked effect on the formation of soils in the county. It aids in the breakdown of parent material, in reworking many deposits, and in shifting materials from place to place.

Living organisms

Insects, bacteria, fungi, and other plants and animals are important in the formation of soils. Gains in organic matter and nitrogen in the soil, gains or losses in plant nutrients, and changes in structure and porosity are among the changes caused by living organisms.

Plants, mainly grasses, have affected soil formation in Motley County more than animals. The grass produced soils that are mostly medium in content of organic matter. Some of the young, sandy, shallow soils are low in organic-matter content.

Parent material

Parent material is the unconsolidated mass in which a soil forms. It determines the limits of the chemical and mineralogical composition of the soils.

The soils in the county developed from four types of parent material, which are classified as follows:

1. Soils that formed in Permian and Triassic red beds.
2. Soils that formed in outwash materials of Tertiary to Quaternary age.
3. Soils that formed in recent eolian material of Quaternary age.
4. Soils that formed in recent alluvium of Quaternary age.

The soils that formed in Permian red beds are extensive. They occur throughout most of the county, wherever Permian material is exposed. In the eastern and northeastern parts of the county, the exposed red beds are sandy or silty. Soils that formed in these materials are Woodward and Quinlan soils. The rougher landscapes, such as those along the Pease River and large drainageways, are in red-bed material. In scattered areas in the central part of Motley County the exposed red beds are clay and shales. Obaro, Aspermont, and Burson soils formed in these materials.

In numerous areas in the northern, western, southern, and central parts of Motley County a mantle of outwash was deposited over the red beds during the Pliocene and Pleistocene Epochs.[6] The mantle is thin in most places. Texture is variable and ranges from sandy to clayey. Quartz pebbles commonly occur in most of these materials. Miles, Devol, Springer, Heatly, Delwin, and Nobscot soils formed in the sandy material. Frankirk and Abilene soils formed in the loamy outwash material.

In the southwestern corner of the county, below the caprock, a rough area of Tertiary and Triassic material occurs. The area is steep, rough, and eroded. It overlies the Permian red beds. Texture is mostly loamy or sandy. The Ogallala Formation of the Tertiary Period lies above the Triassic material in the southwestern corner of the county. Paloduro, Pullman, Potter, and Berda soils formed in this area.

The eolian material is confined to narrow bands paralleling some of the larger streams. This material blew from river channels and was deposited on the southern and eastern sides of stream channels. Texture of these materials is mostly sand and sandy loam. Tivoli and Mobeetie soils formed in them.

The alluvium occurs in narrow bands along flood plains of many streams. These materials are variable in texture and are stratified. In most areas, new material is continually deposited. Yahola, Lincoln, Yomont, and Gageby soils formed in this material.

Topography

Topography, or relief, affects soil formation through its influence on drainage, erosion, plant cover, and soil temperature. The topography of Motley County ranges from nearly level to hilly.

Nearly level to gently sloping soils, such as Sagerton soils, are deeper and have more distinct horizons than such soils as Obaro and Aspermont soils, which are gently sloping to strongly sloping and formed on hilltops and ridges. This is because the less sloping soils receive extra water, have less runoff, and are subject to less erosion.

On steep soils geological erosion occurs almost as fast as the soils form. The substratum is sandy or silty red-bed material. An example is the Quinlan soils, which have been in the process of soil development as long as the generally less sloping Woodward soils.

Time

Time, generally a long time, is required for formation of soils that have distinct horizons. The differences in the length of time that parent materials have been in place, therefore, are commonly reflected in the degree of development of the soil profile.

The soils in Motley County range from recent to well developed. The recent soils, such as Tivoli soils, have very little profile development, and the well-developed soils, such as Miles soils, have well-expressed horizons. Well-developed soils have been in place for a long time and approach equilibrium with their environment in soil development, and they have mature, well-developed profiles.

Classification of the Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationship to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodlands; in developing rural areas; in engineering work; and in many other ways. Soils are placed in broad classes to facilitate study and com-

[6] Udden, J. A., Baker, C. L., and Böse, Emil. Review of the geology of Texas. Univ. Texas Bull. 44, 164 pp., illus. 1916.

parison in large areas such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965. This system is under continual study; readers interested in developments of the current system should search the latest literature available.[7]

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. The classes of the classification are discussed in the following paragraphs.

ORDERS: Ten soil orders are recognized. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ent-i-sol).

The soils in Motley County are in six orders:

Alfisols have a light-colored surface layer low in content of organic matter, a clay-enriched B horizon, an accumulation of aluminum and iron, and a base saturation of more than 35 percent.

Aridisols have a light-colored surface layer low in content of organic matter and inadequate moisture to mature a crop without irrigation in most years.

Entisols have little or no evidence of development of horizons.

Inceptisols have a light-colored surface layer low in content of organic matter, but they lack a clay-enriched B horizon.

Mollisols have a dark-colored surface layer high in content of organic matter and base saturation of more than 50 percent.

Vertisols are clayey soils that have deep, wide cracks part of the year in most years.

SUBORDERS: Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquent* (*Aqu*, meaning water or wet, and *ent*, from Entisol).

GREAT GROUPS: Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Haplaquents (*Hapl*, meaning simple horizons, *aqu* for wetness or water, and *ent*, from Entisols).

SUBGROUPS: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group, and others, called intergrades, that have properties of the group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplaquents (a typical Haplaquent).

FAMILIES: Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used to differentiate families in table 8. An example is the coarse-loamy, siliceous, acid, thermic family of Typic Haplaquents.

Climate[8]

Motley County has a warm-temperate, subtropical climate that is characterized by dry winters and humid summers. Average annual precipitation is 20.22 inches. Four-fifths of this amount falls between April and October. Rainfall generally occurs as a result of thunderstorms; monthly and annual amounts are extremely variable. Maximum precipitation generally occurs during May and June when warm, moist tropical maritime air is carried far inland from the Gulf of Mexico. This airmass produces moderate to heavy afternoon and evening thundershowers that are sometimes accompanied by strong gusty winds and hail.

The Gulf of Mexico source region is cut off rather effectively during the colder months, November to March, by frequent surges of drier polar air from the north and northwest. Consequently, wintertime precipitation is relatively light. Snow falls occasionally in winter but is generally light and generally melts rapidly. Because of drifting of the snow by strong winds, the snow melt is unevenly distributed. The average monthly snowfall data are biased by rare but exceptionally heavy snows such as occurred in January 1966, February 1968, and March 1969. Thus, the average value overestimates expected snowfall. Table 9 gives a climatological summary of Motley County.

Temperature, like rainfall, is extremely variable, especially during the colder months. From November

[7] United States Department of Agriculture. Soil classification, a comprehensive system, 7th approximation. 265 pp., illus. 1960. [Supplements issued in March 1967 and September 1968]

[8] By ROBERT B. ORTON, climatologist for Texas, National Weather Service, U.S. Department of Commerce.

TABLE 8.—*Classification of soil series*

Series	Family	Subgroup	Order
Abilene	Fine, mixed, thermic	Pachic Argiustolls	Mollisols.
Altus	Fine-loamy, mixed, thermic	Pachic Argiustolls	Mollisols.
Aspermont	Fine-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Berda	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Bukreek	Fine-loamy, mixed, thermic	Typic Paleustolls	Mollisols.
Burson	Loamy, mixed (calcareous), thermic, shallow	Ustic Torriorthents	Entisols.
Cottonwood	Loamy, mixed (calcareous), thermic, shallow	Ustic Torriorthents	Entisols.
Delwin	Fine-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Devol	Coarse-loamy, mixed, thermic	Udic Haplustalfs	Alfisols.
Flomot	Coarse-loamy, carbonatic, thermic	Calciorthidic Paleustalfs	Alfisols.
Frankirk	Fine, mixed, thermic	Udic Argiustolls	Mollisols.
Gageby	Fine-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Heatly	Loamy, mixed, thermic	Arenic Paleustalfs	Alfisols.
Hilgrave	Loamy-skeletal, mixed, thermic	Aridic Haplustalfs	Alfisols.
Latom	Loamy, mixed (calcareous), thermic	Lithic Ustic Torriorthents	Entisols.
Lincoln	Sandy, mixed, thermic	Typic Ustifluvents	Entisols.
Lipan	Fine, montmorillonitic, thermic	Entic Pellusterts	Vertisols.
Mansker	Fine-loamy, carbonatic, thermic	Calciorthidic Paleustolls	Mollisols.
Miles	Fine-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Mobeetie	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Motley	Fine-loamy, mixed, thermic	Udic Paleustolls	Mollisols.
Nobscot	Loamy, mixed, thermic	Arenic Paleustalfs	Alfisols.
Obaro	Fine-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Paloduro	Fine-loamy, mixed, thermic	Aridic Haplustolls	Mollisols.
Polar	Loamy-skeletal, mixed, thermic	Ustollic Calciorthids	Aridisols.
Posey	Fine-loamy, mixed, thermic	Calciorthidic Paleustalfs	Alfisols.
Potter	Loamy, carbonatic, thermic, shallow	Ustollic Calciorthids	Aridisols.
Pullman	Fine, mixed, thermic	Torrertic Paleustolls	Mollisols.
Quinlan	Loamy, mixed, thermic, shallow	Typic Ustochrepts	Inceptisols.
Randall	Fine, montmorillonitic, thermic	Udic Pellusterts	Vertisols.
Sagerton	Fine, mixed, thermic	Typic Paleustolls	Mollisols.
Springer	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Tulia	Fine-loamy, carbonatic, thermic	Calciorthidic Paleustalfs	Alfisols.
Woodward	Coarse-silty, mixed, thermic	Typic Ustochrepts	Inceptisols.
Yahola	Coarse-loamy, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.
Yomont	Coarse-silty, mixed (calcareous), thermic	Typic Ustifluvents	Entisols.

through March, cold fronts are frequent, bringing rapid and pronounced changes. However, cold spells are short, rarely lasting more than 48 hours before southwesterly winds bring rapid warming. Strong, fast-moving cold fronts late in spring may follow several weeks of mild weather. The range between summer and winter extremes of temperature is large, characteristic of a continental climate. While most summer days are not uncomfortable, a few hot days do occur. Evaporative-type home air conditioners are effective more than 90 percent of the time.

Prevailing winds at Matador are south to southwesterly throughout the year, although northerly winds are frequent in winter. The strongest sustained winds occur late in winter and in spring.

The average relative humidity at noon is estimated to be 51 percent in January, 43 percent in April, 45 percent in July, and 46 percent in October. The area receives about 66 percent of the total possible sunshine in winter, 70 percent in spring, 77 percent in summer, and 72 percent in fall. Average annual free water (lake) evaporation is 68 inches, while evaporation exceeds rainfall by 48 inches in an average year.

The average length of the warm season, freeze-free period, at Matador is 218 days. The average dates of the last occurrence of 32° F or below in spring and the first occurrence of 32° F or below in fall are April 3 and November 7, respectively.

Glossary

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates such as crumbs, blocks, or prisms are called peds. Clods are aggregates produced by tillage or logging.

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Badlands. Areas of rough, irregular land where most of the surface is occupied by ridges, gullies, and deep channels. Land hard to traverse.

Bench terrace. A shelflike embankment of earth that has a level or nearly level top and a steep or nearly vertical downhill face, constructed along the contour of sloping land or across the slope to control runoff and erosion. The downhill face

of the bench may be made of rocks or masonry, or it may be planted to vegetation.

Broad-base terrace. A ridge-type terrace 10 to 20 inches high and 15 to 30 feet wide that has gently sloping sides, a rounded crown, and a dish-shaped channel along the upper side. This kind of terrace controls erosion by diverting runoff along the contour at a nonscouring velocity. It may be nearly level or have a grade toward one or both ends.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Catena. A sequence, or "chain," of soils on a landscape developed from one kind of parent material but having different characteristics because of differences in relief and drainage.

Channery soil. A soil that contains thin, flat fragments of sandstone, limestone, or schist as much as 6 inches in length along the longer axis. A single piece is called a fragment.

Chiseling. Tillage of soil with an implement having one or more soil penetrating points that loosen the subsoil and bring clods to the surface. A form of emerging tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

Claypan. A compact, slowly permeable soil horizon that contains more clay than the horizon above and below it. A claypan is commonly hard when dry and plastic or stiff when wet.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Deferred grazing. The practice of delaying grazing until range plants have reached a definite stage of growth, in order to increase the vigor of the forage and to allow the desirable plants to produce seed. Contrasts with continuous grazing and rotation grazing.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

TABLE 9.—*Temperature and*

[Data from Matador, elevation 2,280 feet;

Month	Temperature [1]				Precipitation			
	Average daily high	Average monthly high	Average daily low	Average monthly low	Average total	Probability of receiving—		
						0 or trace	0.50 inch or more	1.00 inch or more
	°F	°F	°F	°F	In	Pct	Pct	Pct
January	54.7	77.4	27.3	9.4	0.67	5	50	30
February	58.5	80.0	30.5	12.4	.64	11	53	30
March	65.5	86.2	36.4	17.7	.71	10	60	35
April	77.0	94.2	47.9	31.6	1.56	1	80	60
May	84.1	98.9	57.0	42.7	3.20	<1	97	92
June	91.4	102.5	65.6	54.3	3.05	<1	86	77
July	94.9	102.5	69.5	61.0	2.67	1	79	66
August	94.8	103.7	67.7	58.2	2.04	5	77	60
September	87.0	98.8	60.9	47.2	2.03	4	76	60
October	77.9	93.5	49.8	35.1	2.10	5	80	80
November	65.1	84.1	37.5	21.7	.77	16	44	26
December	57.4	77.1	30.2	14.1	.78	10	51	33
Year	75.7		48.4		20.22			

[1] Length of record: 22 years.

[2] Length of record: 14 years.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Diversion, or diversion terrace. A ridge of earth, generally a terrace, that is built to divert runoff from its natural course and, thus, to protect areas downslope from the effects of such runoff.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Fallow. Cropland left idle in order to restore productivity, mainly through accumulation of water, nutrients, or both. Summer fallow is a common stage before cereal grain in regions of limited rainfall. The soil is tilled for at least one growing season to control weeds, to aid decomposition of plant residues, and to encourage the storage of moisture for the succeeding grain crop.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls in nearly level areas, or of microvalleys and microridges that run with the slope.

Gully. A miniature valley with steep sides cut by running water and through which water ordinarily runs only after rains. The distinction between gully and rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by normal tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage. V-shaped gullies result if the material is more difficult to erode with depth; whereas U-shaped gullies result if the lower material is more easily eroded than that above it.

Gypsum. Calcium sulphate.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be

precipitation data

period of record, 1948–69. The symbol < means less than.]

Precipitation—continued										
Probability of receiving—continued					Average number of days that received [2]—			Snow and sleet		
2.00 inches or more	3.00 inches or more	4.00 inches or more	5.00 inches or more	6.00 inches or more	0.10 inch or more	0.50 inch or more	1.00 inch or more	Total [1]	Maximum [1]	Greatest depth [2]
Pct	*Pct*	*Pct*	*Pct*	*Pct*				*In*	*In*	*In*
8	3	<1	<1	<1	1	([3])	0	2.3	11.5	9
10	2	<1	<1	<1	2	([3])	([3])	2.1	14.0	6
10	4	2	<1	<1	3	([3])	([3])	1.4	15.0	12
30	20	6	4	2	3	1	([3])	([4])	([4])	0
72	52	40	26	20	5	2	1	([4])	([4])	0
55	36	24	14	12	5	2	1	0	0	0
40	20	10	5	2	4	2	1	0	0	0
39	20	10	6	5	4	2	([3])	0	0	0
38	24	15	10	7	4	1	([3])	0	0	0
40	25	15	8	5	3	1	1	([4])	([4])	0
9	4	2	<1	<1	2	1	([3])	.4	4.0	0
14	5	3	1	1	2	([3])	([3])	1.1	8.0	4
					38	12	4	7.3	15.0	12

[3] Less than one-half.

[4] Trace, an amount too small to measure.

like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Humus. The well-decomposed, more or less stable part of the organic matter in mineral soils.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

Basin.—Water is applied rapidly to relatively level plots surrounded by levees or dikes.

Controlled 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, to confine the flow of water to one direction.

Furrow.—Water is applied in small ditches made by cultivation implements used for tree and row crops.

Sprinkler.—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.

Subirrigation.—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Narrow-base terrace. A terrace similar to a broad-base terrace except for the width of the ridge and channel. The base of a narrow-base terrace is ordinarily 4 to 8 feet wide.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Poorly graded. A soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles in poorly graded soil material, density can be increased only slightly by compaction.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Range condition. The state of health or productivity of both soil and forage in a given range, in terms of what productivity could or should be under normal climate and the best practical management. Condition classes generally recognized are—*excellent, good, fair,* and *poor.* The classification is based on the percentage of original, or climax, vegetation on the site, as compared to what ought to grow on it if management were good.

Range site. An area of range where climate, soil, and relief are sufficiently uniform to produce a distinct kind of climax vegetation.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock. Only the upper part of this, modified by organisms and other soil-building forces, is regarded by soil scientists as soil. Most American engineers speak of the whole regolith, even to great depths, as "soil."

Relief. The elevations or inequalities of a land surface, considered collectively.

Rill. A steep-sided channel resulting from accelerated erosion. A rill normally is a few inches in depth and width and is not large enough to be an obstacle to farm machinery.

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Sequum. A sequence consisting of an illuvial horizon and the overlying eluvial horizon. If two sequa are present in a single soil profile, it is said to have a bisequum.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silica. Silica is a combination of silicon and oxygen. The mineral form is called quartz.

Silica-sesquioxide ratio. The ratio of the number of molecules of silica to the number of molecules of alumina plus iron oxide in a soil or the clay fraction of a soil. The more highly weathered materials in warm-temperate, humid regions, and especially those in the tropics, generally have low ratios. The clays in soils with low ratios normally are less active, physically and chemically, than those with high ratios.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Slickensides. Polished and grooved surfaces produced by one mass sliding past another. In soils, slickensides may occur at the bases of slip surfaces on relatively steep slopes and in swelling clays, where there is marked change in moisture content.

Slick spots. Small areas in a field that are slick when wet because they contain excess exchangeable sodium or alkali.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2.0 to 1.0 millimeter); *coarse sand* (1.0 to 0.5 millimeter); *medium sand* (0.5 to 0.25 millimeter); *fine sand* (0.25 to 0.10 millimeter); *very fine sand* (0.10 to 0.05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2.0 to 0.2 millimeter); II (0.2 to 0.02 millimeter); III (0.02 to 0.002 millimeter); IV (less than 0.002 millimeter).

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Gener-

ally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Stone line. A concentration of coarse rock fragments in soils that generally represents an old weather surface. In a cross section, the line may be one stone or more thick. The line generally overlies material that weathered in place, and it is ordinarily overlain by sediment of variable thickness.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Subsoiling. Tillage of a soil below normal depth ordinarily to shatter a hardpan or claypan.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that it may soak into the soil or flow slowly to a prepared outlet without harm. Terraces in fields are generally built so they can be farmed. Terraces intended mainly for drainage have a deep channel that is maintained in permanent sod.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Tilth, soil. The condition of the soil in relation to the growth of plants, especially soil structure. Good tilth refers to the friable state and is associated with high noncapillary porosity and stable, granular structure. A soil in poor tilth is nonfriable, hard, nonaggregated, and difficult to till.

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Trace elements. The chemical elements found in soils in extremely small amounts, yet which are essential to plant growth. Some of the trace elements are zinc, cobalt, manganese, copper, and iron.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Well-graded soil. A soil or soil material consisting of particles that are well distributed over a wide range in size or diameter. Such a soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which plants (specifically sunflower) wilt so much that they do not recover when placed in a dark, humid atmosphere.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs. In referring to a capability unit or range site, read the introduction to the section it is in for general information about its management. Other information is given in tables as follows:

Acreage and extent, table 1, page 5.
Predicted yields, table 2, page 42.
Engineering uses of the soils, tables 3, 4, and 5, pages 48 through 63.
Recreation, table 6, page 65.
Wildlife, table 7, page 68.

Map symbol	Mapping unit	Described on page	Capability unit	Range site	
			Symbol	Name	Page
AbA	Abilene clay loam, 0 to 1 percent slopes	6	IIc-1	Clay Loam	43
AbB	Abilene clay loam, 1 to 3 percent slopes	6	IIe-2	Clay Loam	43
AcA	Altus very fine sandy loam, 0 to 1 percent slopes	6	IIc-2	Sandy Loam	45
AsB	Aspermont silty clay loam, 1 to 3 percent slopes	7	IIIe-5	Clay Loam	43
AsC	Aspermont silty clay loam, 3 to 5 percent slopes	7	IVe-1	Clay Loam	43
AsE	Aspermont silty clay loam, 5 to 12 percent slopes	7	VIe-2	Clay Loam	43
BpF	Berda and Potter soils, 5 to 20 percent slopes	8	VIIs-1	----------	--
	Berda part	--	------	Mixedland Slopes	45
	Potter part	--	------	Very Shallow	45
BuA	Bukreek loam, 0 to 1 percent slopes	9	IIc-2	Mixedland	44
BuB	Bukreek loam, 1 to 3 percent slopes	10	IIe-2	Mixedland	44
CoF	Cottonwood loam, 3 to 20 percent slopes	10	VIIs-1	Gyp	43
DeB	Delwin fine sand, 0 to 3 percent slopes	11	IIIe-8	Sandy	45
DoD	Devol loamy fine sand, 3 to 8 percent slopes	11	IVe-10	Sandy Loam	45
DtD	Devol and Tivoli soils, 1 to 8 percent slopes	11	VIe-3	----------	--
	Devol part	--	------	Sandy Loam	45
	Tivoli part	--	------	Deep Sand	43
FmB	Flomot fine sandy loam, 1 to 3 percent slopes	12	IVe-7	Mixedland Slopes	45
FmC	Flomot fine sandy loam, 3 to 5 percent slopes	12	IVe-4	Mixedland Slopes	45
FmE	Flomot fine sandy loam, 5 to 12 percent slopes	13	VIe-1	Mixedland Slopes	45
FpB	Flomot-Potter complex, 0 to 3 percent slopes	13	IVe-6	----------	--
	Flomot part	--	------	Mixedland Slopes	45
	Potter part	--	------	Very Shallow	45
FrA	Frankirk loam, 0 to 1 percent slopes	15	IIc-1	Clay Loam	43
FrB	Frankirk loam, 1 to 3 percent slopes	15	IIe-2	Clay Loam	43
Ga	Gageby clay loam	15	IIw-1	Loamy Bottomland	44
HeC	Heatly fine sand, 0 to 5 percent slopes	16	VIe-3	Sandy	45
HgF	Hilgrave gravelly sandy loam, 10 to 30 percent slopes	17	VIs-1	Gravelly	43
LaE	Latom-Rock outcrop complex, 3 to 12 percent slopes	17	VIIs-1	Very Shallow	45
Ln	Lincoln soils	18	IVe-2	Sandy Bottomland	45
Lo	Lincoln soils, frequently flooded	19	Vw-2	Sandy Bottomland	45
Lp	Lipan clay, depressional	20	IVw-1	Lakebed	44
MeB	Miles loamy fine sand, 0 to 3 percent slopes	21	IIIe-7	Sandy Loam	45
MeC	Miles loamy fine sand, 3 to 5 percent slopes	21	IVe-5	Sandy Loam	45
MfB	Miles fine sandy loam, 1 to 3 percent slopes	21	IIIe-2	Sandy Loam	45
MfC	Miles fine sandy loam, 3 to 5 percent slopes	21	IIIe-2	Sandy Loam	45
MfE	Miles fine sandy loam, 5 to 8 percent slopes	22	IVe-3	Sandy Loam	45
MoB	Mobeetie fine sandy loam, 0 to 3 percent slopes	22	IIIe-3	Mixedland Slopes	45
MoC	Mobeetie fine sandy loam, 3 to 5 percent slopes	22	IVe-7	Mixedland Slopes	45
MoE	Mobeetie fine sandy loam, 5 to 12 percent slopes	23	VIe-1	Mixedland Slopes	45
MtA	Motley loam, 0 to 1 percent slopes	23	IIc-2	Mixedland	44
MtB	Motley loam, 1 to 3 percent slopes	23	IIe-2	Mixedland	44
NoE	Nobscot soils, 3 to 12 percent slopes	24	VIe-3	Sandy	45
ObB	Obaro loam, 1 to 3 percent slopes	25	IIIe-5	Mixedland	44
ObC	Obaro loam, 3 to 5 percent slopes	25	IVe-9	Mixedland	44
OcE	Obaro-Burson complex, 3 to 12 percent slopes	25	VIIs-1	----------	--
	Obaro part	--	------	Mixedland	44
	Burson part	--	------	Very Shallow	45

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Described on page	Capability unit	Range site	
			Symbol	Name	Page
PaA	Paloduro loam, 0 to 1 percent slopes	26	IIIc-1	Hardland Slopes	44
PaB	Paloduro loam, 1 to 3 percent slopes	26	IIIe-6	Hardland Slopes	44
PME	Polar-Mobeetie association, hilly	28	VIs-1	----------	--
	Polar part	--	------	Gravelly	43
	Mobeetie part	--	------	Mixedland Slopes	45
PnC	Posey-Mansker complex, 3 to 5 percent slopes	29	IVe-4	Hardland Slopes	44
PoD	Potter loam, 3 to 20 percent slopes	30	VIIs-1	Very Shallow	45
PuA	Pullman clay loam, 0 to 1 percent slopes	31	IIIe-4	Clay Loam	43
QuD	Quinlan loam, 3 to 12 percent slopes	31	VIe-2	Mixedland	44
Ra	Randall clay	32	VIw-1	Lakebed	44
SaA	Sagerton clay loam, 0 to 1 percent slopes	33	IIc-1	Clay Loam	43
SaB	Sagerton clay loam, 1 to 3 percent slopes	33	IIe-2	Clay Loam	43
SpB	Springer loamy fine sand, 0 to 3 percent slopes	34	IVe-8	Sandy Loam	45
Tf	Tivoli fine sand	34	VIIe-1	Deep Sand	43
TuB	Tulia loam, 1 to 3 percent slopes	35	IVe-6	Hardland Slopes	44
TuC	Tulia loam, 3 to 5 percent slopes	35	IVe-1	Hardland Slopes	44
WlB	Woodward loam, 1 to 3 percent slopes	35	IIe-1	Mixedland	44
WlC	Woodward loam, 3 to 5 percent slopes	36	IIIe-1	Mixedland	44
WoD	Woodward-Yomont complex, 0 to 15 percent slopes	36	VIe-2	----------	--
	Woodward part	--	------	Mixedland	44
	Yomont part	--	------	Loamy Bottomland	44
WQD	Woodward-Quinland association, rolling	36	VIe-2	Mixedland	44
Ya	Yahola fine sandy loam	37	IIw-1	Loamy Bottomland	44
Yo	Yomont very fine sandy loam	38	IIw-1	Loamy Bottomland	44
Ys	Yomont and Lincoln soils	38	Vw-1	----------	--
	Yomont part	--	------	Loamy Bottomland	44
	Lincoln part	--	------	Sandy Bottomland	45

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