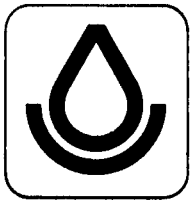
SOIL SURVEY

Lea County, New Mexico



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
NEW MEXICO AGRICULTURAL EXPERIMENT STATION
Issued January 1974

Major fieldwork for this soil survey was done in the period 1960–66. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in this publication refer to conditions in the county in 1967. This survey was made cooperatively by the Soil Conservation Service and the New Mexico Agricultural Experiment Station. It is part of the technical assistance furnished to the Lea County Soil and Water Conservation District.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS 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 Lea 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 and capability unit 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 ranchers and those who work with them can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and range sites.

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

Ranchers and others can find, under "Range Management," 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 homesites, industrial sites, schools, and parks in the sections "Recreation" and "Soils in Engineering."

Engineers and builders can find, under "Soils in Engineering," 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 to the 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 in the section "General Nature of the County."

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SOIL SURVEY OF LEA COUNTY, NEW MEXICO

BY MILLARD T. TURNER, DELLON N. COX, BRICE C. MICKELSON, ARCHIE J. ROATH, AND CARL D. WILSON, SOIL CONSERVATION SERVICE

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

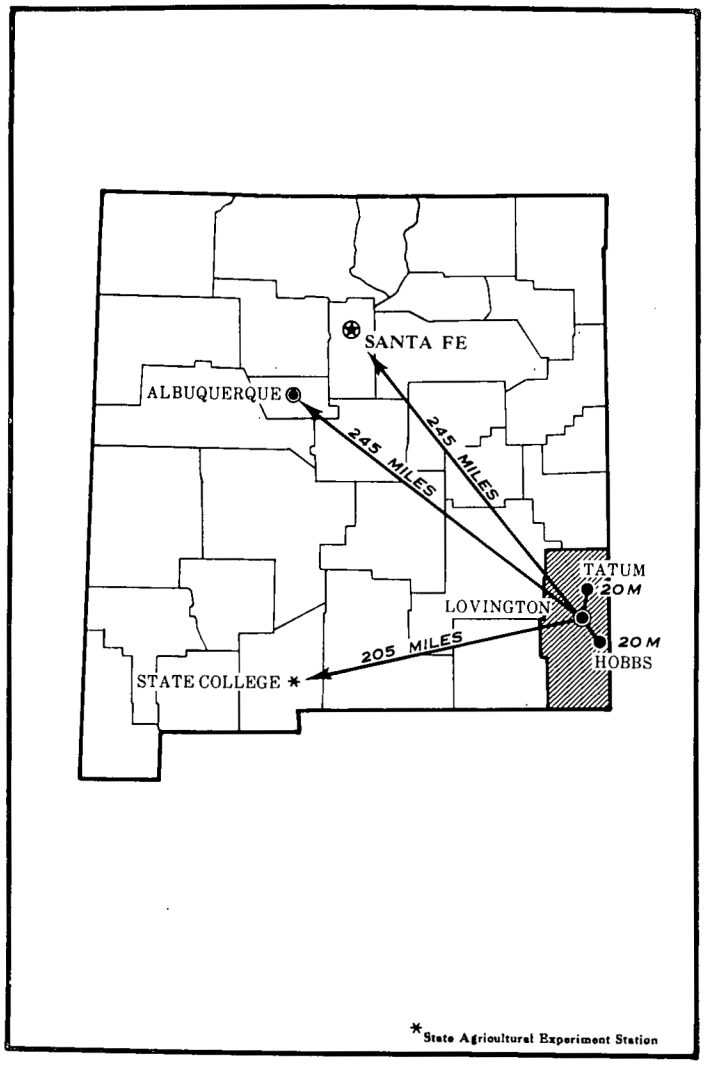

Figure 1.—Location of Lea County in New Mexico.

LEA COUNTY is in the extreme southeastern part of New Mexico (fig. 1). The county is about 108 miles long and 38 to 43 miles wide. The total area is about 2,811,520 acres, or 4,393 square miles.

The major towns in the north-central and northern parts of Lea County are Lovington, the county seat, Hobbs, and Tatum. Lovington is near the center of the county; Hobbs is 20 miles southeast of Lovington, and Tatum 20 miles north of Lovington. Eunice and Jal are the major towns in the south-central and southern parts of the county.

The acreage in Lea County is used mainly for ranching. About 90 percent of the county is rangeland. Cattle, sheep, horses, swine, and poultry are raised.

There are two general types and areas of farming in Lea County. Irrigation farming covers 112,500 acres in the shallow water basin. It produces cotton, grain and feed sorghums, alfalfa, and some truck crops. Dryland farming covers a limited area in the northeastern part of the county. It produces grain and feed crops and some cotton.

Lea County has natural resources. There are large gas and oil fields in many areas of the county. Caliche can be found in most of the county, and potash and gypsum deposits occur in the southern and southwestern parts.

The northern half of Lea County is in the Southern High Plains Resource Area. Elevation averages 3,500 to 4,400 feet, and the gradient is 10 to 15 feet per mile. The southern half of Lea County, south of the Southern High Plains escarpment, consists of gently undulating sandy plains of the Southern Desertic Basins, Plains, and Mountains Resource Area. It has a gradual slope to the south and the southeast. The elevation averages 3,000 to 4,200 feet in the southern part of the county.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Lea 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 (*9*).[1]

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. Amarillo and Gomez, 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 soil 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, Amarillo fine sandy loam, 0 to 1 percent slopes, is one of several phases within the Amarillo 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 in the back of this publication was prepared from the aerial photographs.

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

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

A soil complex consists of areas of two or more soils, so intermingled 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. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Amarillo-Gomez fine sands 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. Amarillo-Arvana association, eroded, is an example.

[1] Italic numbers in parentheses refer to Literature Cited, page 87.

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. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Portales and Gomez fine sandy loams is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be 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. Active dune land is a land type in Lea County.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, 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 present methods of use and management.

Soil Survey Intensities

Part of Lea County was mapped at low intensity and part at medium intensity.

In the low intensity areas the soils were examined at moderate to wide intervals. In several places two or more soils are mapped together as an association, a complex, or an undifferentiated group. Each of the multiple mapping units is named for the major soil series occurring in it, and the dominant soil is named first; an example is Berino-Cacique loamy fine sands association. If the acreage of an individual soil is large enough, that soil is mapped separately. A wide range of slope is permitted within a unit if there are no major differences in use and management.

The major dryland farming areas and the areas used for irrigated farming were surveyed at medium intensity. The soils were examined at closer intervals than those mapped at low intensity and were mapped in more detail and at a larger scale. Most mapping units consist of individual soils, but a few are complexes or undifferentiated

groups. Slope classes are combined if there are no significant differences in use and management.

The maps at the back of this survey vary in scale according to the intensity of mapping. The low-intensity maps are at a scale of 2 inches to the mile (1:31,680). The medium-intensity maps of the northeastern corner of Lea County are also at a scale of 2 inches to the mile (1:31,680). The remaining medium-intensity maps are at a scale of 3.168 inches to the mile (1:20,000).

The soil symbol indicates the intensity of mapping. The first letter of either a medium-intensity or a low-intensity symbol is a capital letter. The second letter of a medium-intensity symbol is a small letter; for example, Kb is the symbol for Kimbrough loam, 0 to 1 percent slopes. The second letter of a low-intensity symbol is a capital letter; for example, KN is the symbol for Kimbrough loam, 0 to 3 percent slopes.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Lea 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, ranch, 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.

There are eight soil associations in Lea County. Five associations are mostly soils of the Southern High Plains Resource Area. These soils are used mainly for range and for dryland and irrigated crops. Three associations are mostly soils of the Southern Desertic Basins, Plains, and Mountains Resource Area. These soils are used mainly for range. The two land resource areas are delineated on the general soil map.

The eight associations and the two land resource areas are described in the following pages. The terms for texture in the titles of the associations apply to the surface layer.

More detailed information about the individual soils in each association can be obtained by studying the detailed soil map and by reading the section "Descriptions of the Soils."

Southern High Plains

The soils in associations 1 through 5 are in the northern half of Lea County. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 190 to 205 days. Elevations range from 3,500 to 4,400 feet. The soils in the western part of this group are used mainly for range, and the soils in the eastern part are used mainly for dryland crops, irrigated crops, and range.

1. Kimbrough association

Nearly level and gently sloping, gravelly and loamy soils that are very shallow and shallow to indurated caliche

This association consists of nearly level and gently sloping, well-drained soils in broad areas on uplands in the northern and central parts of Lea County. The soils have a gravelly loam surface layer that overlies indurated caliche at a depth of 6 to 16 inches. They formed in wind-laid and water-laid deposits. The vegetation is short and mid grasses and shrubs. Elevations range from 3,600 to 4,200 feet. The mean annual precipitation is 12 to 15 inches, the mean annual air temperature 58° to 60° F., and the frost-free season is 195 to 205 days.

This association makes up about 24 percent of Lea County. It is about 70 percent Kimbrough soil. Lea, Stegall, Portales, and Slaughter soils make up the remaining 30 percent.

Typically, Kimbrough soils have a dark grayish-brown gravelly loam surface layer. Indurated caliche is at a depth of about 6 inches.

Kimbrough soils are on low broad ridges and plains. Lea and Stegall soils occur in swales that are bordered by Portales and Slaughter soils.

This association is used mainly for range, wildlife, recreational areas, and construction material. The range is used for grazing cattle, sheep, and horses. Ranches are large, carrying capacities low, and water supplies moderate. Stock tanks and windmills are the main sources of water. The association is a source of crushed caliche and is marked by many caliche pits.

This association is well suited to habitat for antelope, scaled quail, and mourning dove.

2. Kimbrough-Lea association

Nearly level and gently sloping, gravelly and loamy soils that are very shallow to moderately deep to indurated caliche

This association consists of nearly level and gently sloping, well-drained soils in broad areas on uplands in the north-central and central parts of Lea County. The soils have a loam and gravelly loam surface layer over a heavy loam subsoil or indurated caliche. They formed in wind-laid and alluvial deposits over indurated caliche. The vegetation is short and mid grasses and shrubs. Elevations range from 3,600 to 4,200 feet. The mean annual precipitation is 12 to 15 inches, the mean annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days.

This association makes up about 16 percent of Lea County. It is about 40 percent Kimbrough soils, and about 30 percent Lea soils. Portales, Stegall, Arvana, Slaughter, and Zita soils make up the remaining 30 percent of the association.

Figure 2 shows a typical pattern of soils in the association.

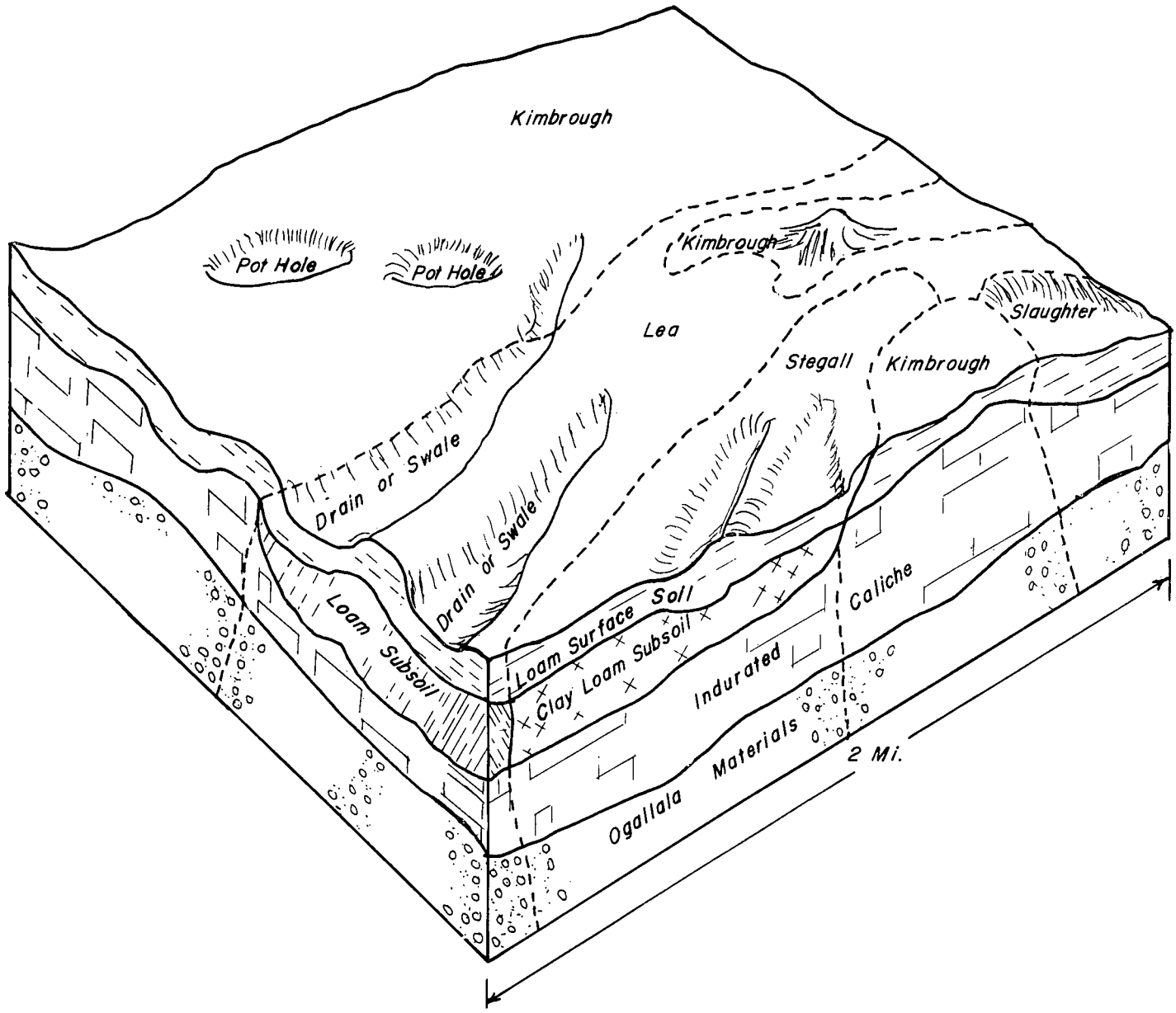

Figure 2.—Typical pattern of soils, topography, and underlying material in Kimbrough-Lea association.

Typically, Kimbrough soils have a dark grayish-brown gravelly loam surface layer that is underlain by indurated caliche at a depth of about 6 inches. Lea soils have a dark grayish-brown to brown loam surface layer, a grayish-brown heavy loam subsoil, and indurated caliche at a depth of about 26 inches.

Kimbrough soils occur in an intricate pattern with Lea soils. They are on low broad ridges and plains. Lea and Stegall soils occur in swales. Portales, Arvana, Slaughter, and Zita soils border the swales and ridges.

This association is used for range, wildlife, dryland farming, and irrigated farming. The gravelly Kimbrough soils are used for grazing cattle, sheep, and horses, and Lea soils are used for farming and grass production. Ranches are large, carrying capacities moderate, and water supply moderate. Irrigation wells supply water for farm crops and home use. Generally, windmills supply water for livestock.

This association is suitable habitat for antelope, scaled quail, and mourning dove.

3. *Portales-Stegall-Lea association*

Nearly level and gently sloping, loamy soils that are moderately deep to soft or indurated caliche

This association consists of nearly level and gently sloping, well-drained soils on uplands in the north-central part of Lea County. The soils have a loam surface layer and a loam to clay subsoil. They formed in wind-

laid and water-laid calcareous sediments. The vegetation is short and mid grasses, forbs, and shrubs. Elevations range from 3,600 to 4,400 feet. The mean annual precipitation is 12 to 16 inches, the mean annual air temperature 58° to 60° F., and the frost-free season 195 to 205 days.

This association makes up about 6 percent of Lea County. It is about 40 percent Portales soils, 20 percent Stegall soils, and 15 percent Lea soils. Arvana, Arch, Drake, Cottonwood, Reeves, Mansker, and Amarillo soils make up the remaining 25 percent.

Typically, Portales soils have a dark-brown to grayish-brown loam surface layer and a pale-brown light clay loam subsoil underlain by chalky loam at a depth of about 26 inches. Stegall soils have a grayish-brown loam surface layer and a dark-brown, dark grayish-brown, and brown heavy clay loam subsoil underlain by indurated caliche at a depth of about 28 inches. Lea soils have a brown to dark grayish-brown loam surface layer and a grayish-brown heavy loam subsoil underlain by indurated caliche at a depth of about 26 inches.

The nearly level to gently sloping Portales soils are on plains. Stegall and Lea soils are in swales. Arvana and Amarillo soils are in long narrow depressions. Mansker soils are on plains, and Arch, Drake, Cottonwood, and Reeves soils are around playas.

This association is used for range, irrigated and dryland farming, and wildlife. It includes most of the farmland in Lea County. Ranches are large, carrying capacities moderately high, and water supplies for livestock ample. Irrigation wells supply water for farm crops and home use and some of the water for livestock. Windmills supply water for livestock on many of the large ranches.

This association is suitable habitat for antelope, mourning dove, and scaled quail.

4. Amarillo-Arvana association

Nearly level and gently sloping, sandy and loamy soils that are moderately deep and deep to soft or indurated caliche

This association consists of nearly level and gently sloping, well-drained soils on uplands in the northern half of Lea County. The soils generally have a fine sandy loam or loamy fine sand surface layer and a sandy clay loam subsoil. They formed in sandy alluvium and wind-deposited sediments. The vegetation is mid grasses, forbs, and shrubs. Elevations range from 3,600 to 4,400 feet. The mean annual precipitation is 12 to 16 inches, the mean annual air temperature 58° to 60° F., and the frost-free season 195 to 205 days.

This association makes up about 7 percent of Lea County. It is about 50 percent Amarillo soils and 30 percent Arvana soils. Portales, Zita, Gomez, Sharvana, and Kimbrough soils make up the remaining 20 percent.

Typically, Amarillo soils have a reddish-brown fine sandy loam or loamy fine sand surface layer and a red to reddish-yellow sandy clay loam subsoil. Chalky loam is at a depth of about 36 inches. Arvana soils have a reddish-brown fine sandy loam or loamy fine sand surface layer and a reddish-brown to red sandy clay loam subsoil. Indurated caliche is at a depth of about 28 inches.

Amarillo, Arvana, and Sharvana soils are on plains. Portales and Zita soils are along depressions. Gomez soils are in broad shallow depressions. Kimbrough soils are on low, broad ridges and plains.

This association is used for range, irrigated and dryland crops, wildlife, and recreational areas. The range is used for grazing cattle, horses, and sheep. Ranches are large, carrying capacities moderate, and water supplies ample.

Indian artifacts can be found in scattered areas throughout the association.

This association is suitable habitat for antelope and game birds and is also suitable for fishponds and shallow water impoundments for ducks.

5. Brownfield-Patricia-Tivoli association

Nearly level and undulating, deep, sandy soils

This association consists of well-drained to excessively drained soils on uplands along the northern boundary of the county and in a narrow strip southeast of Hobbs along the eastern boundary. The soils have a fine sand surface layer over layers of sandy clay loam to fine sand. They formed in sandy sediments and windblown sands. The vegetation is mid grasses, tall grasses, and shrubs. Elevations range from 3,500 to 4,400 feet. The mean annual precipitation is 12 to 15 inches, the mean annual air temperature 58° to 60° F., and the frost-free season 190 to 205 days.

This association makes up about 6 percent of Lea County. It is about 30 percent Brownfield soils, about 20 percent Patricia soils, and about 15 percent Tivoli soils. Springer, Gomez, Amarillo, Arvana, and Sharvana soils make up the remaining 35 percent.

Figure 3 shows a typical pattern of the major soils.

Typically, Brownfield soils have a thick light-brown fine sand surface layer and a red sandy clay loam subsoil. Patricia soils have a brown to pale-brown fine sand surface layer and a reddish-brown to yellowish-red sandy clay loam subsoil. Tivoli soils have a light yellowish-brown fine sand surface layer over layers of pink to very pale brown fine sand.

All of these level to undulating soils are on plains in the "sand country." The Tivoli soils are the dune areas.

This association is used for range, wildlife, and recreational areas. The range is used for grazing cattle and horses. Ranches are large, carrying capacities moderate, and water supplies limited. Stock tanks and windmills are the main sources of water.

Indian artifacts can be found in scattered areas throughout the association.

This association is moderately to poorly suited to habitat for antelope, scaled quail, and mourning dove.

Southern Desertic Basins, Plains, and Mountains

The soils in associations 6, 7, and 8 are in the southern half of Lea County. The average annual precipitation is 10 to 13 inches, the average annual air temperature is 59° to 62° F., and the frost-free season is 190 to 205 days. Elevations range from 3,000 to 4,000 feet. The soils in this group are used for range.

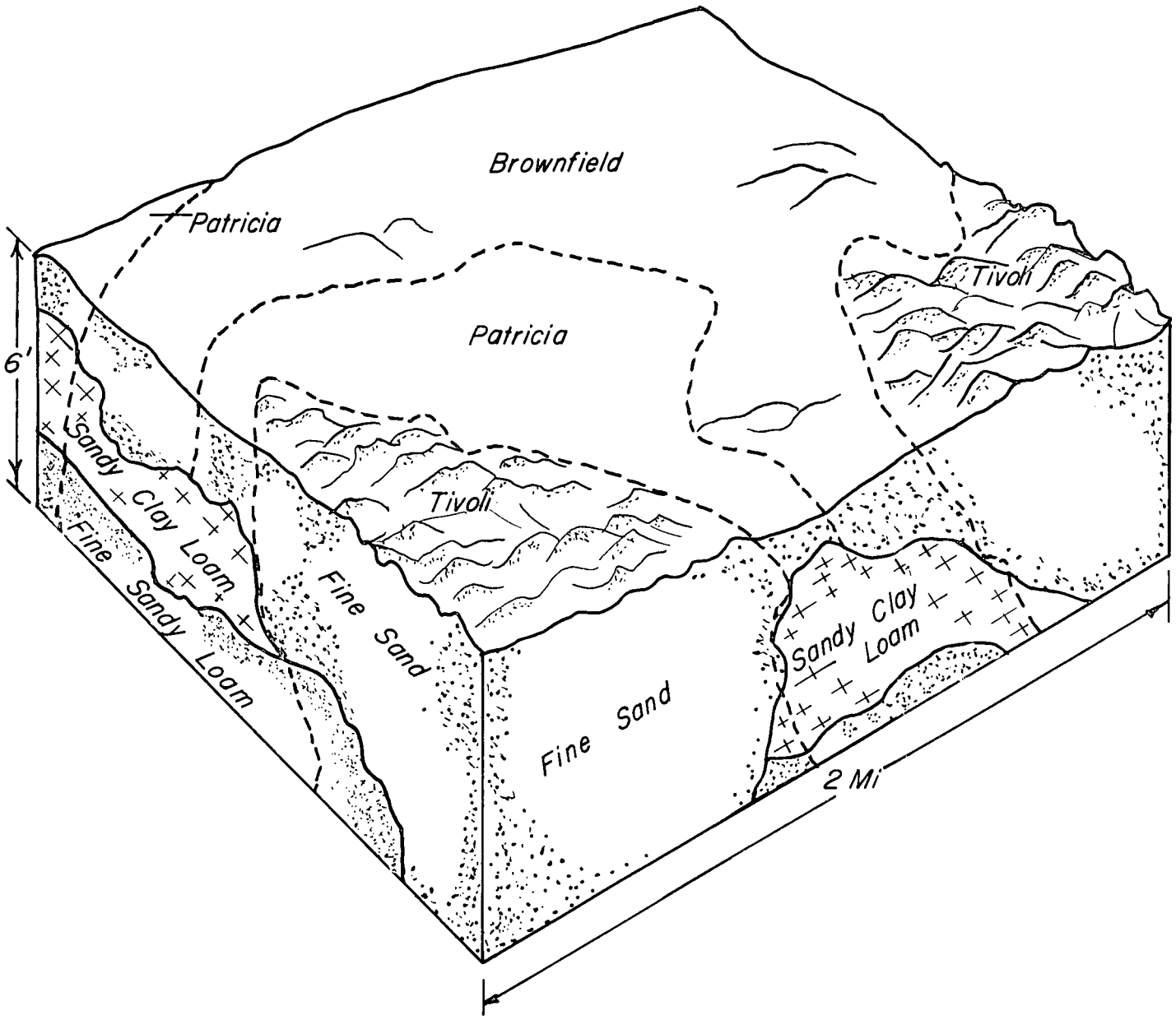

Figure 3.—**Typical pattern of soils, topography, and underlying material in Brownfield-Patricia-Tivoli association.**

6. Simona-Tonuco association

Nearly level and gently undulating, loamy and sandy soils that are shallow to indurated caliche

This association consists of nearly level to gently undulating, well-drained to excessively drained soils on uplands in southern Lea County. The soils have a fine sandy loam to loamy fine sand surface layer. They are underlain by indurated caliche at a depth of less than 20 inches. They formed in calcareous sandy sediments deposited over indurated caliche. The vegetation is short and mid grasses, forbs, and shrubs. Elevations range from 3,000 to 4,000 feet. The mean annual precipitation is 10 to 13 inches, the mean annual air temperature 59° to 62° F., and the frost-free season 190 to 205 days.

This association makes up about 8 percent of Lea County. It is about 50 percent Simona soils, and about 25 percent Tonuco soils. Upton, Mobeetie, Potter, and Wink soils make up the remaining 25 percent.

Typically, Simona soils have a grayish-brown fine sandy loam surface layer and a pale-brown fine sandy loam subsoil. Indurated caliche is at a depth of about 16 inches. Tonuco soils have a yellowish-red loamy fine sand surface layer over a layer of loamy sand. Indurated caliche is at a depth of about 17 inches.

Simona, Tonuco, Upton, and Potter soils are on plains

and low ridges. Mobeetie soils are on alluvial fans. Wink soils are in basins.

This association is used for range, wildlife, and recreational areas. The range is used for grazing cattle and horses. Ranches are large, carrying capacities low to moderate, and water supplies very limited. Stock tanks and windimlls are the main sources of water.

Indian artifacts occur in scattered areas throughout the association.

This association is suitable habitat for scaled quail, antelope, and mourning dove.

7. *Berino-Cacique association*

Nearly level and gently sloping, sandy soils that are deep and moderately deep to soft or indurated caliche

This association consists of nearly level and gently sloping, well-drained soils on uplands in the southern part of Lea County. The soils have a loamy fine sand surface layer and a sandy clay loam subsoil. They formed in sandy alluvium and mixed wind-deposited sediments. The vegetation is mid and tall grasses and shrubs. Elevations range from 3,000 to 3,400 feet. The mean annual precipitation is 10 to 13 inches, the mean annual air temperature 60° to 62° F., and the frost-free season 195 to 205 days.

This association makes up about 7 percent of Lea County. It is about 35 percent Berino soils and about 25 percent Cacique soils. Maljamar, Midessa, Pyote, Simona, Jal, Tonuco, and Wink soils make up the remaining 40 percent.

Typically, Berino soils have a reddish-brown loamy fine sand surface layer and a red light sandy clay loam subsoil. Strongly limy sandy clay loam is at a depth of about 48 inches. Cacique soils have a reddish-brown to yellowish-red loamy fine sand surface layer and a red sandy clay loam subsoil. Indurated caliche is at a depth of about 28 inches.

The soils in this association are on plains in the "sand country."

This association is used for range, wildlife, and recreational areas. The range is used for grazing cattle and horses. Ranches are large, carrying capacities low to moderate, and water supplies very limited. Stock tanks and windmills are the main sources of water.

Indian artifacts occur in scattered areas throughout the association.

This association is suitable habitat for mourning dove and scaled quail.

8. *Pyote-Maljamar-Kermit association*

Gently undulating and rolling, deep, sandy soils

This association consists of gently undulating and rolling, well-drained to excessively drained soils on uplands in the southern part of Lea County. The soils have a fine sand surface layer over layers of sandy clay loam to fine sand. They formed in sandy sediments and wind-deposited sands. The vegetation is mid and tall grasses, forbs, and shrubs. Elevations range from 3,000 to 3,900 feet. The mean annual precipitation is 10 to 12 inches, the mean annual air temperature 60° to 62° F., and the frost-free season 190 to 205 days.

This association makes up about 26 percent of Lea County. It is about 30 percent Pyote soils, about 20 percent Maljamar soils, and about 15 percent Kermit soils. Palomas, Wink, Largo, Pajarito, and Tonuco soils make up the remaining 35 percent.

Figure 4 shows a typical pattern of soils in the association.

Typically, Pyote soils have a thick, light-brown fine sand surface layer and a reddish-yellow to light-brown fine sandy loam subsoil. Maljamar soils have a yellowish-red fine sand to loamy sand surface layer and a red sandy clay loam subsoil. Kermit soils have a pale-brown fine sand surface layer over light yellowish-brown fine sand that extends to a depth of 60 inches or more.

The Maljamar and Pyote series were established subsequent to the publication of the Eddy Area soil survey. For this reason, this association joins large areas of the Kermit-Berino association mapped in the Eddy Area.

The gently undulating Pyote, Maljamar, and Palomas soils are on plains. The rolling Kermit soils are on stabilized dunes. Largo and Pajarito soils are on alluvial fans below outcrops of Triassic red beds.

This association is used for range and wildlife. The range is used for grazing cattle and horses. Ranches are large, carrying capacities low, and water supplies limited. Stock tanks and windmills are the main sources of water. Loose sands, dunes, and gullies make travel across this association difficult. This problem has been relieved in many areas by oiling and caliche topcoating many of the roads.

Indian artifacts occur in scattered areas throughout the association.

These soils are poorly suited to habitat for most wildlife species.

Descriptions of the Soils

This section describes the soil series and mapping units in Lea County. Each soil series is described in considerable detail, and then, briefly, each mapping unit 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, detailed and in technical terms, is for scientists, engineers, and others who need to make thorough and precise studies of soils.

Unless it is otherwise stated, the color and consistence described are those of a dry soil. The range in thickness given for each horizon in the technical profile description applies to profiles in this county.

As mentioned in the section "How This Survey Was

461-652—74——2

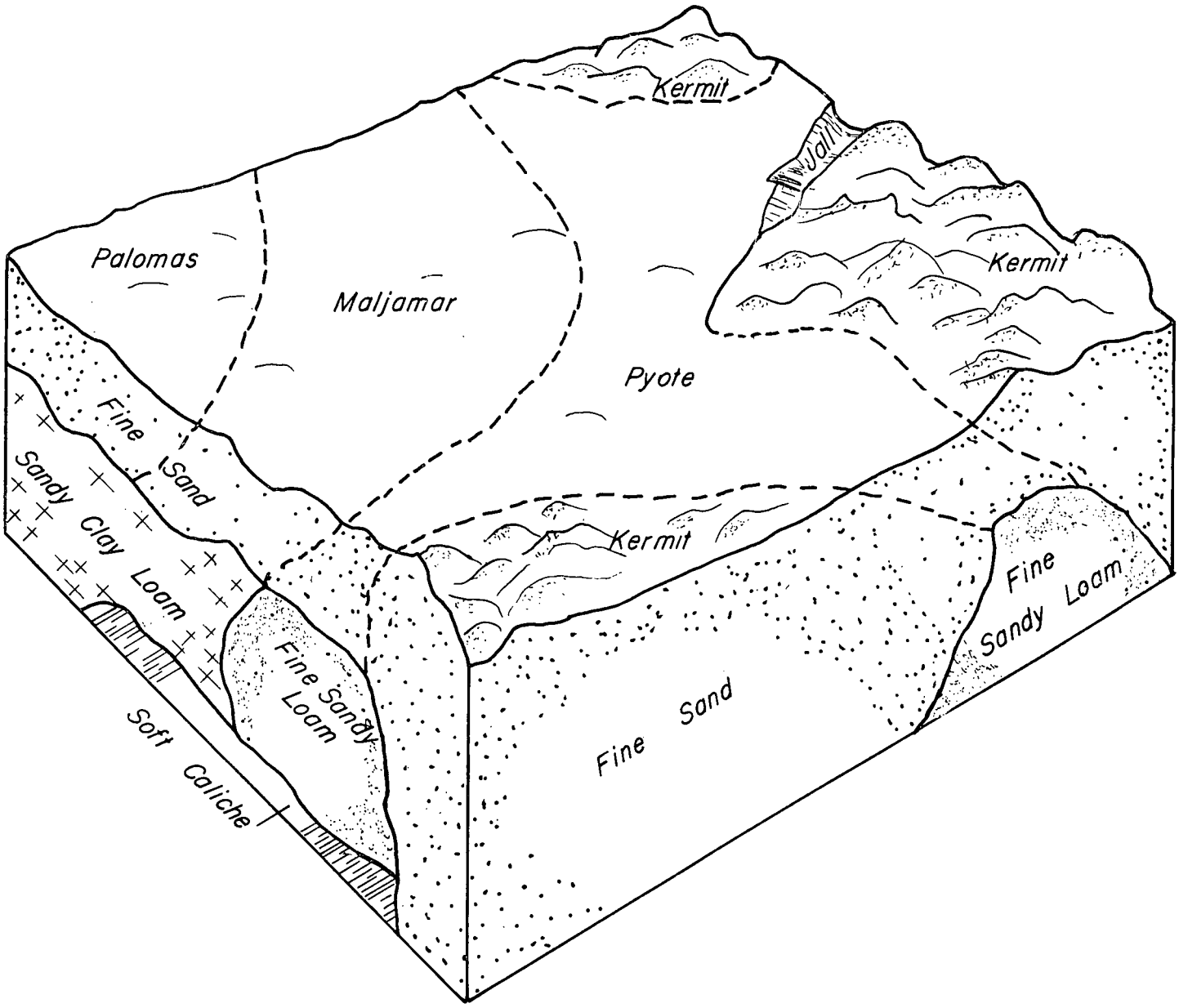

Figure 4.—**Typical pattern of soils, topography, and underlying material in Pyote-Maljamar-Kermit association.**

Made," not all mapping units are members of a soil series. Active dune land, 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, range site, and wildlife habitat group in which the mapping unit has been placed. The page for the description of each capability unit, range site, wildlife habitat group, or other interpretative group can be found 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 at the end of this survey, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*9*).

A given soil series in this county may be identified by a different name in a recently published soil survey of an adjacent county. Such differences in name result from changes in the concepts of soil classification that have occurred since publication. The characteristics of the soil series described in this county are considered to be within the range defined for that series. In those instances where a soil series has one or more features outside the defined range, the differences are explained.

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

Soil	Acres		Percent
	Medium intensity	Low intensity	
Active dune land	6,985		0.2
Amarillo loamy fine sand, 0 to 3 percent slopes	31,845		1.1
Amarillo loamy fine sand, 0 to 3 percent slopes, eroded	4,663		.2
Amarillo fine sandy loam, 0 to 1 percent slopes	14,950		.6
Amarillo fine sandy loam, 1 to 3 percent slopes	3,306		.1
Amarillo loam, 0 to 1 percent slopes	3,865		.1
Amarillo-Arvana loamy fine sands association		27,794	1.0
Amarillo-Arvana fine sandy loams association		12,904	.5
Amarillo-Arvana association, eroded		1,355	(1)
Amarillo-Gomez fine sands	4,879	4,245	.4
Arch loam	483		(1)
Arch-Drake association		7,145	.3
Arvana loamy fine sand, 0 to 3 percent slopes	6,932		.2
Arvana loamy fine sand, 0 to 3 percent slopes, eroded	1,535		.1
Arvana fine sandy loam, 0 to 1 percent slopes	7,472		.3
Arvana fine sandy loam, 1 to 3 percent slopes	597		(1)
Arvana loam, 0 to 1 percent slopes	3,409		.1
Arvana-Lea association		26,076	.9
Badland		798	(1)
Berino-Cacique loamy fine sands association		86,211	3.0
Berino-Cacique fine sandy loams association		18,396	.7
Berino-Cacique association, hummocky		4,170	.1
Brownfield and Patricia fine sands	34,090	17,970	1.8
Brownfield and Patricia fine sands, eroded	8,419		.3
Brownfield-Springer association		29,696	1.0
Brownfield-Springer association, hummocky		1,453	.1
Drake loamy fine sand	1,101		(1)
Gomez fine sand		5,343	.2
Gomez loamy fine sand	4,006	3,817	.2
Gomez fine sandy loam	2,603		.1
Jal association		7,933	.3
Kermit-Palomas fine sands, 0 to 12 percent slopes		76,985	2.7
Kermit-Wink complex, 0 to 3 percent slopes		6,659	.2
Kermit soils and Dune land, 0 to 12 percent slopes		127,159	4.5
Kimbrough loam, 0 to 1 percent slopes	19,335		.7
Kimbrough loam, 0 to 3 percent slopes		11,987	.4
Kimbrough loam, 1 to 3 percent slopes	2,741		.1
Kimbrough gravelly loam, 0 to 3 percent slopes	49,664	196,577	8.8
Kimbrough-Lea complex	145,384	588,347	26.1
Kimbrough-Sharvana complex	1,461	25,367	1.0
Largo-Pajarito complex		9,744	.3
Lea fine sandy loam	2,970		.1
Lea loam	37,133		1.3
Maljamar and Palomas fine sands, 0 to 3 percent slopes		16,182	.6
Mansker loam, 0 to 1 percent slopes	9,416		.3
Mansker loam, 0 to 3 percent slopes		693	(1)
Mansker loam, 1 to 3 percent slopes	5,341		.2
Midessa loam		5,994	.2
Midessa and Wink fine sandy loams		49,459	1.8
Mixed alluvial land		4,690	.2
Mobectie-Potter association, 1 to 15 percent slopes		11,421	.4
Playas	2,504		.1
Portales fine sandy loam, 0 to 1 percent slopes	8,953		.3
Portales fine sandy loam, 1 to 3 percent slopes	2,053		.1
Portales loam, 0 to 1 percent slopes	28,321		1.0
Portales loam, 0 to 3 percent slopes		26,480	1.0
Portales loam, 1 to 3 percent slopes	1,273		(1)
Portales and Gomez fine sandy loams		17,998	.7
Portales-Stegall loams		56,363	2.0
Pyote loamy fine sand		36,954	1.3
Pyote and Maljamar fine sands		335,578	11.9
Pyote soils and Dune land		78,707	2.8
Reeves loam		715	(1)
Reeves-Cottonwood association		2,211	.1
Sharvana loamy fine sand	4,548	25,426	1.1
Sharvana fine sandy loam	7,385	7,736	.6
Simona fine sandy loam, 0 to 1 percent slopes	5,775		.2
Simona fine sandy loam, 0 to 3 percent slopes		69,832	2.5
Simona fine sandy loam, 1 to 3 percent slopes	4,750		.2

See footnote at end of table.

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

Soil	Acres		Percent
	Medium intensity	Low intensity	
Simona-Upton association		65, 106	2. 3
Slaughter loam	13, 975		. 5
Stegall loam	60, 414		2. 2
Stegall silty clay loam	1, 968		. 1
Stegall and Slaughter soils		25, 749	. 9
Stony rolling land		2, 777	. 1
Tivoli-Brownfield fine sands, 0 to 5 percent slopes		17, 248	. 6
Tivoli soils and Dune land, 0 to 12 percent slopes	5, 828		. 2
Tonuco fine sand, hummocky		7, 762	. 3
Tonuco loamy fine sand	659	53, 421	1. 9
Wink fine sand		15, 140	. 6
Wink loamy fine sand		8, 624	. 3
Zita fine sandy loam	1, 237		(1)
Zita loam	8, 475		. 3
Total	2, 811, 520		100. 0

[1] Less than 0.05 percent.

Active Dune Land

Active dune land (Ac) is made up of light-colored, loose sands. It is in the northern, eastern, and southern parts of Lea County. A small acreage occurs within the low intensity area.

Active dune land is closely associated with most of the coarse-textured soils in Lea County. It is closely associated with Brownfield soils, but differs in that it is a uniform, loose, single-grain fine sand; is less red; and occupies a more rolling, dunelike topography. Active dune land is also closely associated with Springer soils, but differs in having uniform texture within the upper 6 to 10 feet. It is also closely associated with Gomez soils.

The depth or thickness of the sand ranges from 6 to 20 feet. In a few places there are thin layers of calcareous material recently blown out from limy depressions. Only a slight accumulation of organic matter and darkening has taken place in the upper few inches, and the color ranges from light gray to reddish brown. The slope range is 5 to 12 percent or more.

Permeability is very rapid, and runoff is very slow. The hazard of soil blowing is very severe.

The surface is mostly bare. In places there are annuals and a few shin oak shrubs. This land type is used for wildlife and recreation. Dryland capability unit VIIIe-1; wildlife habitat group A.

Amarillo Series

The Amarillo series consists of well-drained soils that have a sandy clay loam subsoil. These soils formed in wind-deposited and water-laid, sandy calcareous sediments on alluvial fans and upland plains. Slopes are 0 to 3 percent. The vegetation consists of mid grasses, annuals, mesquite, and cactus. The annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. The elevation ranges from 3,600 to 4,400 feet. These soils are associated with Arvana and Brownfield soils.

Typically, the surface layer is reddish-brown fine sandy loam about 8 inches thick. The subsoil is red to reddish-yellow sandy clay loam about 28 inches thick. The substratum, to a depth of 60 inches or more, is pink chalky loam. In places the surface layer is loam, loamy fine sand, or fine sand.

Amarillo soils are used for irrigated and dryland crops, wildlife, range, and recreation.

Amarillo fine sandy loam, 0 to 1 percent slopes (Af).—This soil is on uplands in the eastern and northeastern parts of Lea County. Included in mapping are small areas of Arvana fine sandy loam, 0 to 1 percent slopes.

Representative profile of Amarillo fine sandy loam, 0.15 mile south of the northwest corner of sec. 16, T. 13 S., R. 38 E., and 100 feet west of a fence:

A11—0 to 2 inches, reddish-brown (5YR 5/4) loamy sand to sandy loam, reddish brown (5YR 4/4) when moist; weak, medium, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; many fine interstitial pores; neutral (pH 7.1), noncalcareous; abrupt boundary. 0 to 8 inches thick.

A12—2 to 8 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak, medium, prismatic structure and moderate, fine, granular; soft, very friable when moist, nonsticky and nonplastic when wet; many coarse and fine roots; many fine interstitial pores; common worm casts; neutral (pH 7.2), noncalcareous; clear boundary. 6 to 8 inches thick.

B21t—8 to 14 inches, red (2.5YR 4/6) sandy clay loam, dark red (2.5YR 3/6) when moist; strong, medium, prismatic structure and weak, fine, subangular blocky; hard, firm when moist, slightly sticky and nonplastic when wet; many fine roots; many fine tubular pores; few, fine, generally rounded concretions of segregated iron and manganese; common worm casts and channels; few, thin, patchy clay films; neutral (pH 7.3), noncalcareous; clear boundary. 6 to 10 inches thick.

B22t—14 to 36 inches, reddish-yellow (5YR 6/6) heavy sandy clay loam, yellowish red (5YR 5/6) when moist; strong, coarse, prismatic structure; very hard, firm when moist, slightly sticky and nonplastic when wet; many fine roots and organic stains around root channels; many fine tubular pores; few worm casts; thin patchy clay films; neutral (pH 7.3), noncalcareous; gradual boundary. 10 to 30 inches thick.

Cca—36 to 60 inches, pink (5YR 8/3) chalky loam, more than 50 percent soft caliche, pink (5YR 7/3) when moist; massive; soft, very friable when moist, slightly sticky and slightly plastic when wet; moderately alkaline (pH 8.3), strongly calcareous.

The A horizon ranges from 7.5YR to 5YR in hue, from 4 to 5 in value when dry and from 3 to 4 when moist, and from 2 to 4 in chroma. The B2t horizon ranges from light to heavy sandy clay loam. It ranges from 2.5YR to 7.5YR in hue and from 4 to 8 in chroma. The thickness of the solum is 22 to 56 inches. Where Amarillo soils are mapped with Arvana soils, the Cca horizon in places is weakly cemented below a depth of 36 inches.

This soil is moderately permeable. Surface runoff is slow. Water intake is rapid. Available water holding capacity is 7 to 9 inches. Roots penetrate to more than 60 inches in places. Soil blowing is a moderate hazard.

Cotton, small grain, sorghum, and alfalfa are the main crops. This soil is also used for range, wildlife, and recreation. Irrigated capability unit IIe–2; dryland capability unit IIIe–1; Sandy range site; wildlife habitat group B.

Amarillo fine sandy loam, 1 to 3 percent slopes (Ag).—This soil occupies areas of 40 to 160 acres in the eastern and northeastern parts of the county. It is associated with Amarillo fine sandy loam, 0 to 1 percent slopes. Included with this soil in mapping were small areas of Arvana soils and Amarillo loamy fine sand, 0 to 3 percent slopes.

Except for slope, this soil is similar to Amarillo fine sandy loam, 0 to 1 percent slopes. Runoff is medium. Erosion is a moderate hazard.

Cotton, sorghum, small grain, and alfalfa are grown on this soil. Some of the acreage is used for range, some for wildlife, and some for recreation. Irrigated capability unit IIIe-4; dryland capability unit IIIe-1; Sandy range site; wildlife habitat group B.

Amarillo loam, 0 to 1 percent slopes (Ah).—This soil is in long broad swales. Included with this soil in mapping are small tracts of Lea loam and Stegall loam.

This soil has a brown loam surface layer and a reddish-brown sandy clay loam subsoil. Otherwise, it is similar to Amarillo fine sandy loam, 0 to 1 percent slopes. The delineations are long and narrow. In places along swales and drains, they are several miles long and less than one-fourth mile wide. Slopes are typically less than 0.5 percent, but range to 1 percent near the sides of drains. Soil blowing is a moderate hazard. Available water holding capacity is 8 to 10 inches.

This soil is used mainly for range. Small grain, alfalfa, sorghum, and cotton are grown in a few areas. The soil is also used as wildlife habitat and recreational sites. Irrigated capability unit IIe-1; dryland capability unit IIIec-1; Loamy range site; wildlife habitat group B.

Amarillo loamy fine sand, 0 to 3 percent slopes (Ad).—This soil is in the northern and eastern parts of Lea County. Included in mapping are areas of Amarillo loamy fine sand, 0 to 3 percent slopes, eroded; Arvana loamy fine sand, 0 to 3 percent slopes; and Brownfield and Patricia fine sands.

This soil is similar to Amarillo fine sandy loam, 0 to 1 percent slopes, but its surface layer is loamy fine sand and 8 to 10 inches thick. Where this soil is plowed to a depth of 12 to 15 inches, some of the sandy clay loam subsoil is mixed with the surface layer. Runoff is very slow. Available water holding capacity is 6 to 8 inches. Soil blowing is a severe hazard.

This soil is used for range and irrigated small grain, sorghum, and alfalfa. Irrigated capability unit IIIe-10; dryland capability unit IVe-4; Sandy range site; wildlife habitat group B.

Amarillo loamy fine sand, 0 to 3 percent slopes, eroded (Ae).—This soil is in the northern and northeastern parts of Lea County. Included in mapping are small areas of Arvana and Brownfield soils.

This soil is similar to Amarillo fine sandy loam, 0 to 1 percent slopes, but its surface layer is loamy fine sand, it is more sloping, and it is eroded. This soil is intermingled with dunes and hummocks in about half of the unit. The rest is blown-out depressions that expose the red sandy clay loam subsoil. Runoff is very slow. Available water holding capacity is 5 to 7 inches. Soil blowing is a severe hazard.

Some of the acreage is irrigated by sprinklers and produces feed crops. The soil is also used as range, wildlife habitat, and recreational sites. Irrigated capability unit IVe-8; dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group C.

Amarillo-Arvana loamy fine sands association (0 to 3 percent slopes) (AB).—This association is about 50 percent Amarillo loamy fine sand, 0 to 3 percent slopes, and 40 percent Arvana loamy fine sand, 0 to 3 percent slopes. The rest is Portales, Mansker, Brownfield, Patricia, and Tivoli soils. Gomez soils are closely associated with these soils in the northeastern part of Lea County.

The Amarillo soil is similar to Amarillo fine sandy loam, 0 to 1 percent slopes, but its surface layer differs in texture and is about 8 inches thick. The Arvana soil is similar to Arvana fine sandy loam, 0 to 1 percent slopes, except for texture of the surface layer. (See Arvana Series.) Runoff is very slow. Available water holding capacity in Amarillo soil is 6 to 8 inches, and in Arvana soil 4 to 6 inches. Soil blowing is a severe hazard.

The soils in this association are used as range and wildlife habitat. Amarillo soil: Dryland capability unit IVe-4; Sandy range site; wildlife habitat group B. Arvana soil: Dryland capability unit IVe-5; Sandy range site; wildlife habitat group B.

Amarillo-Arvana association, eroded (0 to 3 percent slopes) (AS).—This soil is about 50 percent Amarillo loamy fine sand, 0 to 3 percent slopes, eroded, and 35 percent Arvana loamy fine sand, 0 to 3 percent slopes, eroded. The rest is Amarillo fine sandy loam, 0 to 1 percent slopes, Brownfield and Patricia fine sands, and Tivoli soils and Dune land, 0 to 12 percent slopes.

The Amarillo soil is similar to Amarillo fine sandy loam, 0 to 1 percent slopes, except for slope, the soil blowing hazard, and the loamy fine sand texture of the surface layer. The Arvana soil is similar to Arvana fine sandy loam, 0 to 1 percent slopes, but its surface layer is

loamy fine sand or red sandy clay loam. Runoff is very slow. The available water holding capacity is 6 to 8 inches in Amarillo soil and 4 to 6 inches in Arvana soil. Soil blowing is a severe hazard.

The soils in this association are used as range and wildlife habitat and are sources of water supply. Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group C.

Amarillo-Arvana fine sandy loams association (0 to 3 percent slopes) (AL).—This association is about 60 percent Amarillo fine sandy loam and 30 percent Arvana fine sandy loam. The rest is Portales fine sandy loam, 0 to 1 percent slopes, and Brownfield and Patricia fine sands.

The Amarillo soil is similar to Amarillo fine sandy loam, 0 to 1 percent slopes. The Arvana soil is similar to Arvana fine sandy loam, 0 to 1 percent slopes.

The soils in this association are used as range and wildlife habitat. Amarillo soil: Dryland capability unit IIIe-1; Sandy range site; wildlife habitat group B. Arvana soil: Dryland capability unit IVe-6; Sandy range site; wildlife habitat group B.

Amarillo-Gomez fine sands (0 to 3 percent slopes) (AK).—This complex is on plains in the northeastern part of Lea County. It is about 50 percent Amarillo fine sand and 40 percent Gomez fine sand. The rest is mostly Portales, Arch, and Springer soils.

The Amarillo soil is similar to Amarillo fine sandy loam, 0 to 1 percent slopes, but its surface layer is fine sand about 12 inches thick. The Gomez soil is similar to Gomez loamy fine sand (see Gomez Series), but its surface layer is fine sand about 10 inches thick. Runoff is very slow. Soil blowing is a severe hazard.

The acreage is used as range, recreational areas, and wildlife habitat. Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group F.

Amarillo-Gomez fine sands (0 to 3 percent slopes) (AU).—This complex is on plains in the northeastern part of Lea County. It is about 55 percent Amarillo fine sand and 30 percent Gomez fine sand. The rest is Arch, Portales, and Springer soils.

The Amarillo soil is similar to Amarillo fine sandy loam, but its surface layer is fine sand about 16 inches thick. The Gomez soil is similar to Gomez loamy fine sand, but it has a fine sand surface layer about 13 inches thick. Runoff is very slow. Soil blowing is a severe hazard.

These soils are used as range, recreational areas, and wildlife habitat. Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group F.

Arch Series

The Arch series consists of well-drained, calcareous soils that have a loam to light clay loam surface layer and loam to clay loam underlying material. These soils formed in gray chalky old alluvium modified by the calcium carbonate deposited by ground water. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses, annuals, snakeweed, and mesquite. The average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. The elevation ranges from 3,600 to 4,000 feet. These soils are associated with Drake soils.

Typically, the surface layer is light brownish-gray loam about 10 inches thick. The next layer is light-gray heavy loam about 6 inches thick. The substratum, to a depth of 60 inches and more, is white silty clay loam and clay loam and has a high lime content. The soils are calcareous throughout.

Arch soils are used mainly as range and wildlife habitat. Part of the acreage is irrigated cropland.

Arch loam (0 to 1 percent slopes) (AM).—This soil is in low concave areas or on benches of shallow intermittent playa lakes. Included in mapping are areas of Drake, Gomez, and Portales soils.

Representative profile of Arch loam, south-central part of southwest quarter of sec. 27, T. 19 S., R. 38 E., east of the T & NM Railroad:

A1—0 to 10 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure in upper inch to weak, fine, granular; soft, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; few fine and medium tubular pores; moderately alkaline (pH 8.0); few, segregated, generally rounded, fine concretions of calcium carbonate; strongly calcareous; clear boundary. 5 to 11 inches thick.

AC—10 to 16 inches, light-gray (10YR 7/2) heavy loam, light brownish gray (10YR 6/2) when moist; brown organic stain in places; weak, fine and medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common fine roots; few fine tubular pores; moderately alkaline (pH 8.2), strongly calcareous; gradual boundary. 5 to 9 inches thick.

Cca—16 to 60 inches, white (10YR 8/1) soft caliche of silty clay loam to clay loam texture, gray (10YR 6/1) when moist; weak, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; few fine roots in the upper inches; few fine and medium tubular pores; strongly alkaline (pH 8.6), strongly calcareous.

The A horizon ranges from loam to light clay loam in texture, from 4 to 6 in value, and from 2 to 4 in chroma. The AC horizon is loam to light clay loam, values are 6 to 7, and chroma is 2 to 3. The Cca horizon is soft to weakly cemented and at a depth of 10 to 20 inches.

This soil is moderately permeable. Runoff is slow. Water intake is moderate. Available water holding capacity is 3 to 5 inches. Roots penetrate to a depth of 10 to 20 inches over the strongly limy substratum. Soil blowing is a severe hazard.

This soil is used mainly as range and wildlife habitat. Part of the acreage is irrigated cropland. Cotton, sorghum, small grains, and alfalfa are grown. Irrigated capability unit IVe-9; dryland capability unit VIe-4; Sandy range site; wildlife habitat group D.

Arch-Drake association (0 to 3 percent slopes) (AV).—This association is about 45 percent Arch loam and about 45 percent Drake loamy fine sand. The rest is Portales, Mansker, and Gomez soils.

The Arch soil is similar to Arch loam. It is generally on concave benches along playa lakes. In places where the sides of these lakes are sheltered from the wind, there are higher benches occupied by Drake loamy fine sand. The Drake soil is similar to Drake loamy fine sand. (See Drake Series.)

The soils in this association are used as range and wildlife habitat. Arch soil: Dryland capability unit VIe-4; Sandy range site; wildlife habitat group C. Drake soil: Dryland capability unit VIIe-1; Sandy range site; wildlife habitat group C.

Arvana Series

The Arvana series consists of well-drained soils that have a sandy clay loam subsoil overlying indurated caliche at a depth of 20 to 34 inches. These soils formed in wind-deposited and alluvial sandy calcareous sediments over indurated caliche. They are on upland plains. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses, thorny shrubs, and annuals. The average annual precipitation is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,600 to 4,400 feet. These soils are associated with Amarillo and Tonuco soils.

Typically, the surface layer is reddish-brown fine sandy loam about 6 inches thick. In places it is loamy fine sand or loam. The subsoil is reddish-brown to red, light to heavy sandy clay loam about 22 inches thick. The substratum is pinkish-white indurated caliche. In most places reaction is neutral above the indurated caliche layer.

Arvana soils are used as cropland, range, and wildlife habitat.

Arvana fine sandy loam, 0 to 1 percent slopes (Ap).—This soil is on uplands and in some of the broad swales in the northern half of Lea County. It is 20 to 34 inches deep over indurated caliche. Included with this soil in mapping are small areas of Amarillo, Portales, and Mansker soils.

Representative profile 0.1 mile west of the New Mexico-Texas State line, 25 feet north of county road, southeast quarter of sec. 11, T. 14 S., R. 38 E.:

A1—0 to 6 inches, reddish-brown (5YR 4/4) fine sandy loam, dark reddish brown (5YR 3/4) when moist; weak, fine, granular structure and weak, medium, subangular blocky; soft, friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine interstitial pores; few sand pockets intermixed; neutral (pH 7.0), noncalcareous; clear boundary. 4 to 10 inches thick.

B21t—6 to 16 inches, reddish-brown (5YR 4/4) light sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, fine and medium, subangular blocky structure; soft, friable when moist, sticky and slightly plastic when wet; many fine roots; many fine interstitial pores; few worm casts; neutral (pH 7.2), noncalcareous; clear boundary. 8 to 10 inches thick.

B22t—16 to 28 inches, red (2.5YR 4/6) heavy sandy clay loam, dark red (2.5YR 3/6) when moist; moderate, medium, prismatic structure and strong, medium, subangular blocky; hard, firm when moist, sticky and slightly plastic when wet; common fine roots; thin patchy clay films; neutral (pH 7.3), noncalcareous; clear boundary. 8 to 14 inches thick.

Ccam—28 inches, pinkish-white (7.5YR 8/2) indurated caliche; about 1 inch of broken caliche fragments over the indurated caliche.

The A horizon ranges from light fine sandy loam to heavy fine sandy loam and from reddish brown to dark reddish brown or brown. In places, an inch of loamy fine sand covers the surface. The B2t horizon ranges from reddish brown to yellowish red or red. In some places a thin, transitional, calcareous layer lies between the B2t horizon and the Ccam horizon. The indurated caliche begins at a depth of 20 to 34 inches. In places it is fragmental in the upper 10 to 12 inches. Below this it is thick and massive. It ranges from 2 to 6 feet or more in thickness and grades to soft or weakly cemented caliche.

This soil is moderately permeable. Runoff is slow. Water intake is rapid, and the available water holding capacity is 5 to 7 inches. Roots penetrate to a depth of 20 to 34 inches over the indurated caliche. Soil blowing is a moderate hazard.

Irrigated and dryfarmed crops grown are cotton, small grain, sorghum, and alfalfa. Large areas are used as range and wildlife habitat. Irrigated capability unit IIe-9; dryland capability unit IVe-6; Sandy range site; wildlife habitat group D.

Arvana fine sandy loam, 1 to 3 percent slopes (Ar).—This soil has long slopes. Except for slope, it is similar to Arvana fine sandy loam, 0 to 1 percent slopes. Included with this soil in mapping were small areas of Amarillo, Portales, and Mansker soils. Runoff is medium, and erosion is a moderate hazard.

Most of the acreage is cultivated and is used chiefly for cotton, sorghum, and small grain. Irrigated capability unit IIIe-7; dryland capability unit IVe-6; Sandy range site; wildlife habitat group D.

Arvana loam, 0 to 1 percent slopes (At).—This soil occupies broad areas and long, narrow swales. Included in mapping were small areas of Amarillo, Lea, and Stegall soils.

This soil is similar to Arvana fine sandy loam, 0 to 1 percent slopes, except for the texture of the surface layer. Soil blowing is a moderate hazard. The water intake rate is moderate.

This soil is used for cultivated crops and improved pasture. Common crops are cotton, sorghum, small grain, and alfalfa. Some areas are used as range and wildlife habitat. Irrigated capability unit IIe-3; dryland capability unit IVec-2; Loamy range site; wildlife habitat group D.

Arvana loamy fine sand, 0 to 3 percent slopes (An).—This soil is in the northeastern and east-central parts of Lea County. Included with this soil in mapping were small areas of Amarillo, Brownfield, and Sharvana soils.

This soil is similar to Arvana fine sandy loam, 0 to 1 percent slopes, except that it has a surface layer of loamy fine sand 10 to 12 inches thick. Runoff is very slow. Soil blowing is a severe hazard.

This soil is used for irrigated cotton, sorghum, small grain, and alfalfa. Some areas are used as range and wildlife habitat. Irrigated capability unit IVe-6; dryland capability unit IVe-5; Sandy range site; wildlife habitat group D.

Arvana loamy fine sand, 0 to 3 percent slopes, eroded (Ao).—This soil is in the northeastern and east-central parts of Lea County. Included with this soil in mapping were small areas of Amarillo, Brownfield, and Tivoli soils.

This soil is similar to Arvana fine sandy loam, 0 to 1 percent slopes, but it has been severely eroded by wind. The texture of the exposed surface layer ranges from loamy sand to sandy clay loam. In places most of the surface layer has been removed, leaving bare sandy clay loam areas intermingled with low sand hummocks. In other places the subsoil has eroded to expose large fragments of indurated caliche. Most old, eroded fields are bordered on the east and north by large, barren sand dunes. In some places the hummocks are covered with shin oak or sand sagebrush, bluestem grasses, and scattered mesquite or catclaw mimosa. Slopes are mainly 1 to 2 percent.

Runoff is slow. Available water holding capacity is 3 to 6 inches. Rooting depth to indurated caliche is

dominantly 20 to 40 inches. Soil blowing is a severe hazard.

This soil is used for irrigated pasture and as range and wildlife habitat. Irrigated capability unit IVe-6; dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group C.

Arvana-Lea association (0 to 1 percent slopes) (AW).—This mapping unit is about 40 percent Arvana loam, 40 percent Lea loam, and 20 percent an Amarillo soil. It is in the northern part of Lea County, on plains and in long swales, on uplands, or in broad, concave lowlands.

Arvana soil is similar to Arvana fine sandy loam, 0 to 1 percent slopes, except that the surface layer is loam about 8 inches thick and the upper part of the subsoil is heavy sandy clay loam. The Lea soil is similar to Lea loam (see Lea Series).

Water intake rate is moderate. The hazard of soil blowing is moderate.

These soils are used as range and wildlife habitat. Dryland capability unit IVec-2; Loamy range site; wildlife habitat group D.

Badland

Badland (BD) is in the San Simon Sink and near several salt lake areas bordering Eddy County. It is made up of barren areas of soft, water-laid and wind-laid sediments. No stones occur, but light-gray interbedded sands and silts are exposed in the walls and along the rims of lakes and sinks. The slope range is 15 to 30 percent. Many recent gullies cut the slopes, leaving a rough and denuded landscape. The floor of San Simon Sink is an irregular, wavy, barren exposure of soft, water-laid materials. In a few places some soil accumulation supports a few weeds and shrubs.

Included in mapping were small areas of Arch, Mansker, Portales, and Drake soils, and near Lane Salt Lake and Williams Lake, some areas of Active dune land that border the eroded and denuded salt basins.

Runoff is very rapid, and erosion is a very severe hazard.

This area has no agricultural value. Much of the surface runoff serves to recharge the ground water system. The erosion on this land type is a source of sedimentation. Dryland capability unit VIIIe-2; wildlife habitat group A.

Berino Series

The Berino series consists of well-drained soils that have a light sandy clay loam subsoil. These are undulating to hummocky soils on upland plains in the "deep sand country" in the southern part of Lea County. They formed in wind-worked sands of mixed origin overlying alluvial, sandy, calcareous sediments. Slopes are 0 to 3 percent. The vegetation consists of mid and tall grasses and shrubs. The average annual precipitation is 10 to 13 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 195 to 205 days. Elevations range from 3,000 to 3,400 feet. These soils are closely associated with Maljamar, Palomas, and Cacique soils.

Typically, the surface layer is reddish-brown loamy fine sand about 6 inches thick. The subsoil is red light sandy clay loam about 42 inches thick. The substratum, to a depth of 60 inches and more, is pink light sandy clay loam that has a high lime content.

Berino soils are used as wildlife habitat, range, and recreational areas. Indian artifacts can be found in some areas.

Berino-Cacique loamy fine sands association (0 to 3 percent slopes) (BE).—About 50 percent of this association is Berino soils and about 40 percent is Cacique soils. The rest is Maljamar, Palomas, and Tonuco soils. This association is mostly in the southern part of Lea County.

Representative profile of Berino loamy fine sand in an area of Berino-Cacique loamy fine sands association, northeast quarter of sec. 16, T. 24 S., R. 34 E., about three-fourths of a mile north of highway:

A1—0 to 6 inches reddish-brown (5YR 4/4) loamy fine sand, dark reddish brown (5YR 3/4) when moist; weak, fine, granular structure; soft, friable when moist, nonsticky and nonplastic when wet; many fine roots; neutral (pH 7.0), noncalcareous; smooth, abrupt boundary. 4 to 10 inches thick.

B1—6 to 16 inches, red (2.5YR 4/6) light sandy clay loam, dark red (2.5YR 4/6) when moist; moderate, medium, subangular blocky structure; soft, friable when moist, nonsticky and nonplastic when wet; many medium roots; neutral (pH 7.0), noncalcareous; smooth, clear boundary. 4 to 12 inches thick.

B2t—16 to 30 inches, red (2.5YR 5/6) light sandy clay loam, red (2.5YR 4/6) when moist; strong, medium, subangular blocky structure; slightly hard, friable when moist, sticky and slightly plastic when wet; common medium and fine roots; moderately thick clay films; neutral (pH 7.1), noncalcareous; gradual boundary. 12 to 20 inches thick.

B3—30 to 48 inches, red (2.5YR 5/6) light sandy clay loam, red (2.5YR 5/8) when moist; weak, coarse, prismatic and weak, fine, granular structure; slightly hard, friable when moist, sticky and slightly plastic when wet; few fine roots; neutral (pH 7.3), noncalcareous; clear boundary. 7 to 20 inches thick.

Cca—48 to 60 inches, pink (7.5YR 7/4) light sandy clay loam, light brown (7.5YR 6/4) when moist; massive; soft, friable when moist, slightly sticky and slightly plastic when wet; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from brown to reddish brown. It is loamy sand to loamy fine sand and in places has a thin layer of fine sand on the surface. Reaction of the A horizon is neutral to mildly alkaline. The B horizon ranges from reddish brown to yellowish red or red. It is heavy fine sandy loam to sandy clay loam. The clay content is 18 to 30 percent. The B2t horizon is generally neutral but in places is mildly alkaline in the lower part. The Cca horizon is commonly at a depth of 29 to 60 inches, and lime content ranges from moderate to high. The Cca horizon is soft or strongly cemented caliche in some areas where Berino soils are associated with Cacique soils.

The Berino soil is moderately permeable. Runoff is very slow. Water intake is rapid. Available water holding capacity is 7 to 10 inches. Roots penetrate to a depth of 60 inches or more. Soil blowing is a severe hazard.

A representative profile of Cacique loamy fine sand is described under the heading "Cacique Series."

The Cacique soil is moderately permeable. Runoff is very slow. Water intake is rapid, and the available water holding capacity is 3 to 6 inches. Root penetration

is restricted by the indurated caliche at a depth of 20 to 34 inches. Soil blowing is a severe hazard.

The soils in this association are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-2; Sandy range site; wildlife habitat group G.

Berino-Cacique association, hummocky (0 to 3 percent slopes) (BH).—This mapping unit is about 50 percent Berino fine sand, 40 percent Cacique fine sand, and 10 percent Kermit, Maljamar, and Palomas soils. These soils are on low sand dunes and hummocks intermingled with small concave areas where the red sandy clay subsoil is exposed. The hummocks consist of surface soil that was blown from adjacent areas and deposited around clumps of vegetation, mostly shin oak and common mesquite shrubs.

The Berino soil is similar to Berino loamy fine sand, but its surface layer is fine sand about 10 inches thick. The Cacique soil is similar to Cacique loamy fine sand, but it has a fine sand surface layer about 7 inches thick.

The soils in this association are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-2; Deep Sand range site; wildlife habitat group C.

Berino-Cacique fine sandy loams association (0 to 3 percent slopes) (BF).—This mapping unit is about 50 percent Berino fine sandy loam, 40 percent Cacique fine sandy loam, and 10 percent Pyote, Kermit, and Wink soils.

The Berino soil is similar to Berino loamy fine sand, but its surface layer is fine sandy loam about 8 inches thick. The Cacique soil is similar to Cacique loamy fine sand, but its surface layer is fine sandy loam about 8 inches thick.

Runoff is slow. Water intake is moderate. Soil blowing is a moderate hazard.

These soils are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-3; Sandy range site; wildlife habitat group G.

Brownfield Series

The Brownfield series consists of well-drained soils that have a thick surface layer of fine sand and a sandy clay loam subsoil. They formed in wind-deposited sands on uplands in the northern part of Lea County. Slopes are 0 to 3 percent. The vegetation consists of tall and mid grasses and shrubs. The average annual precipitation is 12 to 15 inches, the average annual air temperature ranges from 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,600 to 4,400 feet. These soils are associated with Patricia, Amarillo, Springer, and Tivoli soils.

Typically, the surface layer is light-brown fine sand about 22 inches thick. The subsoil is red sandy clay loam to a depth of 63 inches.

Brownfield soils are used mostly as range, but also as wildlife habitat and recreational areas. Indian artifacts can be found in some areas.

Brownfield and Patricia fine sands (0 to 3 percent slopes) (Bp).—This mapping unit is about 45 percent Brownfield fine sand, 45 percent Patricia fine sand, and 10 percent Amarillo, Gomez, and Springer soils. These nearly level to gently undulating soils are in the northern and northeastern parts of Lea County. Some areas are almost entirely Brownfield soil, some are almost entirely Patricia soil, and some areas contain both soils.

These soils are similar except for the thickness of the surface layer. The surface layer of Brownfield fine sand is 20 to 32 inches thick. The surface layer of Patricia fine sand is 8 to 20 inches thick.

Representative profile of Brownfield fine sand in an area of Brownfield and Patricia fine sands, southeast quarter of sec. 14, T. 11 S., R. 38 E.:

A11—0 to 8 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine and medium roots; many organic stains; neutral (pH 6.8), noncalcareous; abrupt boundary. 7 to 12 inches thick.

A12—8 to 22 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine and medium roots; very few organic stains; neutral (pH 6.9); abrupt boundary. 13 to 20 inches thick.

B2t—22 to 42 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; moderate, coarse, prismatic and weak, medium, subangular blocky structure; hard, firm when moist, sticky and slightly plastic when wet; many fine and medium roots; few sand-filled root channels; very few organic stains; continuous thin clay films; few, segregated, generally rounded iron and manganese concretions in lower part; neutral (pH 7.1), noncalcareous; clear boundary. 12 to 40 inches thick.

B3—42 to 63 inches, red (2.5YR 5/6) light sandy clay loam, red (2.5YR 4/6) when moist; slightly sandier and lighter in color with increasing depth; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; neutral (pH 7.2) grading to mildly alkaline (pH 7.5), noncalcareous.

The A horizon ranges from 5YR to 10YR in hue, and the B horizon ranges from 2.5YR to 5YR. The B horizon is 18 to 30 percent clay. Reaction throughout the B horizon is neutral to mildly alkaline.

The Brownfield soil is moderately permeable. Runoff is very slow. Water intake rates are rapid. The available water holding capacity ranges from 6 to 8 inches. Roots penetrate to a depth of more than 60 inches. Soil blowing is a severe hazard.

A representative profile of Patricia fine sand is described under the heading "Patricia Series."

Patricia fine sand is moderately permeable. Surface runoff is very slow. Water intake is rapid. The available water holding capacity is 6 to 8 inches. The effective rooting depth is 60 inches and more. Soil blowing is a severe hazard.

Soils in this unit are used as range and wildlife habitat. Patricia fine sand is suitable for growing irrigated crops and can be plowed deep to mix the sandy clay loam subsoil with the fine sand surface layer.

Brownfield soil: Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group F. Patricia soil: Irrigated capability unit IVe-11; dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group F.

Brownfield and Patricia fine sands (0 to 3 percent slopes) (BN).—This mapping unit is about 55 percent Brownfield fine sand, 35 percent Patricia fine sand, and 10 percent inclusions of Tivoli soils and Dune land and of Springer, Amarillo, and Gomez soils. These soils are in the northern part of the county.

The soils in this mapping unit are more undulating than the Brownfield and Patricia fine sands in the medium intensity survey area.

These soils are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group F.

Brownfield and Particia fine sands, eroded (0 to 3 percent slopes) (Br).—This mapping unit is about 45 percent Brownfield fine sand, 45 percent Patricia fine sand, and 10 percent inclusions of Tivoli, Springer, and Gomez soils. These soils are in the northern and northeastern parts of Lea County. Some areas are almost entirely Brownfield soil, and others are almost entirely Patricia soil. The landscape is one of dunes and hummocks in a complex, choppy terrain. The sand dunes are 3 to 6 feet high and 8 to 20 feet or more in diameter. In places concave eroded areas expose the red sandy clay loam subsoil.

These soils are similar to those described as representative of Brownfield fine sand and Patricia fine sand except for thickness of the surface layer. In places part of the surface layer has been removed through soil blowing, and in other places sand has accumulated, making the surface layer thicker than that of the representative profile.

These soils are used as range and wildlife habitat. They are not suitable for cropland. Dryland capability unit VIIe-1; Sand Hills (HP) range site; wildlife habitat group C.

Brownfield-Springer association (0 to 3 percent slopes) (BO).—This mapping unit is about 60 percent Brownfield fine sand, 30 percent Springer loamy fine sand, and 10 percent inclusions of Tivoli, Gomez, Patricia, and Amarillo soils. The landscape is one of billowy and undulating, low sand dunes intermingled with nearly level sandy areas. This association is on low dunes in places.

The Brownfield soil is similar to Brownfield fine sand. A representative profile of Springer loamy fine sand is described under the heading "Springer Series."

The Springer soil has moderately rapid permeability. Runoff is very slow. Water intake is rapid, and available water holding capacity is 6 to 8 inches. Roots penetrate to a depth of 60 inches and more. Soil blowing is a severe hazard.

These soils are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group F.

Brownfield-Springer association, hummocky (0 to 3 percent slopes) (BS).—This mapping unit is about 65 percent Brownfield soils, 25 percent Springer soils, and about 10 percent inclusions of Tivoli, Amarillo, and Arvana soils. Hummocks and dunes form a complex pattern of concave and convex, rolling terrain. The dunes are 3 to 6 feet high and 8 to 20 feet or more in diameter. Soil blowing has exposed the red sandy clay loam or fine sandy loam subsoil in the concave, barren areas.

The Springer soil has a fine sand surface layer about 8 inches thick. Otherwise it is similar to Springer loamy fine sand.

These soils are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-1; Sand Hills (HP) range site; wildlife habitat group C.

Cacique Series

The Cacique series consists of well-drained soils that have a sandy clay loam subsoil underlain by indurated caliche at a depth of 20 to 34 inches. These soils formed in a thin, wind-laid mantle of sands of mixed origin. They are on uplands, in range areas in the southern part of Lea County. Slopes are 0 to 3 percent. The vegetation consists of mid grasses and shrubs. The average annual precipitation is 10 to 13 inches, the annual average air temperature is 60° to 62° F., and the frost-free season is 195 to 205 days. Elevations range from 3,000 to 3,400 feet. These soils are associated with Berino, Tonuco, and Palomas soils.

Typically, the surface layer is reddish-brown to yellowish-red loamy fine sand about 12 inches thick. In places it is fine sand or fine sandy loam. The subsoil is red sandy clay loam about 16 inches thick. It is underlain by white indurated caliche.

The Cacique soils in this county are mapped only with Berino soils. They are used as range, wildlife habitat, and recreational areas.

Representative profile of Cacique loamy fine sand in an area of Berino-Cacique loamy fine sands association, about 1.6 miles south of Eunice cemetery fence, 0.2 mile east of State Highway No. 18 along caliche road, 0.2 mile north of the south line of sec. 10, T. 22 S., R. 37 E.:

A11—0 to 4 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) when moist; weak, medium, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; no roots; few organic areas; neutral (pH 7.1), noncalcareous; clear boundary. 3 to 6 inches thick.

A12—4 to 12 inches, yellowish-red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; very weak, coarse, prismatic and weak, medium, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; no roots; neutral (pH 7.1), noncalcareous; gradual boundary. 6 to 8 inches thick.

B2t—12 to 24 inches, red (2.5YR 5/6) light sandy clay loam, red (2.5YR 4/6) when moist; moderate, medium, subangular blocky and weak, coarse, prismatic structure; slightly hard, friable when moist, sticky and slightly plastic when wet; many medium roots; many organic stains; few, thin, patchy clay films bridging within sandy clay loam peds; neutral (pH 7.3), noncalcareous; clear boundary. 8 to 14 inches thick.

B3—24 to 28 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; weak, coarse, prismatic structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; few coarse roots; neutral (pH 7.3), noncalcareous; abrupt boundary. 3 to 6 inches thick.

Ccam—28 inches, pinkish-white (7.5YR 8/2) indurated caliche; less cemented with increasing depth.

The A horizon ranges from brown to reddish brown or yellowish red. It is loamy sand or loamy fine sand. The B horizon is red or yellowish-red heavy fine sandy loam that is 18 to 30 percent clay. The Ccam horizon is 5YR to 7.5YR in hue and is at a depth of 20 to 34 inches.

Cottonwood Series

The Cottonwood series consists of well-drained, calcareous loamy soils underlain by gypsum at a depth of 4 to 10 inches. These soils formed in thick beds of gypsiferous materials on uplands, near dry salt lakes. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses and shrubs. The average annual precipitation is

12 to 16 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,500 to 4,100 feet. These soils are associated with Reeves and Arch soils.

Typically, the surface layer is light brownish-gray loam about 8 inches thick. The substratum is white gypsum. The soil is strongly alkaline.

The Cottonwood soils in Lea County are mapped only with Reeves soils. They are used as range, wildlife habitat, and recreational areas.

Representative profile of Cottonwood loam in an area of Reeves-Cottonwood association, west of Ranger Lake NW¼NW¼ sec. 11, T. 11 S., R. 36 E.:

A—0 to 8 inches, light brownish-gray (10YR 6/2) loam, brown (10YR 5/3) when moist; moderate, medium, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; strongly calcareous, strongly alkaline (pH 8.5); clear boundary. 4 to 10 inches thick.

Ccs—8 inches, white (10YR 8/1) gypsum, light gray (10YR 7/1) when moist; massive; no roots; common fine calcium carbonate concretions. Many feet thick.

The A horizon ranges from loam to silty clay loam. It is light gray to reddish brown in hues of 10YR to 5YR. The Ccs horizon is either gypsum or gypsum mixed with pale-brown calcium carbonate.

Drake Series

The Drake series consists of calcareous, well-drained loamy sands to sandy loams underlain by heavy sandy loam to sandy clay loam. These soils are on low hills and ridges on the lee sides of large dry lakes and broad swales. They formed in windblown material from adjacent depressions. Slopes are 0 to 5 percent. The vegetation consists of mid and tall grasses, forbs, and shrubs. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,600 to 4,000 feet. These soils are associated with Arch and Gomez soils.

Typically, the surface layer is light brownish-gray loamy fine sand about 9 inches thick. The next layer is pale-brown heavy fine sandy loam about 9 inches thick. The upper part of the substratum, to a depth of 30 inches, is light-gray heavy fine sandy loam. The lower part, to a depth of 60 inches and more, is very pale brown sandy clay loam that contains a few lime concretions. These soils are calcareous throughout.

Drake soils are used as range and wildlife habitat.

Drake loamy fine sand (1 to 5 percent slopes) (Dr).—This soil is on low dunes on the lee side of large concave swales and playa lakes. Included in mapping are small areas of Arch soils.

Representative profile of Drake loamy fine sand, NE¼NE¼ sec. 31, T. 11 S., R. 36 E., 100 feet south of a fence:

A1—0 to 9 inches, light brownish-gray (10YR 6/2) loamy fine sand, grayish brown (10YR 5/2) when moist; weak, fine, granular structure; soft, very friable when moist nonsticky and nonplastic when wet; many fine roots; many fine interstitial pores; many worm casts; mildly alkaline (pH 7.7), moderately calcareous; abrupt boundary. 4 to 10 inches thick.

AC—9 to 18 inches, pale-brown (10YR 6/3) heavy fine sandy loam, brown (10YR 5/3) when moist; weak, fine, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many medium roots; common fine interstitial pores; few, fine, generally rounded, segregated calcium carbonate concretions; mildly alkaline (pH 7.8), moderately calcareous; clear boundary. 6 to 12 inches thick.

C1—18 to 30 inches, light-gray (10YR 7/2) heavy fine sandy loam, light brownish gray (10YR 6/2) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many medium roots; common fine interstitial pores; few, fine, generally rounded, segregated calcium carbonate concretions; mildly alkaline (pH 7.8), moderately calcareous; gradual boundary. 6 to 16 inches thick.

C2—30 to 60 inches, very pale brown (10YR 7/3) sandy clay loam, pale brown (10YR 6/3) when moist; weak, fine, granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common medium roots, the number decreasing with depth; common fine tubular pores; few organic stains; few, fine, generally rounded concretions of segregated calcium carbonate, the number increasing with depth; moderately alkaline (pH 8.3), strongly calcareous.

The A horizon ranges from grayish-brown to light brownish-gray loamy sand to sandy loam.

This soil is moderately permeable. Runoff is slow. Water intake is rapid, and the available water holding capacity is 7 to 9 inches. Roots penetrate to a depth of more than 60 inches. Soil blowing is a severe hazard.

This soil is used mostly as range and wildlife habitat. Dryland capability unit VIIe-1; Sandy range site; wildlife habitat group C.

Drake Series, Low Rainfall Variant

The Drake series, low rainfall variant, consists of calcareous, well-drained soils that have a loamy fine sand surface layer that is underlain by fine sandy loam and sandy clay loam. These soils formed in wind-deposited calcareous material on low, convex dunes on the eastern sides of playas in the southern part of Lea County. Slopes are 0 to 3 percent. The vegetation consists of mid grasses, forbs, and shrubs. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 200 to 205 days. Elevations range from 3,000 to 3,400 feet. These soils are associated with Jal, Midessa, and Wink soils.

Typically, the surface layer is pale-brown fine sand and very pale brown loamy fine sand about 12 inches thick. The next layer is white heavy fine sandy loam about 4 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown sandy clay loam. The soil is calcareous throughout.

The Drake low rainfall variant in Lea County is mapped only with Jal soils. It is used as range and wildlife habitat.

Representative profile of Drake loamy fine sand, low rainfall variant, in an area of Jal association, 0.1 mile west of the northeast corner of sec. 20, T. 21 S., R. 32 E.:

A11—0 to 2 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 4/3) when moist; very weak, thin, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common very fine interstitial pores; moderately alkaline (pH 8.0), slightly calcareous; clear, wavy boundary. 0 to 3 inches thick.

A12—2 to 12 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) when moist; weak, medium, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common very fine interstitial pores and few fine tubular pores; few fine lime concretions; moderately alkaline (pH 8.1), moderately calcareous; abrupt, wavy boundary. 6 to 12 inches thick.

C1—12 to 16 inches, white (10YR 8/2) heavy fine sandy loam, light gray (10YR 7/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, slightly sticky and nonplastic when wet; many fine roots; many fine tubular pores; common fine lime concretions; moderately alkaline (pH 8.1), strongly calcareous; abrupt, wavy boundary. 3 to 11 inches thick.

C2—16 to 60 inches, very pale brown (10YR 8/4) sandy clay loam, very pale brown (10YR 7/4) when moist; massive; hard, friable when moist, sticky and plastic when wet; common fine roots, the number decreasing with depth; common fine tubular pores; common threads of lime; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from 10YR to 2.5Y in hue, from 5 to 7 in value, and from 2 to 3 in chroma. In places the A horizon is single grain and has loose consistence. The C horizon ranges from 10YR to 2.5Y in hue, from 7 to 8 in value when dry and from 6 to 7 when moist, and from 2 to 4 in chroma. The lime in the C horizon ranges from disseminated to common concretions or segregated threads.

Gomez Series

The Gomez series consists of well-drained soils that have a fine sandy loam subsoil. These soils formed in calcareous water-deposited sandy sediments in broad shallow basins on uplands. Slopes are 0 to 3 percent. The vegetation consists of mid and tall grasses and shrubs. The average annual precipitation is 12 to 15 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,900 to 4,100 feet. These soils are associated with Arch and Portales soils.

Typically, the surface layer is brown and yellowish-brown loamy fine sand about 15 inches thick. In places it is fine sand or fine sandy loam. The subsoil is light-gray fine sandy loam about 7 inches thick. The substratum is white fine sandy loam, high in lime content, to a depth of more than 60 inches.

Gomez soils are used as range, irrigated cropland, and wildlife habitat. Indian artifacts can be found in some areas.

Gomez loamy fine sand (0 to 3 percent slopes) (Go).—This soil is in depressions in the northern part of Lea County. Included with this soil in mapping are areas of Amarillo and Tivoli soils.

Representative profile of Gomez loamy fine sand, 50 feet west of the New Mexico-Texas State line, northeast quarter of sec. 11, T. 11 S., R. 38 E.:

A11—0 to 8 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 4/3) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine roots; neutral (pH 7.3), noncalcareous; clear, smooth boundary. 7 to 10 inches thick.

A12—8 to 15 inches, yellowish-brown (10YR 5/4) loamy fine sand, brown (10YR 5/3) when moist; weak, coarse, prismatic structure; soft, very friable when moist, nonsticky and nonplastic when wet; many medium roots; few fine calcium carbonate concretions; few organic stains; mildly alkaline (pH 7.7), moderately calcareous; clear, wavy boundary. 6 to 12 inches thick.

B2—15 to 22 inches, light-gray (10YR 7/2) fine sandy loam, light brownish gray (10YR 6/2) when moist; weak, coarse, prismatic structure and weak, fine, granular; slightly hard, very friable when moist, slightly sticky and nonplastic when wet; many medium roots; common fine interstitial pores; many medium calcium carbonate concretions, 20 to 30 percent calcium carbonate; few worm casts; mildly alkaline (pH 7.8), moderately calcareous; clear boundary. 7 to 18 inches thick.

Cca—22 to 60 inches, white (10YR 8/2) soft caliche of fine sandy loam texture, light gray (10YR 7/2) when moist; weak, medium, platy structure; slightly hard, very friable when moist, sticky and plastic when wet; few medium roots; many medium calcium carbonate concretions; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from brown to yellowish brown and light brown. The B2 horizon ranges from yellowish brown to light gray. Depth to the Cca horizon ranges from 20 to 40 inches.

This soil has moderately rapid permeability. Available water holding capacity is 3 to 5 inches. Water intake is rapid, and runoff is very slow. Roots penetrate to a depth of 20 to 40 inches over the strong lime. Soil blowing is a severe hazard.

This soil is used mainly as range, wildlife habitat, and recreational areas. Limited cultivation is possible under irrigation. Irrigated capability unit IVe-11; dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group B.

Gomez loamy fine sand (0 to 3 percent slopes) (GM).—This is a gently undulating soil in depressions in the northern part of Lea County. Included in mapping and making up about 15 percent of the mapping unit are small areas of Brownfield, Patricia, Portales, and Tivoli soils.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group B.

Gomez fine sand (0 to 3 percent slopes) (GF).—This soil is gently undulating to undulating. Included with this soil in mapping and making up about 15 percent of the mapping unit are areas of Brownfield, Patricia, Tivoli, and Portales soils.

Except for surface texture, this soil is similar to Gomez loamy fine sand.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIe-5; Deep Sand range site; wildlife habitat group F.

Gomez fine sandy loam (0 to 3 percent slopes) (Gs).—This soil occurs as level areas and depressions. It is associated with Amarillo, Brownfield, Portales, and Mansker soils. Included in mapping were small areas of Amarillo, Portales, and Mansker soils.

This soil has a grayish-brown fine sandy loam surface layer. Otherwise it is similar to Gomez loamy fine sand.

Runoff is medium. Available water holding capacity is 4 to 6 inches. Soil blowing is a moderate hazard.

The soil is mainly used as range, cropland, and wildlife habitat. Irrigated capability unit IIIe-7; dryland capability unit IVe-6; Sandy range site; wildlife habitat group B.

Jal Series

The Jal series consists of nearly level to gently sloping, well-drained soils that are high in lime. These soils have a loamy fine sand to fine sandy loam surface layer that is underlain by loam. They formed in chalky stream or lake sediments, in basins in the southern part of Lea County. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses and shrubs. The average annual precipitation is about 10 to 13 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 205 days. Elevations range from 3,000 to 3,400 feet. These soils are associated with Wink, Midessa, and Drake soils.

Typically, the surface layer is pale-brown sandy loam about 12 inches thick. The substratum, to a depth of 60 inches and more, is soft white caliche.

Jal soils are used as range, recreational areas, and wildlife habitat. Indian artifacts can be found in some areas.

Jal association (0 to 3 percent slopes) (JA).—This association is about 55 percent Jal sandy loam, 30 percent Drake loamy fine sand, low rainfall variant, and 15 percent Wink, Simona, and Midessa soils. These soils are in the southern part of Lea County. The nearly level to gently sloping Jal soil is on slightly concave playa lake benches. The gently sloping or gently undulating Drake soil, low rainfall variant, is on low convex dunes on the eastern side of the playas.

Representative profile of Jal sandy loam in an area of Jal association, north of ranch road in southwest corner of the northeast quarter of sec. 28, T. 26 S., R. 36 E.:

A11—0 to 3 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) when moist; weak, medium, granular structure, weak, medium, platy in the upper 1/2 to 1 inch; slightly hard, friable when moist, slightly sticky and nonplastic when wet; few fine roots; common very fine and fine interstitial pores; disseminated lime segregated into common, medium, soft masses and hard nodules; moderately alkaline (pH 8.3), strongly calcareous; abrupt boundary. 2 to 5 inches thick.

A12—3 to 12 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 5/3) when moist; weak, fine and medium, subangular blocky structure; soft, very friable when moist, slightly sticky and nonplastic when wet; common very fine and fine roots; common very fine and fine interstitial pores; numerous small worm casts or insect casts; disseminated lime segregated into common, small to medium, soft masses and few, small, hard nodules; moderately alkaline (pH 8.4), strongly calcareous; abrupt boundary. 8 to 15 inches thick.

C1ca—12 to 30 inches, white (10YR 8/1), soft caliche of loam texture, white (10YR 8/2) when moist; moderate, medium, platy structure; hard, firm when moist, slightly sticky and slightly plastic when wet; few fine and medium roots; few medium tubular pores; many, fine, hard nodules; strongly alkaline (pH 8.5), strongly calcareous; gradual boundary. 14 to 20 inches thick.

C2ca—30 to 48 inches, white (10YR 8/1), soft caliche of heavy loam texture, white (10YR 8/2) when moist; moderate, thin, platy structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few fine tubular pores; many, large, hard lime concretions; strongly alkaline (pH 8.5), strongly calcareous; clear boundary. 12 to 24 inches thick.

C3ca—48 to 60 inches, white (10YR 8/2), soft caliche of a heavy loam texture, light gray (10YR 7/2) when moist; massive; soft, friable when moist, slightly sticky and slightly plastic when wet; no roots; few fine tubular pores; some segregated lime but less than in horizon above; strongly alkaline (pH 8.6), strongly calcareous.

The A horizon ranges from fine sandy loam to loamy fine sand and from 7.5 YR to 10YR in hue, from 6 to 7 in value when dry and from 4 to 6 when moist, and from 2 to 3 in chroma. This horizon is massive to weak, fine, subangular blocky to weak, medium, granular. The substratum is 25 to 50 percent calcium carbonate (fig. 5). Segregated lime occurs throughout the profile.

The Jal soil is moderately permeable. Runoff is slow. Water intake is rapid, and the available water holding capacity is 2 to 4 inches. Roots penetrate to a depth of 20 to 30 inches over the soft caliche. Soil blowing is a severe hazard.

A representative profile of Drake loamy fine sand, low rainfall variant, is described under the heading "Drake Series, Low Rainfall Variant."

The Drake soil, low rainfall variant, is moderately permeable. Runoff is slow. Water intake is rapid, and the available water holding capacity is 7.5 to 9 inches. Roots penetrate to a depth of more than 60 inches. Soil blowing is a severe hazard.

These soils are used as range and wildlife habitat. Drake soil: Dryland capability unit VIIe-2; Sandy range site; wildlife habitat group J. Jal soil: Dryland capability unit VIIs-5; Limy range site; Wildlife habitat group J.

Kermit Series

The Kermit series consists of excessively drained, noncalcareous loose sands. These soils formed in wind-deposited sands in the Southern Desertic Basins, Plains, and Mountains. Most of the fine particles have been sorted out and blown away. These soils occur extensively in the "sand country" in the southern part of Lea County. They are undulating to billowy, forming stabilized dunes 4 to 15 feet or more high. Slopes are 0 to 12 percent. The vegetation consists of mid and tall grasses, forbs, and shrubs. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 200 to 205 days. Elevations range from 3,000 to 3,900 feet. These soils are associated with Maljamar, Pyote, and Berino soils.

Typically, the surface layer is pale-brown fine sand about 8 inches thick. It is underlain by light yellowish-brown fine sand to a depth of more than 60 inches. The soil is neutral in reaction.

These soils are used as range and wildlife habitat. Indian artifacts can be found in some areas.

Kermit-Palomas fine sands, 0 to 12 percent slopes (KD).—This complex consists of coarse-textured soils. It is about 70 percent Kermit fine sand, 20 percent Palomas fine sand, and 10 percent Maljamar and Pyote soils. The landscape is one of large, irregularly sloping, duny areas of Kermit fine sand and intervening concave areas of Palomas fine sand. The dunes are 8 feet to 12 feet or more high. The concave areas are sandy to a depth of 4 to 20 inches. Below this is red light sandy clay loam. The Kermit soil has a slope of 3 to 12 percent and the Palomas soil has a slope of 0 to 5 percent.

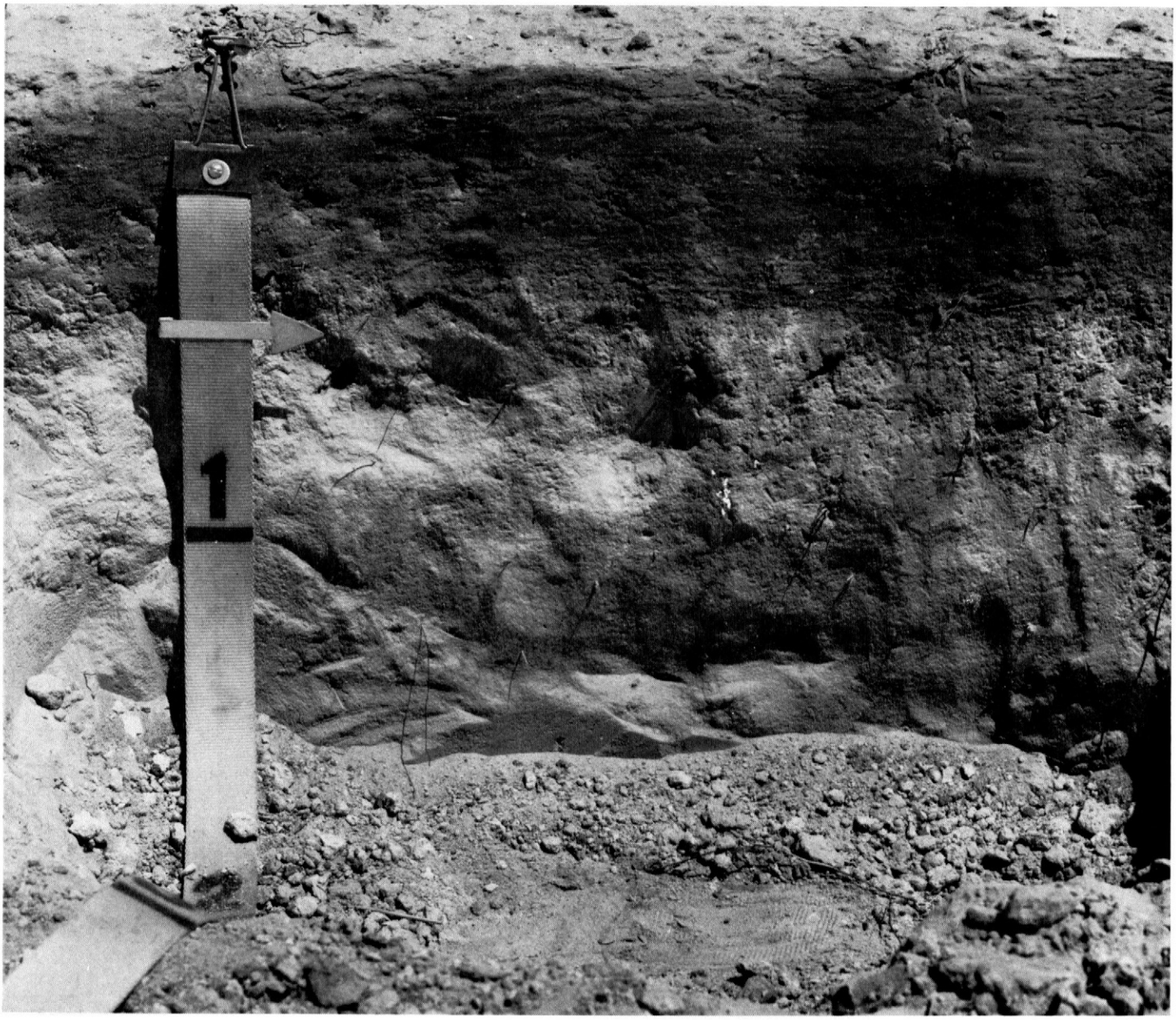

Figure 5.—**Profile of Jal sandy loam. The surface layer is strongly calcareous sandy loam, and the underlying material is soft caliche.**

Representative profile of Kermit fine sand, south of Bennett and Jal, near the Texas-New Mexico State line, 50 feet south and 100 feet west of the northeast corner of the southeast quarter of sec. 24, T. 26 S., R. 37 E.:

A1—0 to 8 inches, pale-brown (10YR 6/3) fine sand, brown (10YR 5/3) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; neutral (pH 6.9), noncalcareous; gradual boundary. 6 to 12 inches thick.

C—8 to 60 inches, light yellowish-brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; neutral (pH 7.1), noncalcareous.

The profile ranges from pale brown to reddish brown.

The Kermit soil is very rapidly permeable. Runoff is very slow. Water intake is rapid, and available water holding capacity is 3 to 4 inches. Roots penetrate to a depth of more than 60 inches. Soil blowing is a severe hazard.

A representative profile of Palomas fine sand is described under the heading "Palomas Series."

The Palomas soil is moderately permeable. Runoff is very slow. Water intake is rapid, and the available water holding capacity is 6 to 8 inches. Roots penetrate 42 to 70 inches to the strong lime zone. Soil blowing is a severe hazard.

These soils are used as range and wildlife habitat. Kermit soil: Dryland capability unit VIIe-10; Sand Hills (SD) range site; wildlife habitat group H. Palomas soil: Dryland capability unit VIIe-10; Deep Sand range site; wildlife habitat group H.

Kermit-Wink complex, 0 to 3 percent slopes (KE).—This soil complex is about 70 percent Kermit fine sand, about 20 percent Wink fine sand, and about 10 percent inclusions of Active dune land, Maljamar, Palomas, Berino, Cacique, and Pyote soils.

These are deep sandy soils subject to severe soil blowing. The landscape is one of hummocks and dunes, resulting from the accumulation and removal of sands. The Kermit soil is on stabilized sand dunes, and the Wink soil is in depressions.

Except for the narrower range in slope, the Kermit soil is similar to that in Kermit-Palomas fine sands, 0 to 12 percent slopes. The Wink soil is similar to Wink fine sand (see Wink Series) except that in places the surface layer and subsoil are eroded and the substratum of white, limy sandy loam is exposed.

This complex is used only as range and wildlife habitat. Kermit soil: Dryland capability unit VIIe-10; Sand Hills (SD) range site; wildlife habitat group H. Wink soil: Dryland capability unit VIIe-10; Deep Sand range site; wildlife habitat group H.

Kermit soils and Dune land, 0 to 12 percent slopes (KM).—This mapping unit is in the southern part of Lea County. It is about 45 percent Kermit soils, 45 percent Active dune land, and about 10 percent Maljamar, Palomas, Wink, and Pyote soils. The Kermit soil is hummocky and undulating and is adjacent to, or surrounds, the Dune land areas. Some areas consist almost entirely of Kermit soil, and some are mostly Dune land.

Dune land consists of large barren sand dunes, or hills and ridges of wind-deposited sands that actively shift and drift with the wind. It is described under the heading "Active Dune Land." The Kermit soil is similar to that in Kermit-Palomas fine sands, 0 to 12 percent slopes, but its surface layer is fine sand to coarse sand.

These soils are used as range, wildlife habitat, and recreational areas. Kermit soil: Dryland capability unit VIIe-10; Sand Hills (SD) range site; wildlife habitat group H. Dune land: Dryland capability unit VIIIe-1; wildlife habitat group A.

Kimbrough Series

The Kimbrough series consists of well-drained loams, gravelly loams, or gravelly fine sandy loams overlying indurated caliche at a depth of 6 to 20 inches. These soils formed in wind-deposited and water-deposited sediments on uplands in the northern half of Lea County. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses and shrubs. The average annual precipitation is 12 to 15 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,600 to 4,200 feet. Kimbrough soils are associated with Lea, Stegall, Portales, and Arvana soils.

Typically, the surface layer is dark grayish-brown gravelly loam about 6 inches thick. In places it is loam. The substratum is white indurated caliche (fig. 6).

Kimbrough soils are used for range, wildlife, and limited irrigated farming. They are a source of crushed caliche for use in construction.

Kimbrough gravelly loam, 0 to 3 percent slopes (Kg).—This soil is on prairie uplands. It is known locally as "scabland." Included in mapping are areas of Stegall, Lea, Slaughter, and Arvana soils.

Representative profile of Kimbrough gravelly loam, on north edge of a caliche pit, SW¼NE¼ sec. 16, T. 17 S., R. 37 E.:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, thin, platy structure; slightly hard, friable when moist, sticky and slightly plastic when wet; few caliche fragments on the surface and intermixed; mildly alkaline (pH 7.8), slightly calcareous; abrupt boundary. 2 to 6 inches thick.

A12—2 to 6 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; slightly hard, very friable when moist, sticky and slightly plastic when wet; many, sharp-angled, hard caliche fragments intermixed; mildly alkaline (pH 7.8), strongly calcareous; abrupt boundary. 4 to 10 inches thick.

Ccam—6 inches, white (10YR 8/1), indurated caliche, fragmental and indurated to a depth of about 30 inches, grading to weakly cemented, white caliche below. Several feet to many feet thick.

The A horizon ranges from gravelly loam to gravelly fine sandy loam in texture and from 7.5YR to 10YR in hue. It is dark grayish brown when dry and very dark grayish brown when moist. In areas where this horizon is gravelly, the depth to indurated caliche is 6 to 16 inches. The caliche is either fragmentary or massive.

This soil is moderately permeable. Runoff is slow to medium. Water intake is moderate, and the available water holding capacity is 1 to 2 inches. Roots penetrate to a depth of 6 to 16 inches. Erosion is a slight hazard.

This soil is too shallow to be suitable for crops. It is used for range and wildlife. It is also a source of crushed caliche for use in construction. Dryland capability unit VIIs–1; Shallow (HP) range site; wildlife habitat group K.

Kimbrough gravelly loam, 0 to 3 percent slopes (KO).—This soil is on low ridges in the northern part of Lea County. Included in mapping are areas of Lea, Sharvana, Stegall, and Slaughter soils.

This soil is used as range and wildlife habitat. It is also a source of crushed caliche for use in construction. Dryland capability unit VIIs-1; Shallow (HP) range site; wildlife habitat group K.

Kimbrough loam, 0 to 1 percent slopes (Kb).—This soil is in narrow swales, in small playas, and on low broad ridges between swales. It forms a narrow border between Lea loam in the swales and the adjacent sloping Kimbrough gravelly loam. It is underlain by indurated caliche at a depth of 10 to 20 inches. Included in mapping and making up about 15 percent of the mapping unit are areas of Sharvana, Lea, and Stegall soils.

This soil is similar to Kimbrough gravelly loam, 0 to 3 percent slopes, but its surface layer is loam about 16 inches thick. The available water holding capacity is 1.5 to 3.5 inches. Roots penetrate to a depth of 10 to 20 inches.

This soil is used as irrigated cropland, wildlife habitat, recreational areas, and range. Irrigated capability unit IVs-2; dryland capability unit VIs-2; Shallow (HP) range site; wildlife habitat group D.

Kimbrough loam, 1 to 3 percent slopes (Kc).—This soil is on slopes between ridges and swales in the northern

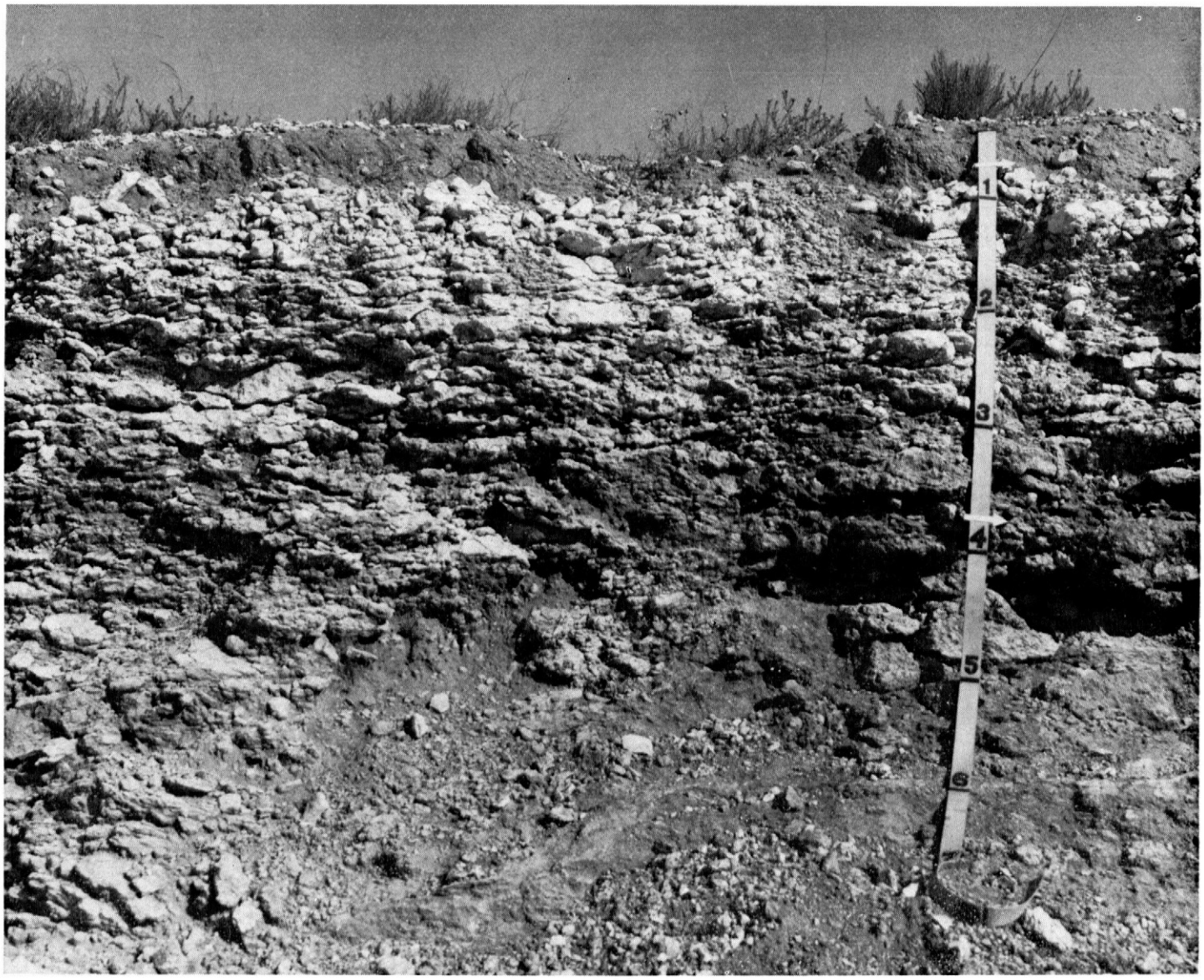

Figure 6.—**Profile of Kimbrough gravelly loam, 0 to 3 percent slopes. The thin surface layer rests on beds of white indurated caliche.**

part of Lea County. Included in mapping are areas of Sharvana soils and Kimbrough gravelly loam, 0 to 3 percent slopes.

This soil is similar to Kimbrough gravelly loam, 0 to 3 percent slopes, but its surface layer is loam about 12 inches thick. Runoff is medium. Available water holding capacity is 1.5 to 3 inches. Roots penetrate to a depth of 10 to 18 inches.

This soil is used as range and wildlife habitat. Dryland capability unit VIs-2; Shallow (HP) range site; wildlife habitat group K.

Kimbrough loam, 0 to 3 percent slopes (KN).—This soil is in the northern part of Lea County. Included in mapping are small areas of Sharvana, Lea, and Stegall soils and Kimbrough gravelly loam, 0 to 3 percent slopes.

This soil is similar to Kimbrough gravelly loam, 0 to 3 percent slopes, but its surface layer is loam about 14 inches thick. Available water holding capacity is 1.5 to 3.5 inches. Roots penetrate to a depth of 10 to 20 inches.

This soil is used as range and wildlife habitat. Dryland capability unit VIs-2; Shallow (HP) range site; wildlife habitat group K.

Kimbrough-Lea complex (0 to 3 percent slopes) (Kh).—This complex is about 60 percent Kimbrough gravelly loam, 25 percent Lea loam, 10 percent inclusions of Stegall and Arvana soils, and 5 percent inclusions of Slaughter and Sharvana soils. In places the Kimbrough and Lea soils are about equally distributed.

The generally dominant Kimbrough soil is on slightly convex areas or on low knolls. It is very shallow over a thick bed of indurated caliche. The Lea soil has a dark grayish-brown to brown surface layer and a grayish-

brown to brown loam subsoil (see Lea Series). Indurated caliche is at a depth of 20 to 40 inches.

The soils in this complex are used as range, wildlife habitat, and recreational areas. They are also a source of caliche for use in road construction. Kimbrough soil: Dryland capability unit VIIs-1; Shallow (HP) range site; wildlife habitat group K. Lea soil: Dryland capability unit VIIs-1; Loamy range site; wildlife habitat group K.

Kimbrough-Lea complex (0 to 3 percent slopes) (KU).—In some areas this complex is about 50 percent Kimbrough gravelly loam and 25 percent Lea loam, and in a few about 40 percent Kimbrough soils and 40 percent Lea soils. It is 20 to 25 percent inclusions of Stegall, Arvana, Slaughter, and Sharvana soils. The Kimbrough soil is gently sloping and is on the tops and sides of low ridges. The Lea soil is nearly level and is in swales between the ridges.

The soils in this complex are used as range, wildlife habitat, and recreational areas. They are also a source of caliche for use in construction. Kimbrough soil: Dryland capability unit VIIs-1; Shallow (HP) range site; wildlife habitat group K. Lea soil: Dryland capability unit VIIs-1; Loamy range site; wildlife habitat group K.

Kimbrough-Sharvana complex (0 to 3 percent slopes) (Ks).—This complex is on smooth broad prairies in association with the Kimbrough-Lea complex in the northern part of Lea County. It is about 60 percent Kimbrough gravelly loam, 25 percent Sharvana fine sandy loam, and 15 percent inclusions of Slaughter, Stegall, and Arvana soils.

The Kimbrough soil is underlain by indurated caliche at a depth of 6 to 16 inches. The Sharvana soil is similar to Sharvana loamy fine sand (see Sharvana Series), but its surface layer is fine sandy loam about 6 inches thick.

These soils are eroded in places. Soil blowing has removed most of the original surface layer in old abandoned fields and exposed caliche at the surface, or it has exposed fragments of caliche and the reddish-brown sandy clay loam subsoil of the Sharvana soil. The Kimbrough soil is on slightly elevated level areas and has a few small caliche pebbles on the mounds. The underlying caliche undulates irregularly near the surface. Runoff generally accumulates in small intermittent lakes and potholes.

These soils are used for range and wildlife and as a source of caliche. Kimbrough soil: Dryland capability unit VIIs-1; Shallow (HP) range site; wildlife habitat group K. Sharvana soil: Dryland capability unit VIIs-1; Sandy range site; wildlife habitat group K.

Kimbrough-Sharvana complex (0 to 3 percent slopes) (KX).—This complex is about 55 percent Kimbrough gravelly loam, 25 percent Sharvana fine sandy loam, and 20 percent inclusions of Slaughter, Stegall, and Arvana soils. The Kimbrough soil is gently sloping and is on the tops and sides of low ridges in the northern part of Lea County. The Sharvana soil is nearly level to gently sloping and is between the ridges. It is similar to Sharvana loamy fine sand, but its surface layer is fine sandy loam about 6 inches thick.

The soils in this complex are used for range and wildlife and as a source of caliche. Kimbrough soil: Dryland capability unit VIIs-1; Shallow (HP) range site; wildlife habitat group K. Sharvana soil: Dryland capability unit VIIs-1; Sandy range site; wildlife habitat group K.

Largo Series

The Largo series consists of well-drained, calcareous soils that have a light loam surface layer underlain by loam to clay loam. These gently sloping soils are on alluvial fans below outcrops of Triassic materials, in the southern part of Lea County. They formed in calcareous loamy alluvium. Slopes are 0 to 3 percent. The vegetation is short and mid grasses, forbs, and shrubs. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 200 days. Elevations range from 3,200 to 3,700 feet. These soils are associated with Pajarito and Palomas soils.

Typically, the surface layer is brown light loam about 6 inches thick. The next layer is reddish-brown to yellowish-red stratified loam, light silty clay loam, and clay loam about 24 inches thick. The substratum, to a depth of about 60 inches, is weak red silty and clayey shale. These soils are calcareous throughout.

Largo soils are used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in this area.

Largo-Pajarito complex (0 to 3 percent slopes) (LP).—The soils in this complex formed on alluvial fans and plains and on foot slopes having outcrops of Triassic red-bed material. This complex is about 45 percent Largo loam, about 40 percent Pajarito loamy fine sand, and 15 percent inclusions of Palomas and Maljamar soils. It occurs only in the Southern Desertic Basins, Plains, and Mountains Resource Area in the southern part of Lea County.

The Largo soil is on alluvial plains and lower alluvial fans near deep gullied channels or in valley-filled channels where overflow and flooding are common after torrential rains.

Representative profile of Largo loam in an area of Largo-Pajarito complex, one-half mile south of State Highway No. 128, northwest of Jal, about 0.3 mile east of Jal Dump grounds, sec. 24, T. 25 S., R. 36 E.:

A11—0 to 1 inch, brown (7.5YR 5/4) fine sandy loam, dark brown (10YR 4/4) when moist; weak, thin, platy structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine interstitial pores; few dark organic stains; mildly alkaline (pH 7.7), slightly calcareous; abrupt boundary. 0 to 1 inch thick.

A12—1 to 6 inches, brown (7.5YR 5/5) light loam, dark brown (10YR 4/4) when moist; moderate, thick, platy and weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few coarse tubular pores; few organic stains; few worm casts; few root channels; few mycelia; mildly alkaline (pH 7.7), slightly calcareous; abrupt boundary. 4 to 12 inches thick.

AC1—6 to 13 inches, reddish-brown (5YR 5/4) loam, reddish brown (5YR 4/4) when moist; weak, coarse, subangular blocky and moderate, medium, granular structure; hard, firm when moist, sticky and plastic when wet; few fine roots; few small shale fragments intermixed; many worm casts; moderately alkaline (pH 7.9), strongly calcareous; clear boundary. 6 to 10 inches thick.

AC2—13 to 22 inches, yellowish-red (5YR 4/6) light silty clay loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, subangular blocky and weak, fine, granular structure; slightly hard, very friable when moist, sticky and plastic when wet; few fine roots; moderately alkaline (pH 8.1), strongly calcareous; gradual boundary. 8 to 10 inches thick.

AC3—22 to 30 inches, reddish-brown (2.5YR 5/4) clay loam, reddish brown (2.5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; few fine roots; common fragments of shale; common threads of calcium carbonate; moderately alkaline (pH 8.3), strongly calcareous; clear boundary. 6 to 27 inches thick.

C—30 to 60 inches, weak red (10R 4/4) silty and clayey shale intermixed, dusky red (10R 3/4) when moist; Triassic red-bed material.

The A horizon ranges from yellowish red to reddish brown or light reddish brown. It is loam to silty clay loam or clay loam, often in intermixed thin strata. Depth to shale is 24 to 60 inches. Reaction throughout the profile ranges from mildly alkaline to strongly alkaline.

Permeability in the Largo soil is moderately slow, and runoff is medium. Water intake is moderate, and the available water holding capacity is 5 to 6 inches. Roots penetrate to a depth of 24 to 60 inches. Erosion is a moderate hazard.

A representative profile of Pajarito loamy fine sand is described under the heading "Pajarito Series."

Permeability in the Pajarito soil is moderately rapid. Runoff is slow. Water intake is rapid, and available water holding capacity is 5 to 7 inches. Roots penetrate to a depth of 60 inches or more. Soil blowing is a severe hazard.

These soils are used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in some areas. Largo soil: Dryland capability unit VIIe-2; Loamy range site; wildlife habitat group I. Pajarito soil: Dryland capability unit VIIe-2; Sandy range site; wildlife habitat group I.

Lea Series

The Lea series consists of well-drained soils that have a loam to clay loam subsoil underlain by indurated caliche at a depth of 20 to 40 inches. These soils are on broad flat areas and in depressions in and adjacent to swales and alluvial fans. They formed in loamy sediments and recently deposited alluvium. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses, mesquite, and cactus. The average annual precipitation is 12 to 15 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,800 to 4,100 feet. These soils are associated with Kimbrough and Stegall soils.

Typically, the surface layer is dark grayish-brown to brown loam about 10 inches thick. In places it is fine sandy loam. The subsoil is grayish-brown heavy loam about 8 inches thick. The upper part of the substratum is light-gray loam about 8 inches thick. It rests on indurated caliche (fig. 7).

Irrigated crops are produced where water is available. These soils are also used for dryland crops, range, and wildlife.

Lea loam (0 to 1 percent slopes) (Le).—This nearly level to depressional soil is in broad swalelike areas in the north-central part of Lea County. Included in mapping are areas of Stegall loam, Kimbrough loam, and Arvana loam.

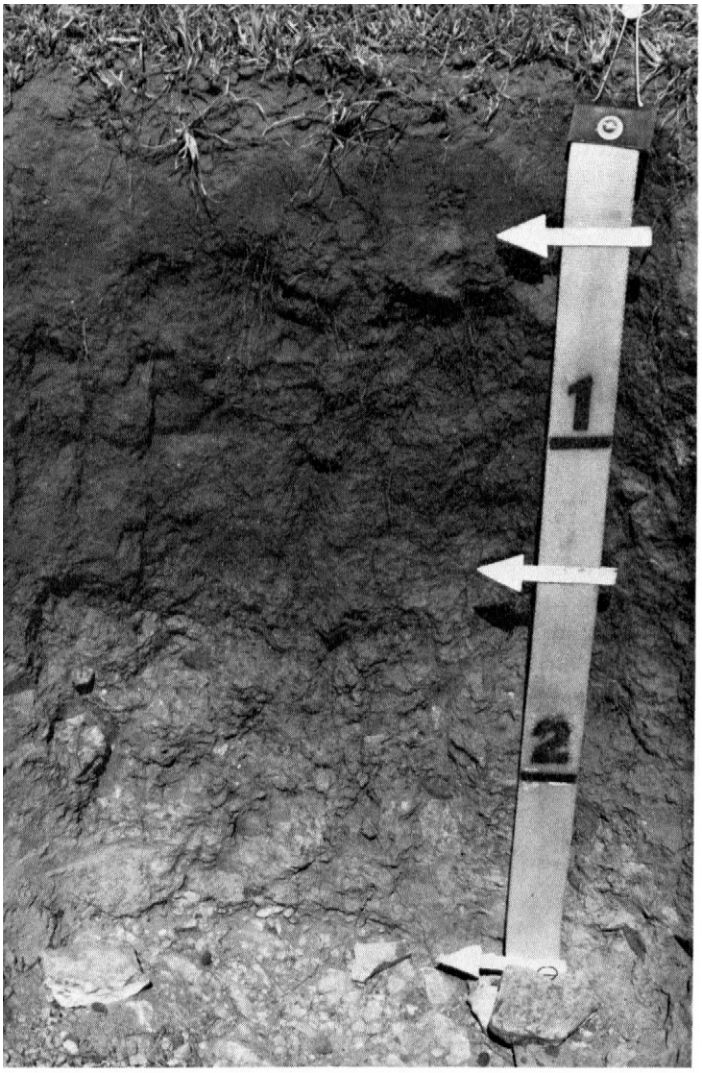

Figure 7.—**Profile of Lea loam. Indurated caliche is at a depth of about 26 inches.**

Representative profile of Lea loam, 1,150 feet northwest of a windmill and 450 feet east of the county cemetery road, NW¼SW¼ sec. 18, T. 15 S., R. 36 E.:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, platy structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; common fine tubular pores; neutral (pH 7.2), noncalcareous; clear boundary. 3 to 7 inches thick.

A3—4 to 10 inches, brown (10YR 4/3) loam, dark brown (10YR 3/3) when moist; moderate, coarse, prismatic and moderate, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; common fine tubular pores; neutral (pH 7.0), noncalcareous; clear boundary. 6 to 12 inches thick.

B2ca—10 to 18 inches, grayish-brown (10YR 5/2) heavy loam, brown (10YR 4/3) when moist; moderate, coarse,

prismatic and moderate, medium, subangular blocky structure; hard, firm when moist, slightly sticky and plastic when wet; common fine and few medium roots; few fine tubular pores; many medium soft masses and common fine threads and filaments of carbonates; moderately alkaline (pH 8.2), moderately calcareous; gradual boundary. 6 to 10 inches thick.

C1ca—18 to 26 inches, light-gray (10YR 7/1) heavy loam, light brownish gray (10YR 6/2) when moist; massive; slightly hard, friable when moist, slightly sticky and plastic when wet; carbonates are well disseminated with few, small, segregated, soft masses; moderately alkaline (pH 8.0), strongly calcareous; abrupt boundary. 5 to 11 inches thick.

C2cam—26 inches, white (10YR 8/2) indurated caliche, very pale brown (10YR 8/3) when moist; thin laminae in the upper part; in places fractured, fractures filled with carbonates; becoming less cemented with depth. Many feet thick.

The A horizon ranges from 10YR to 7.5YR in hue, from 2 to 3 in chroma, and from 4 to 5 in value. The B horizon is 5 or 6 in value and ranges from loam to light clay loam. The B and the C1ca horizons have few to many, segregated, soft concretions of calcium carbonate. The C2cam horizon is at a depth of 20 to 40 inches.

This soil is moderately permeable. Runoff is slow. Water intake is moderate, and the available water holding capacity is 5 to 7 inches. Root penetration is restricted by the indurated caliche at a depth of 20 to 40 inches. Soil blowing is a moderate hazard.

This soil is used for irrigated cotton, sorghum, small grain, and alfalfa and for dryfarmed cotton and sorghum. It is also used as range and wildlife habitat. Irrigated capability unit IIe-3; dryland capability unit IVec-2; Loamy range site; wildlife habitat group D.

Lea fine sandy loam (0 to 1 percent slopes) (La).—This gently undulating soil is in the north-central part of Lea County. Included in mapping were areas of Arvana fine sandy loam and Portales fine sandy loam.

Except for the fine sandy loam surface layer, which is 4 to 7 inches thick, this soil is similar to Lea loam. Soil blowing is a moderate hazard.

This soil is used as cropland, range, wildlife habitat, and recreational areas. Irrigated capability unit IIe-9; dryland capability unit IVe-6; Sandy range site; wildlife habitat group D.

Maljamar Series

The Maljamar series consists of well-drained soils that have a sandy clay loam subsoil. Indurated caliche is at a depth of 40 to more than 60 inches. These soils formed in wind-deposited sandy loams and sands on uplands. Slopes are 0 to 3 percent. The vegetation consists of mid and tall grasses. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 200 days. Elevations range from 3,000 to 3,900 feet.

Typically, the surface layer is yellowish-red fine sand and loamy sand about 24 inches thick. The subsoil is red sandy clay loam about 20 inches thick. The substratum is yellowish-red light sandy clay loam. White indurated caliche is at a depth of about 50 inches.

Maljamar soils are used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in places.

The Maljamar series was proposed after the publication of the Eddy Area soil survey. Some Maljamar soils in Lea County are, therefore, adjacent to Berino soils in the Eddy Area.

Maljamar and Palomas fine sands, 0 to 3 percent slopes (MF).—This unit is about 45 percent Maljamar fine sand and 45 percent Palomas fine sand. The remaining 10 percent is Kermit and Wink soils. Some areas are mostly Maljamar fine sand or Palomas fine sand, and other areas are made up of both soils.

Maljamar soils have a 24- to 38-inch surface layer, and the Palomas soils have a 12- to 20-inch surface layer.

Representative profile of Maljamar fine sand from an area of Maljamar and Palomas fine sands, 0 to 3 percent slopes, about 0.9 mile south of the northwest corner of sec. 28, T. 17 S., R. 32 E. west of paved road, and 0.9 mile north of New Mexico State Highway No. 529:

A11—0 to 20 inches, yellowish-red (5YR 5/6) fine sand, yellowish red (5YR 4/6) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine roots; many medium interstitial pores; neutral (pH 6.8), noncalcareous; clear boundary. 20 to 30 inches thick.

A12—20 to 24 inches, yellowish-red (5YR 5/6) loamy sand, yellowish red (5YR 4/6) when moist; weak, fine, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine and medium interstitial pores; neutral (pH 7.0), noncalcareous; clear boundary. 4 to 8 inches thick.

B21t—24 to 36 inches, red (2.5YR 5/8) sandy clay loam, red (2.5YR 4/8) when moist; compound moderate, medium, subangular blocky structure and strong, medium, prismatic; hard, firm when moist, sticky and slightly plastic when wet; common fine roots; common fine tubular pores; common thin clay films on peds and in pores; 5 percent small quartzite pebbles; neutral (pH 7.2), noncalcareous; clear boundary. 10 to 16 inches thick.

B22t—36 to 44 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; compound moderate, medium, subangular blocky structure and moderate, medium, prismatic; hard, firm when moist, sticky and slightly plastic when wet; common fine roots; common fine tubular pores; few, small, segregated iron-manganese concretions; common thin clay films on peds and in pores; 5 percent small quartzite pebbles; neutral (pH 7.3), noncalcareous; abrupt boundary. 6 to 10 inches thick.

C1—44 to 50 inches, yellowish-red (5YR 5/6) light sandy clay loam, yellowish red (5YR 4/6) when moist; weak, medium, subangular blocky structure and weak, coarse, prismatic; slightly hard, friable when moist, sticky and slightly plastic when wet; few fine tubular pores; 10 percent small quartzite pebbles; neutral (pH 7.3); abrupt boundary. 4 to 8 inches thick.

IIC2cam—50 inches, white (5YR 8/1), indurated, fractured caliche.

The A horizon ranges from brown to yellowish-red fine sand to loamy fine sand. The B2 horizon is light sandy clay loam to heavy sandy clay loam and extends to a depth of 24 to 38 inches. There are small amounts of segregated calcium carbonate in places. The IICcam horizon is at a depth of 40 to more than 60 inches.

Maljamar and Palomas soils are moderately permeable. Runoff is very slow. Water intake is rapid. The available water holding capacity is 5 to 8 inches for the Maljamar soil and 6 to 8 inches for the Palomas soil. Roots penetrate to a depth of 40 to more than 60 inches over the indurated caliche. Soil blowing is a severe hazard. Slopes are smooth, except where eroded.

A representative profile of Palomas fine sand is described under the heading "Palomas Series."

Soils in this unit are used as range, wildlife habitat, and recreational areas. Some Indian artifacts are found on these soils. Dryland capability unit VIIe-2; Deep Sand range site; wildlife habitat group F.

Mansker Series

The Mansker series consists of well-drained soils that have a loam surface layer that is underlain by loam to clay loam. Thick beds of soft caliche are at a depth of 12 to 20 inches. These soils formed in strongly calcareous, wind-deposited and water-deposited, medium-textured to moderately fine textured sediments. They are on uplands, bordering intermittent drainageways in most places. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses and shrubs. The average annual precipitation is 12 to 16 inches, the average annual air temperature is about 58° to 60° F., and the frost-free season range is 195 to 205 days. Elevations range from 3,600 to 4,000 feet. These soils are closely associated with the Portales and Zita soils.

Typically, the surface layer is brown loam about 10 inches thick. The next layer is light-brown light clay loam about 9 inches thick. The substratum, to a depth of 60 inches, is a pink light clay loam that has a high lime content.

Mansker soils are used as cropland, range, wildlife habitat, and recreational areas. The thick beds of caliche provide a source of caliche for use in construction. Indian artifacts can be found in some areas.

Mansker loam, 0 to 1 percent slopes (Ma).—This soil is in swales and along the bordering slopes of swales and potholes. It is also on low benchlike knolls in association with Kimbrough and Portales soils. Included in mapping are small areas of Portales, Gomez, and Zita soils.

Representative profile of Mansker loam, 60 feet south of county road, sec. 14, T. 17 S., R. 37 E.:

A11—0 to 4 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) when moist; weak, fine, granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine tubular pores; many calcium carbonate concretions; moderately alkaline (pH 8.0), strongly calcareous; abrupt boundary. 4 to 5 inches thick.

A12—4 to 10 inches, brown (7.5YR 5/3) loam, dark brown (7.5YR 3/3) when moist; weak, fine, granular and weak, fine, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine tubular pores; many organic stains and worm casts; many carbonate concretions; moderately alkaline (pH 8.3), strongly calcareous; abrupt, smooth boundary. 4 to 6 inches thick.

AC—10 to 19 inches, light-brown (7.5YR 6/4) light clay loam, brown (7.5YR 5/4) when moist; weak, fine, granular and weak, fine, subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; few fine roots; common fine tubular pores; many worm casts; many calcium carbonate concretions that increase in number with increasing depth; moderately alkaline (pH 8.4), strongly calcareous; gradual, wavy boundary. 4 to 9 inches thick.

Cca—19 to 60 inches, pink (7.5YR 7/4), soft caliche consisting of light clay loam, light brown (7.5YR 6/4) when moist; weak, fine, granular structure; hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots grading to no roots at a depth of 26 inches; soft and weakly cemented caliche, decreasing in carbonate below a depth of 40 inches; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from grayish brown or brown to dark brown. The AC horizon ranges from pale-brown or light-brown heavy loam to light clay loam. The Cca horizon ranges from pink or pinkish white to white. It is 30 to 60 percent calcium carbonate.

This soil is moderately permeable. Runoff is slow. Water intake is moderate, and the available water holding capacity is 4 to 6 inches. Roots penetrate 12 to 20 inches to the strong lime zone. Soil blowing is a severe hazard.

This soil is used for irrigated crops, range, and wildlife. Irrigated capability unit IIIe-5; dryland capability unit VIe-4; Sandy range site; wildlife habitat group D.

Mansker loam, 1 to 3 percent slopes (Me).—This gently undulating soil borders swales and playa lakes. Included in mapping are small tracts of Portales, Gomez, and Zita soils.

Except for slope, this soil is similar to Mansker loam, 0 to 1 percent slopes. Runoff is medium and erosion is a moderate hazard.

This soil is used for irrigated crops, range, and wildlife. Irrigated capability unit IVe-7; dryland capability unit VIe-4; Sandy range site; wildlife habitat group D.

Mansker loam, 0 to 3 percent slopes (MK).—This soil is along swales and playa lakes in the northern part of Lea County. Included in mapping are areas of Portales loam, Lea loam, and Arvana loam.

Except for slope, this soil is similar to Mansker loam, 0 to 1 percent slopes. Runoff is slow to medium, and erosion is a moderate hazard unless cover is maintained.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIe-4; Sandy range site; wildlife habitat group D.

Midessa Series

The Midessa series consists of calcareous, nearly level to gently sloping, well-drained soils that have a loam to clay loam subsoil. These soils formed in wind-deposited and water-deposited, calcareous sediments on plains. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses and shrubs. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is from 190 to 200 days. Elevations range from 3,100 to 3,400 feet. These soils are associated with Jal and Wink soils.

Typically, the surface layer is dark grayish-brown loam about 4 inches thick. In places it is fine sandy loam. The subsoil is grayish-brown to pale-brown clay loam about 18 inches thick. The substratum, to a depth of 60 inches, is light-gray clay loam that has a high lime content. The soil is calcareous throughout.

Midessa soils are used as range, wildlife habitat, and recreational areas.

Midessa loam (0 to 3 percent slopes) (MM).—This soil is on plains. Slopes are convex in places.

Representative profile of Midessa loam, southwest corner of sec. 27, T. 19 S., R. 37 E., 20 feet north of highway and 1 mile east of Monument:

A11—0 to 2 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy and weak, fine, granular structure; soft, friable when moist, slightly sticky and slightly

plastic when wet; few fine roots; mildly alkaline (pH 7.7), slightly calcareous; abrupt boundary. 2 to 4 inches thick.

A12—2 to 4 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; few worm casts; mildly alkaline (pH 7.8), slightly calcareous; abrupt boundary. 2 to 3 inches thick.

B21—4 to 12 inches, grayish-brown (10YR 5/2) clay loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; few fine roots; many fine tubular pores; few worm casts; many fine calcium carbonate concretions; moderately alkaline (pH 8.2), strongly calcareous; clear boundary. 7 to 20 inches thick.

B22—12 to 22 inches, pale-brown (10YR 6/3) clay loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; few fine roots; many, soft and hard, fine calcium carbonate concretions; moderately alkaline (pH 8.4), strongly calcareous; gradual boundary. 9 to 12 inches thick.

Cca—22 to 60 inches, light-gray (10YR 7/2), soft caliche consisting of clay loam, gray (10YR 6/1) when moist; moderate, fine, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; about 35 percent chalky or silty soils mixed with soft calcium carbonate, decreasing in lime content below a depth of 48 inches; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from dark grayish brown to brown light loam to heavy loam. The B horizon is 20 to 30 percent clay and ranges from loam to clay loam. Depth to chalky material or caliche is 20 to 39 inches.

This soil is moderately permeable. Runoff is slow. Water intake is moderate, and the available water holding capacity is 4 to 7 inches. Roots penetrate to a depth of 20 to 39 inches to the strong lime zone. Soil blowing is a moderate hazard.

This soil is used as range and wildlife habitat. Dryland capability unit VIIe-3; Loamy range site; wildlife habitat group G.

Midessa and Wink fine sandy loams (0 to 3 percent slopes) (MN).—This unit is about 45 percent Midessa fine sandy loam and 40 percent Wink fine sandy loam. Some areas are mostly Midessa soil or Wink soil, and other areas are made up of both soils. Included in mapping are areas of Maljamar, Palomas, and Kermit soils that make up the remaining 15 percent of this unit.

The Midessa soil is similar to Midessa loam, but its surface layer is fine sandy loam. The Wink soil is similar to Wink fine sand (see Wink Series), but its surface layer differs in texture and is about 6 inches thick. Surface runoff is slow. Water intake is moderate to rapid. There is a strong lime zone at a depth of 20 to 40 inches. Soil blowing is a moderate hazard.

These soils are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-3; Sandy range site; wildlife habitat group G.

Mixed Alluvial Land

Mixed alluvial land (MU) consists of unconsolidated, stratified alluvium of varying texture. It is mainly along Monument Draw and its tributaries in the southeastern part of Lea County. It occurs intermittently in drainageways. A small acreage is along swales in the northeastern part. Included in mapping are small areas of Amarillo and Portales soils.

The alluvium is generally no more than 24 to 36 inches thick over a buried soil or the parent material of adjacent soils. Evidence of the origin of this material is the stratification, the location in drainageways, and the debris from floods that has accumulated on the vegetation within the drainageway.

The alluvium consists of recently deposited soil material from adjacent slopes. In places where the adjacent soils are fine to medium textured, the alluvium is loamy. In places where the adjacent soils are moderately coarse textured and coarse textured, the alluvium is sandy. Where the adjacent soils are of varying textures, the alluvium is stratified, loamy, and sandy.

Loamy alluvium is most extensive. It is generally dark-gray, calcareous loam that is moderately deep over caliche. The sandy alluvium consists of deep sands that bury the original soils, or of deep windblown sands that were subsequently flooded.

Permeability is moderate to rapid. Runoff is slow. Water intake is moderate to rapid, and the available water holding capacity is 4 to 7 inches. Roots penetrate to a depth of about 40 to 60 inches, or more. The vegetation consists of mid grasses, forbs, and shrubs. Erosion is a moderate hazard.

Mixed alluvial land is used as range and wildlife habitat. Some tracts are cut for native hay. Dryland capability unit VIe-1; Bottomland range site; wildlife habitat group C.

Mobeetie Series

The Mobeetie series consists of well-drained soils that have a light fine sandy loam subsoil. These soils formed in calcareous sandy loam sediments derived from outcrops of the Ogallala Formation. They are mainly on foot slopes and on alluvial fans along the margins of the Southern High Plains. These soils are nearly level to rolling. Slopes are 1 to 10 percent. The vegetation consists of mid grasses and shrubs. The average annual precipitation is 10 to 13 inches, the average annual temperature is 60° to 62° F., and the frost-free season is 195 to 205 days. Elevations range from 3,700 to 4,000 feet. These soils are closely associated with Potter and Mansker soils.

Typically, the surface layer is brown fine sandy loam about 4 inches thick. The subsoil is brown light fine sandy loam about 20 inches thick. The substratum, to a depth of 60 inches, is brown fine sandy loam that contains lime. This soil is calcareous throughout the profile.

The Mobeetie soils in Lea County are mapped only with Potter soils. They are used as range and wildlife habitat.

Mobeetie-Potter association, 1 to 15 percent slopes (MW).—This association is about 70 percent Mobeetie fine sandy loam and about 25 percent Potter gravelly fine sandy loam. Slopes range from 1 to 10 percent in the Mobeetie soil and from 5 to 15 percent in the Potter soil, but are dominantly 4 to 6 percent. These soils are along the escarpment of the Southern High Plains and draws

of the major swales. The rolling to hilly Potter soils are on rimlike escarpments, and the Mobeetie soils are on foot slopes. Included in mapping are areas of Stony rolling land and Mixed alluvial land and of Mansker, Maljamar, and Pyote soils.

Representative profile of Mobeetie fine sandy loam in Mobeetie-Potter association, 1 to 15 percent slopes, below an escarpment on ranch, on the north line of sec. 1, T. 22 S., R. 34 E., where the section line crosses a natural gas pipeline:

A1—0 to 4 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common, few, soft and hard calcium carbonate concretions; moderately alkaline (pH 8.0), strongly calcareous; clear boundary. 4 to 12 inches thick.

B2—4 to 24 inches, brown (10YR 5/3) light fine sandy loam, dark brown (10YR 4/3) when moist; weak, coarse, prismatic structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine pores; common, fine, soft and hard concretions of calcium carbonate; moderately alkaline (pH 8.2), strongly calcareous; gradual boundary. 14 to 24 inches thick.

Cca—24 to 60 inches, brown (10YR 5/3) light fine sandy loam, dark brown (10YR 4/3) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common caliche pebbles and threads of lime; moderately alkaline (pH 8.4), strongly calcareous.

Throughout the profile the soil ranges from 10YR to 7.5YR in hue and from very weak to weak in structure. The A horizon ranges from fine sandy loam to loamy fine sand. Gravel is well distributed throughout the profile. The amount varies.

Permeability of the Mobeetie soil is moderately rapid. Runoff is medium to rapid. Water intake is rapid, and available water holding capacity is 6 to 8 inches. Roots penetrate to a depth of 60 inches or more. Soil blowing is a moderate hazard, and water erosion is a moderate to severe hazard.

A representative profile of Potter gravelly fine sandy loam is described under the heading "Potter Series."

Permeability of the Potter soil is moderate. Runoff is rapid. Water intake is moderate, and available water holding capacity is 0.5 to 1.5 inches. Roots penetrate to a depth of 4 to 10 inches. Erosion is a severe hazard.

The soils in this association are used as range and wildlife habitat. Mobeetie soil: Dryland capability unit VIe-4; Sandy range site; wildlife habitat group K. Potter soil: Dryland capability unit VIIs-1; Shallow (HP) range site; wildlife habitat group K.

Pajarito Series

The Pajarito series consists of well-drained soils that have a light fine sandy loam subsoil. These soils formed in a mixture of calcareous sandy sediments from Triassic or Permian red beds. They are on alluvial fans. Slopes are 0 to 3 percent. The vegetation consists of mid grasses and shrubs. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 200 days. Elevations range from 3,200 to 3,700 feet. These soils are associated with Maljamar, Palomas, and Kermit fine sands.

Typically, the surface layer is yellowish-red to reddish-brown loamy fine sand about 16 inches thick. The subsoil is red light fine sandy loam about 18 inches thick. The substratum, to a depth of 60 inches and more, is light-red light fine sandy loam that contains lime concretions. The soil is calcareous throughout.

In Lea County, Pajarito soils are mapped only with Largo soils.

Representative profile of Pajarito loamy fine sand in an area of Largo-Pajarito complex, near the center of sec. 8, T. 23 S., R. 35 E., about 1 mile northeast of San Simon Sink:

A11—0 to 10 inches, yellowish-red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; few fine roots; few organic stains; mildly alkaline (pH 7.6), slightly calcareous; clear boundary. 5 to 11 inches thick.

A12—10 to 16 inches, reddish-brown (5YR 5/4) loamy fine sand, reddish brown (5YR 4/4) when moist; weak, coarse, granular structure; loose when dry or moist, nonsticky and nonplastic when wet; few fine roots; few organic stains; mildly alkaline (pH 7.8), moderately calcareous; gradual boundary. 4 to 8 inches thick.

B2—16 to 34 inches, red (2.5YR 5/6) light fine sandy loam, red (2.5YR 4/6) when moist; weak, coarse, prismatic and weak, medium, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; strongly alkaline (pH 8.5), strongly calcareous; clear boundary. 10 to 20 inches thick.

C1—34 to 48 inches, light-red (2.5YR 6/6) light fine sandy loam, red (2.5YR 4/6) when moist; weak, coarse, prismatic structure; soft, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common, soft, white calcium carbonate splotches; strongly alkaline (pH 8.5), strongly calcareous; gradual boundary. 10 to 24 inches thick.

C2ca—48 to 60 inches, light-red (2.5YR 6/6) light fine sandy loam, red (2.5YR 5/6) when moist; soft, very friable when moist, nonsticky and nonplastic when wet; common, soft and hard, fine, white, rounded, segregated calcium carbonate concretions; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from 7.5YR to 5YR in hue and from loamy fine sand to fine sand in texture. The B2 horizon ranges from 5YR to 2.5YR in hue. Depth to the C2ca horizon ranges from 29 to 60 inches.

Palomas Series

The Palomas series consists of well-drained to excessively drained soils that have a fine sandy loam to sandy clay loam subsoil. These soils formed in medium-textured to moderately coarse textured, alluvial fan sediments derived from red-bed sandstone. Slopes are 0 to 5 percent and are generally smooth except where eroded by winds. The vegetation consists of mid and tall grasses and shrubs. The average annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 200 days. Elevations range from 3,000 to 3,900 feet. These soils are associated with Maljamar and Kermit soils.

Typically, the surface layer is reddish-brown fine sand about 16 inches thick. The subsoil is red heavy fine sandy

loam to sandy clay loam about 44 inches thick. The substratum is pinkish-white sandy loam that has a high lime content.

The Palomas soils in Lea County are mapped only with Maljamar soils. They are used for range, wildlife habitat, and recreational areas. Indian artifacts can be found in some areas.

Representative profile of Palomas fine sand in an area of Maljamar and Palomas fine sands, 0 to 3 percent slopes, in the southeast corner of sec. 28, T. 17 S., R. 32 E., about 3.8 miles south of Maljamar:

A1—0 to 16 inches, reddish-brown (5YR 5/4) fine sand, dark reddish brown (5YR 3/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine roots; few small organic stains; many, fine, irregular pores; neutral (pH 6.7), noncalcareous; clear boundary. 12 to 20 inches thick.

B1—16 to 36 inches, red (2.5YR 5/6) heavy fine sandy loam, red (2.5YR 4/6) when moist; weak, medium, subangular blocky structure; soft, friable when moist, nonsticky and nonplastic when wet; many fine roots; many, very fine, irregular and few fine tubular pores; common fine organic stains; neutral (pH 7.1), noncalcareous; gradual boundary. 8 to 20 inches thick.

B2t—36 to 48 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; moderate, medium, subangular blocky to moderate, coarse, prismatic structure; hard, friable when moist, sticky and slightly plastic when wet; common fine roots; common fine and very fine tubular pores; common thin clay films on ped faces and as bridges between sand grains; common, small, slightly dark organic stains on ped faces and along old root channels; neutral (pH 7.1), noncalcareous; clear boundary. 10 to 15 inches thick.

B3t—48 to 60 inches, red (2.5YR 5/6) sandy clay loam, red (2.5YR 4/6) when moist; weak, medium, subangular blocky structure; hard, firm when moist, sticky and slightly plastic when wet; few fine roots; few fine tubular pores; common thin clay films on ped faces, lining pores, and as bridges between sand grains; few, small, slightly dark organic stains along root channels or ped faces; few fine concretions; soft masses or filaments of segregated lime; mildly alkaline (pH 7.6), noncalcareous; clear boundary. 10 to 15 inches thick.

Cca—60 to 66 inches, pinkish-white (5YR 8/2), soft caliche of sandy loam texture, pinkish gray (5YR 7/2) when moist; mildly alkaline (pH 7.8), strongly calcareous.

The A horizon ranges from fine sand to coarse sand. The B2t horizon ranges from light sandy clay loam to heavy fine sandy loam. Small amounts of segregated calcium carbonate may be present. The depth to the Cca horizon ranges from 42 to 70 inches.

Patricia Series

The Patricia series consists of well-drained soils that have a sandy clay loam subsoil. These soils formed in wind-deposited sandy materials on the High Plains. Slopes are 0 to 3 percent. The vegetation consists of mid and tall grasses and shrubs. The average annual precipitation is 12 to 15 inches, average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,600 to 4,400 feet. These soils are associated with Brownfield, Amarillo, and Arvana soils.

Typically, the surface layer is brown to pale-brown fine sand that grades to loamy sand and is about 16 inches thick. The subsoil is reddish-brown to yellowish-red sandy clay loam about 42 inches thick (fig. 8). The substratum is pink light sandy clay loam high in content of hard caliche.

The Patricia soils in Lea County are mapped only with Brownfield soils. They are used for range, wildlife, and recreational areas. A few tracts are irrigated cropland. Indian artifacts can be found in some areas.

Representative profile of Patricia fine sand in an area of Brownfield and Patricia fine sands, 2,500 feet south and 250 feet east of the northwest corner sec. 2, T. 9 S., R. 36 E.:

A11—0 to 8 inches, brown (10YR 5/3) fine sand, dark brown (10YR 4/3) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine and medium roots; neutral (pH 6.9), noncalcareous; gradual boundary. 2 to 10 inches thick.

A12—8 to 16 inches, pale-brown (10YR 6/3) fine sand grading to loamy sand, brown (10YR 5/3) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine and medium roots; neutral (pH 7.1), noncalcareous; clear boundary. 6 to 10 inches thick.

B21t—16 to 24 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic and weak, medium, subangular blocky structure; very hard, friable when moist, slightly sticky and slightly plastic when wet; many fine and medium roots; thin patchy clay films on vertical cleavage planes; neutral (pH 7.3), noncalcareous; gradual boundary. 6 to 25 inches thick.

B22t—24 to 48 inches, yellowish-red (5YR 5/6) sandy clay loam, yellowish red (5YR 4/6) when moist; weak, coarse, prismatic and weak, medium, subangular blocky structure; very hard, friable when moist, slightly sticky and slightly plastic when wet; common fine and medium roots; thin patchy clay films on vertical cleavage planes; neutral (pH 7.3), noncalcareous; diffuse boundary. 20 to 30 inches thick.

B23t—48 to 58 inches, yellowish-red (5YR 5/6) light sandy clay loam, yellowish red (5YR 4/6) mottled with pinkish white (5YR 8/2) and pink (5YR 7/4) when moist; weak, medium, prismatic structure; soft, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; mildly alkaline (pH 7.6), slightly calcareous; abrupt boundary. 8 to 20 inches thick.

Cca—58 to 70 inches, pink (5YR 7/4) light sandy clay loam, reddish yellow (5YR 6/6) and many faint mottles of pinkish white (5YR 8/2) and pink (5YR 7/4) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; thin discontinuous layers of indurated caliche; moderately alkaline (pH 8.3), strongly calcareous.

The hue of the A horizon ranges from 10YR to 5YR. Depth to the Cca horizon is 46 to 60 inches or more.

Playas

Playas (Pb) are barren, flat, generally dry, undrained basins. Some contain shallow water for short periods at infrequent intervals. Commonly, these areas are salty.

Playas consist mainly of silty and clayey, water-laid sediments. They are subject to periodic overflow and are barren of vegetation other than a few annual forbs.

Included in mapping are a few areas of Drake, Cottonwood, Arch, and Reeves soils.

Playas provide some water for livestock and wildlife. They are used mainly for recreation in locating Indian artifacts. Dryland capability unit VIIIw-1; wildlife habitat group L.

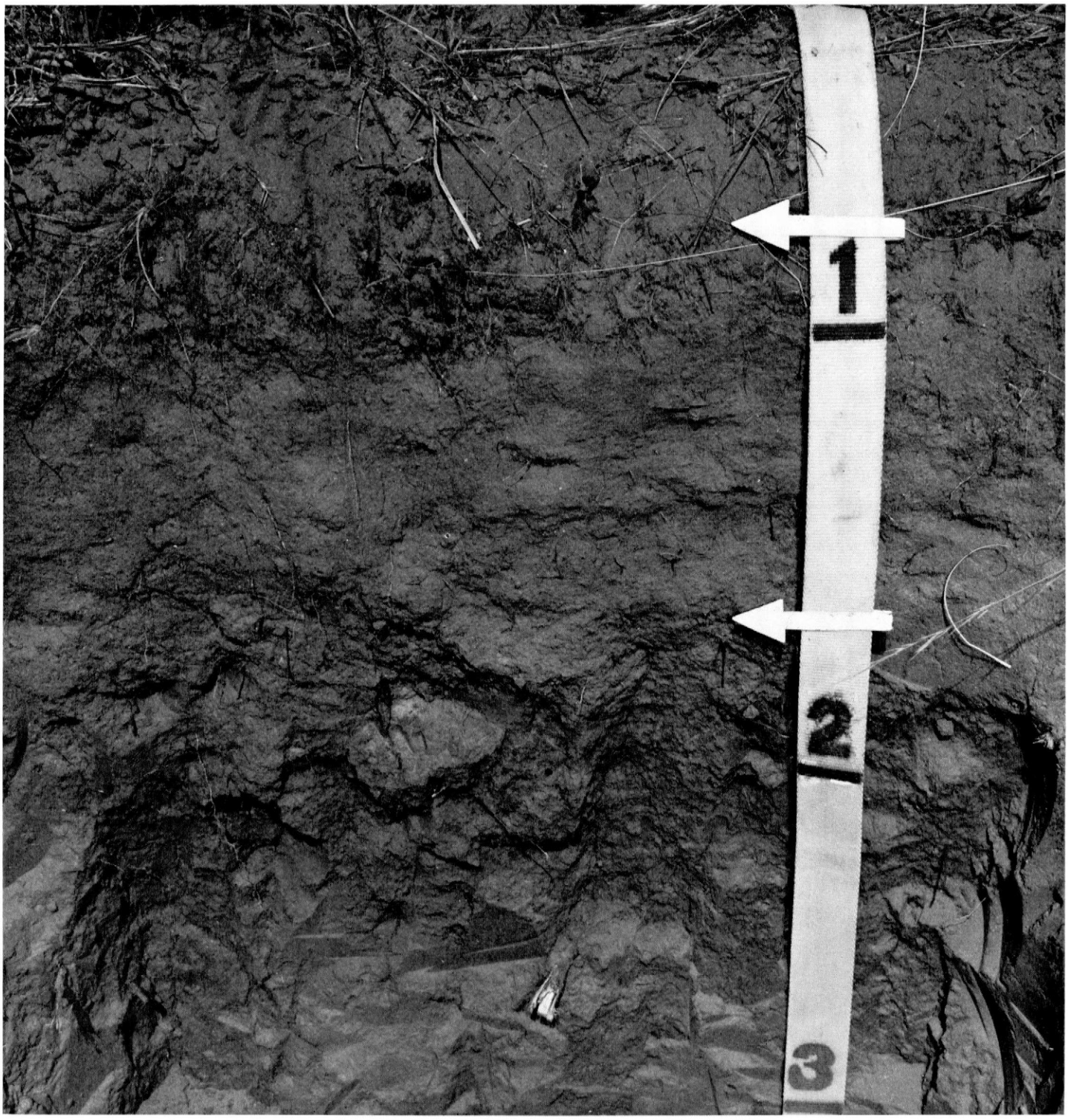

Figure 8.—**Profile of Patricia fine sand. Lower arrow shows typical depth to boundary between surface layer and sandy clay loam subsoil.**

Portales Series

The Portales series consists of well-drained soils that have a light clay loam subsoil. These soils are on upland plains. They formed in strongly calcareous, wind-deposited and water-deposited sediments. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses and shrubs. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 190 to 205 days. Elevations range from 3,600 to 4,000 feet. These soils are associated with Arch, Mansker, and Gomez soils.

Typically, the surface layer is dark-brown to grayish-brown loam about 12 inches thick. In places it is fine sandy loam. The subsoil is pale-brown light clay loam about 14 inches thick. The substratum, to a depth of 60 inches, is very pale brown chalky loam (fig. 9). The soil is calcareous throughout.

Portales soils are used for irrigated and dryland crops, range, recreational areas, and wildlife.

Portales loam, 0 to 1 percent slopes (Ph).—This soil is in depressions, swales, and along playa lakes in the north-central and northeastern parts of Lea County. Included in mapping are small areas of Mansker and Zita soils.

Representative profile of Portales loam, in the approximate center of the east-west line of sec. 26, T. 14 S., R. 38 E., the north side of the road, 0.45 mile west of New Mexico-Texas State line and 0.4 mile south of irrigation well:

A11—0 to 8 inches, dark-brown (10YR 4/3) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine tubular pores; few, fine, soft calcium carbonate concretions; mildly alkaline (pH 7.6), slightly calcareous; clear boundary. 5 to 10 inches thick.

A12—8 to 12 inches, grayish-brown (10YR 5/2) loam, dark grayish brown (10YR 4/2) when moist; weak, fine,

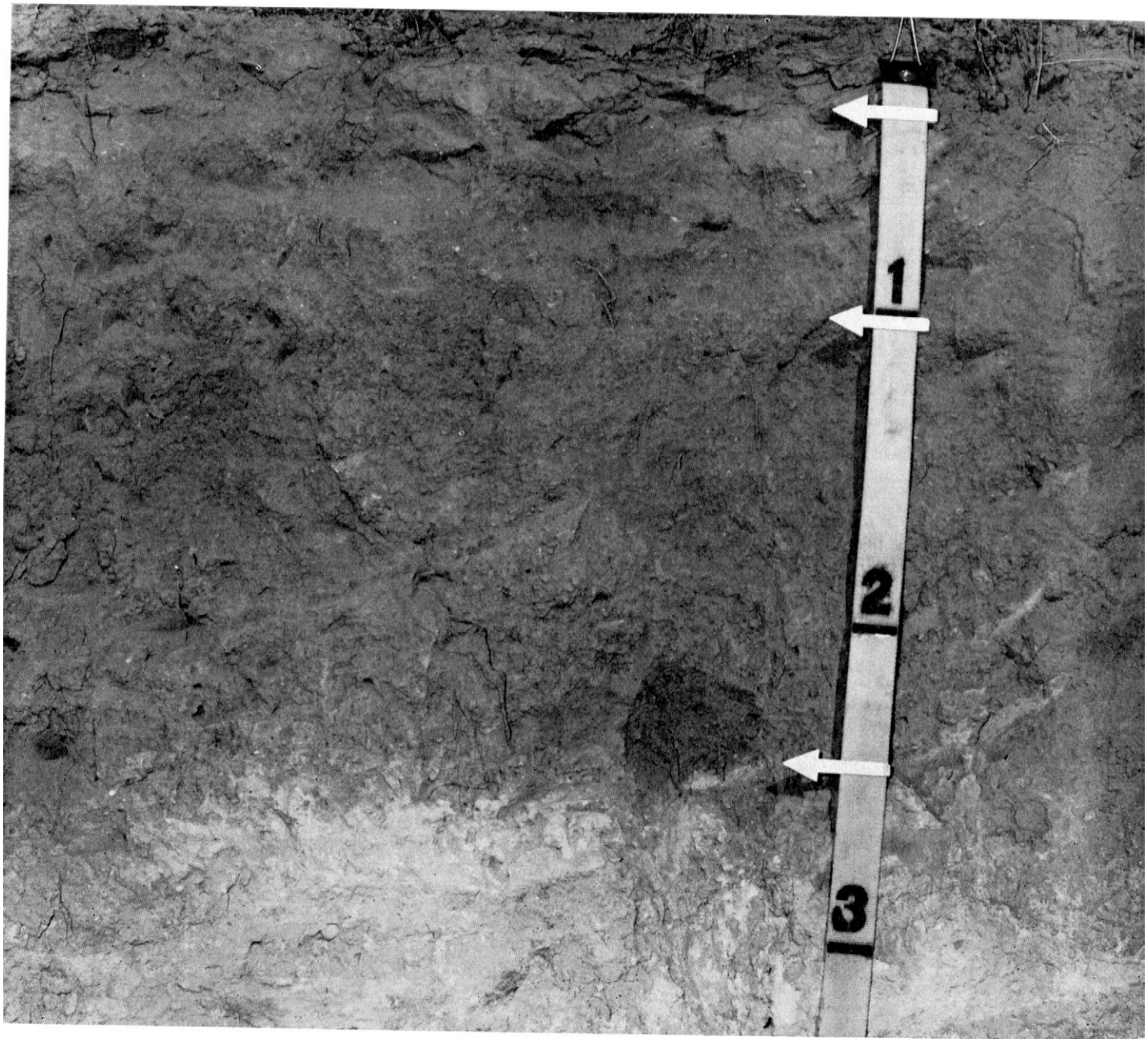

Figure 9.—**Profile of Portales loam. Soft caliche is at a depth of 20 to 36 inches.**

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granular and weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; few fine tubular pores; few fine calcium carbonate concretions; mildly alkaline (pH 7.6), slightly calcareous; gradual boundary. 3 to 6 inches thick.

B2—12 to 26 inches, pale-brown (10YR 6/3) light clay loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; many fine roots; many fine tubular pores; common, fine, soft calcium carbonate concretions; moderately alkaline (pH 8.2), strongly calcareous; clear boundary. 12 to 20 inches thick.

Cca—26 to 60 inches, very pale brown (10YR 8/3) chalky loam mixed with silty soils, very pale brown (10YR 7/3) when moist; weak, fine, granular structure; soft, friable when moist, slightly sticky and slightly plastic when wet; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from 7.5YR to 10YR in hue and from 3 to 5 in value. The B horizon ranges from 7.5YR to 10YR in hue and from 5 to 6 in value. The Cca horizon is 25 to 50 percent calcium carbonate. Depth to the Cca horizon is 20 to 36 inches.

This soil is moderately permeable. Runoff is slow. Water intake is moderate, and the available water holding capacity is 9 to 11 inches. Roots penetrate to a depth of 20 to 36 inches to the strong lime zone. Soil blowing is a moderate hazard.

This soil is used for irrigated and dryland crops, range, and wildlife. Irrigated capability unit IIe–3; dryland capability unit IVe–2; Loamy range site; wildlife habitat group B.

Portales loam, 1 to 3 percent slopes (Po).—This soil is on low ridges in the north-central and northeastern parts of Lea County. Except for slope, it is similar to Portales loam, 0 to 1 percent slopes. Slopes are short. Included in mapping are small areas of Mansker and Zita soils.

Runoff is medium. Water erosion and soil blowing are moderate hazards.

This soil is used as cropland, range, and wildlife habitat. Irrigated capability unit IIIe-6; dryland capability unit IVe–2; Loamy range site; wildlife habitat group B.

Portales loam, 0 to 3 percent slopes (PC).—This soil is in the northern part of Lea County. Except for slope, it is similar to Portales loam, 0 to 1 percent slopes. Included in mapping are areas of Mansker, Zita, Stegall, and Lea soils.

Runoff is slow to medium. Water erosion and soil blowing are moderate hazards.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit IVe-2; Loamy range site; wildlife habitat group B.

Portales fine sandy loam, 0 to 1 percent slopes (Pe).—This soil is in the north-central and northeastern parts of Lea County. It is similar to Portales loam, 0 to 1 percent slopes, but it occupies slightly higher positions and has a fine sandy loam surface layer. In some places the substratum is light-gray chalky loam. Included in mapping are areas of Mansker, Zita, and Gomez soils.

Soil blowing is a severe hazard. The available water holding capacity is 8 to 10 inches.

This soil is used for irrigated and dryfarmed crops, pasture, and range. Irrigated capability unit IIe-9; dryland capability unit IVe-3; Sandy range site; wildlife habitat group B.

Portales fine sandy loam, 1 to 3 percent slopes (Pf).—This soil is similar to Portales loam, 0 to 1 percent slopes, except for surface layer texture and slope. Included in mapping are small areas of Mansker, Simona, and Gomez soils.

Runoff is medium, and the available water holding capacity is 8 to 10 inches. Soil blowing is a severe hazard.

This soil is used for irrigated and dryfarmed crops, range, and wildlife. Irrigated capability unit IIIe–7; dryland capability unit IVe–3; Sandy range site; wildlife habitat group B.

Portales and Gomez fine sandy loams (0 to 3 percent slopes) (PG).—This mapping unit is about equal parts Portales fine sandy loam and Gomez fine sandy loam. Some areas are mostly Portales soil, and some are mostly Gomez soil. The Portales soil is sloping or undulating. The Gomez soil is in slightly concave areas. Included in mapping are small areas of Amarillo, Lea, and Arvana fine sandy loams.

The Portales soil is similar to Portales loam, 0 to 1 percent slopes, except for surface layer texture and slope. The Gomez soil is similar to Gomez loamy fine sand (see Gomez Series), but its surface layer differs in texture and is about 6 inches thick.

Runoff is slow. Soil blowing is a severe hazard.

The soils in this mapping unit are used as range, wildlife habitat, and recreational areas. Portales soil: Dryland capability unit IVe-3; Sandy range site; wildlife habitat group B. Gomez soil: Dryland capability unit IVe-6; Sandy range site; wildlife habitat group B.

Portales-Stegall loams (0 to 3 percent slopes) (PS).—This complex is in the northern part of Lea County. It is about 40 percent Portales loam, 40 percent Stegall loam, and 20 percent inclusions of Lea and Mansker soils. These soils are on low, concave and convex slopes on the Southern High Plains. The Portales soil is similar to Portales loam, 0 to 1 percent slopes. The Stegall soil is similar to Stegall loam (see Stegall Series). In many places the smoother and lower portions of the swales are occupied by the Stegall soil. In some areas, the low mounds or long ridges along the swales are occupied by Portales soil.

These soils are used as range, wildlife habitat, and recreational areas. They are not cultivated. Dryland capability unit IVe-2; Loamy range site; wildlife habitat group E.

Potter Series

The Potter series consists of well-drained gravelly fine sandy loams that are underlain by platy caliche at a depth of 4 to 10 inches. These rolling and hilly soils are on escarpments that separate the Southern High Plains Resource Area from the Southern Desertic Basins, Plains, and Mountains Resource Area. They formed in a mixture of wind and water deposits. Slopes are 5 to 15 percent. The vegetation consists of mid grasses, forbs, and shrubs. The average annual precipitation is 12 to 15 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 205 days. Elevations range from 3,700 to 4,000 feet. Mansker, Mobeetie, and Kimbrough soils are closely associated with the Potter soils.

Typically, the surface layer is brown, calcareous gravelly fine sandy loam about 4 inches thick. It rests on fragmental, platy caliche.

The Potter soils in Lea County are mapped only with Mobeetie soils. They are used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in some areas.

Representative profile of Potter gravelly fine sandy loam within an area of Mobeetie-Potter association, 1 to 15 percent slopes, on the north line of sec. 1, T. 22 S., R. 34 E., on ranch:

A1—0 to 4 inches, brown (10YR 5/3) gravelly fine sandy loam, dark brown (10YR 4/3) when moist; weak, fine, granular structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; about 30 percent caliche fragments and gravel; mildly alkaline (pH 7.8), strongly calcareous; abrupt boundary. 4 to 10 inches thick.

Ccam—4 inches, fragmental, platy caliche.

The A horizon ranges from 7.5YR to 10YR in hue. The Ccam horizon is weakly cemented to fragmental platy caliche and ranges from white to pink in color. The depth to caliche is 4 to 10 inches.

Pyote Series

The Pyote series consists of well-drained soils that have a fine sandy loam subsoil. These soils formed in wind-deposited sediments on upland plains and alluvial fans. Slopes are 0 to 3 percent. The vegetation consists of mid and tall grasses and shrubs. The annual precipitation is 10 to 12 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 200 days. Elevations range from 3,000 to 3,900 feet. Pyote soils are associated with Maljamar, Kermit, and Palomas soils.

Typically, the surface layer is light-brown fine sand about 30 inches thick. In places it is loamy fine sand. The subsoil is fine sandy loam about 18 inches thick. It is reddish yellow in the upper part and light brown in the lower part. The substratum, to a depth of 60 inches, is pink fine sandy loam.

This soil is used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in some areas.

Pyote and Maljamar fine sands (0 to 3 percent slopes) (PU).—This mapping unit is about 45 percent Pyote fine sand, 45 percent Maljamar fine sand, and 10 percent inclusions of Palomas and Kermit soils. Some areas are mostly Pyote fine sand, some areas are mostly Maljamar fine sand, and other areas contain both soils. These soils occur only in the southern part of Lea County.

Representative profile of Pyote fine sand in an area of Pyote and Maljamar fine sands, in the northwest quarter of sec. 5, T. 20 S., R. 34 E., south of the highway, near pipeline crossing on oilfield road.

A1—0 to 30 inches, light-brown (7.5YR 6/4) fine sand, brown (7.5YR 5/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine roots; neutral (pH 6.7), noncalcareous; clear boundary. 20 to 35 inches thick.

B21t—30 to 40 inches, reddish-yellow (7.5YR 6/6) fine sandy loam, strong brown (7.5YR 5/6) when moist; weak, medium, prismatic structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; clay coatings on sand grains; common organic stains; neutral (pH 6.9), noncalcareous; clear boundary. 8 to 15 inches thick.

B22t—40 to 48 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 5/4) when moist; moderate, medium, prismatic and weak, medium, subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; clay coatings on sand grains; common organic stains; neutral (pH 7.2), noncalcareous; clear boundary. 6 to 15 inches thick.

C—48 to 60 inches, pink (7.5YR 7/4) fine sandy loam, light brown (7.5YR 6/4) when moist; weak, fine, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; neutral (pH 7.3), noncalcareous.

The A horizon ranges from 7.5YR to 5YR in hue. Dry values are 5 and 6, moist values are 4 and 5, and chromas range from 4 to 6. Colors in the B21t horizon are reddish yellow to red. The lower part of the B horizon and the C horizon range from noncalcareous to calcareous.

The Pyote soil has moderately rapid permeability. Runoff is very slow. Water intake is rapid and the available water holding capacity is 5 to 7 inches. Roots penetrate to a depth of 60 inches or more. Soil blowing is a severe hazard.

These soils are used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-2; Deep Sand range site; wildlife habitat group F.

Pyote loamy fine sand (0 to 3 percent slopes) (PT).—This soil is similar to the Pyote soil in Pyote and Maljamar fine sands, but it has a loamy fine sand surface layer about 25 inches thick. Included with this soil in mapping are small areas of Palomas and Maljamar soils.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-2; Deep Sand range site; wildlife habitat group F.

Pyote soils and Dune land (0 to 3 percent slopes) (PY).—This mapping unit is about 45 percent Pyote soils, 45 percent Dune land, and 10 percent inclusions of Kermit and Wink soils. Some areas are mostly Pyote soils, some are mostly Dune land, and other areas contain both. This mapping unit is only in the southern part of Lea County. The Pyote fine sand is similar to the Pyote soil in Pyote and Maljamar fine sands, but its surface layer ranges from fine sand to coarse sand. Dune land is light yellowish-brown fine sand. It is intermingled with depressions of Pyote fine sand. The dunes, similar to those in Active dune land, range from 4 to 10 feet in height.

These soils are used as range, wildlife habitat, and recreational areas. Some areas contain Indian artifacts. Pyote soil: Dryland capability unit VIIe-2; Deep Sand range site; wildlife habitat group H. Dune land: Dryland capability unit VIIIe-1.

Reeves Series

The Reeves series consists of well-drained, calcareous soils that have a fine sandy loam to loam subsoil underlain by gypsiferous material. These soils are on uplands. They formed in water-deposited sediments derived from sedimentary rock. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses, forbs, and shrubs. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 190 to 205 days. Elevations range from 3,500 to 4,100 feet. The Reeves soils are associated with Cottonwood and Arch soils.

Typically, the surface layer is gray loam about 2 inches thick. The subsoil is light-brownish-gray loam about 10 inches thick. The substratum consists of white light clay loam that overlies thick beds of white gypsiferous and limy materials.

Reeves soils are used as range, wildlife habitat, and recreational areas.

Reeves loam (0 to 1 percent slopes) (RE).—This soil is in low, smooth concave areas near large playa lakes and on low, broad terraces near large salt lakes. It is slightly to moderately saline. Included in mapping are small areas of Cottonwood and Arch soils.

Representative profile of Reeves loam, 0.2 mile west of Ranger Lake, along the east-west fence, north of the Tatum Dump, near the northwest corner of sec. 14, T. 11 S., R. 36 E.:

A1—0 to 2 inches, gray (10YR 6/1) loam, gray (10YR 5/1) when moist; moderate, medium, platy structure; hard, friable when moist, sticky and plastic when wet; many fine roots; mildly alkaline (pH 7.8), strongly calcareous; abrupt boundary. 2 to 10 inches thick.

B2—2 to 12 inches, light brownish-gray (10YR 6/2) loam, grayish brown (10YR 5/2) when moist; weak, fine, granular and weak, medium, subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; many medium and coarse roots; mildly alkaline (pH 7.8), strongly calcareous; abrupt boundary. 8 to 12 inches thick.

C1ca—12 to 16 inches, white (10YR 8/1) light clay loam, light gray (10YR 7/2) when moist; moderate, thin and medium, platy structure; very hard, friable when moist, sticky and plastic when wet; few fine roots; moderately alkaline (pH 8.4), strongly calcareous; abrupt boundary. 4 to 8 inches thick.

C2cs—16 to 20 inches, white (10YR 8/2), crystallized gypsum, light gray (10YR 7/2) when moist; weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; mildly alkaline (pH 7.6), slightly calcareous; abrupt boundary. 4 to 10 inches thick.

C3ca—20 to 26 inches, white (10YR 8/1) chalky loam, light gray (10YR 7/1) when moist; moderate, thin, platy and moderate, medium, granular structure; hard, friable when moist, sticky and plastic when wet; mildly alkaline (pH 7.8), strongly calcareous.

C4cacs—26 to 60 inches, white (10YR 8/1), mixed chalky loam and gypsum, light gray (10YR 7/1) when moist; massive; hard, friable when moist, sticky and plastic when wet; moderately alkaline (pH 8.2), strongly calcareous.

The A horizon ranges from gray to pale brown or light brown loam to very fine sandy loam. It is 10YR to 7.5YR in hue. The B horizon ranges from light brownish-gray to grayish-brown loam to heavy fine sandy loam. The C1ca horizon is at a depth of 10 to 22 inches and rests on strata of gypsiferous material.

This soil is moderately permeable. Runoff is slow. Water intake is moderate, and the available water holding capacity is 2 to 4 inches. Roots penetrate to a depth of 10 to 22 inches. Soil blowing and water erosion are moderate hazards.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIs-4; Loamy range site; wildlife habitat group J.

Reeves-Cottonwood association (0 to 3 percent slopes) (RT).—This association occurs as scattered areas near salt lakes throughout Lea County. It is about 70 percent Reeves loam, 20 percent Cottonwood loam, and 10 percent Arch, Mansker, and Portales soils. The Reeves soil is in or near dry salt lakes. The Cottonwood soil is either bordering the salt lakes or between areas of the Reeves soil.

A representative profile of Cottonwood loam is described under the heading "Cottonwood Series."

The Cottonwood soil is moderately permeable. Runoff is rapid. Water intake is moderate, and available water holding capacity is 1 to 2 inches. Roots penetrate to a depth of 4 to 10 inches to the underlying gypsiferous materials. Soil blowing and water erosion are severe hazards.

The soils in this association are used as range, wildlife habitat, and recreational areas. Reeves soil: Dryland capability unit VIIs-4; Loamy range site; wildlife habitat group J. Cottonwood soil: Dryland unit VIIs-2; Gyp Flats range site; wildlife habitat group J.

Sharvana Series

The Sharvana series consists of well-drained soils that have a fine sandy loam to sandy clay loam subsoil. These soils formed in wind-deposited and water-deposited sediments on upland plains. Indurated caliche is at a depth of 12 to 20 inches. Slopes are 0 to 3 percent. The vegetation consists of mid grasses and shrubs. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60°F., and the frost-free season is 190 to 205 days. Elevations range from 3,600 to 4,400 feet. These soils are associated with Arvana, Amarillo, Kimbrough, and Stegall soils.

Typically, the surface layer is brown to reddish-brown loamy fine sand about 5 inches thick. In places it is fine sandy loam. The subsoil is reddish-brown sandy clay loam about 11 inches thick. The substratum is indurated caliche.

Sharvana soils are used as cropland, range, wildlife habitat, and recreational areas.

Sharvana loamy fine sand (0 to 3 percent slopes) (SA).—This soil is in the north-central part of the county. Included in mapping were small areas of Arvana, Kimbrough, and Simona soils. These included areas make up about 20 percent of the acreage.

Representative profile of Sharvana loamy fine sand, in south half of sec. 18, T. 11 S., R. 35 E.:

A11—0 to ½ inch, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 3/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; no roots; neutral (pH 6.8), noncalcareous; abrupt boundary. 0 to 2 inches thick.

A12—½ to 5 inches, reddish-brown (5YR 5/4) loamy fine sand, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic and weak, fine, granular structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; few fine interstitial pores and root channels; many organic stains; neutral (pH 7.0), noncalcareous; abrupt boundary. 4 to 6 inches thick.

B21t—5 to 12 inches, reddish-brown (5YR 5/4) sandy clay loam, reddish brown (5YR 4/4) when moist; moderate, coarse, prismatic and moderate, medium, subangular blocky structure; hard, firm when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine tubular pores; common worm casts; common organic stains; few thin clay films; neutral (pH 7.2), noncalcareous; clear boundary. 6 to 8 inches thick.

B22t—12 to 16 inches, reddish-brown (5YR 4/4) sandy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, coarse, prismatic and moderate, medium,

subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many fine tubular pores; common worm casts; few thin clay films; neutral (pH 7.3), noncalcareous; abrupt boundary. 2 to 4 inches thick.

Ccam—16 inches, indurated caliche.

The A horizon ranges from 4 to 5 in value and from 3 to 4 in chroma. The B horizon ranges from 5YR to 2.5YR in hue and from heavy fine sandy loam to light sandy clay loam in texture. The Ccam horizon is at a depth of 12 to 20 inches.

This soil is moderately permeable. Runoff is very slow. Water intake is rapid, and the available water holding capacity is 2 to 3 inches. Roots penetrate to a depth of 12 to 20 inches. Soil blowing is a severe hazard.

This soil is used as range and wildlife habitat. Dryland capability unit VIe-8; Sandy range site; wildlife habitat group D.

Sharvana loamy fine sand (0 to 3 percent slopes) (Sf).—This soil is in the north-central part of Lea County. It is gently undulating in places. Included in mapping and making up about 10 percent of the acreage are areas of Arvana soils and smaller areas of Kimbrough and Simona soils.

This soil is used as irrigated cropland, range, and wildlife habitat. Irrigated capability unit IVe-6; dryland capability unit VIe-8; Sandy range site; wildlife habitat group D.

Sharvana fine sandy loam (0 to 3 percent slopes) (Sh).—This soil is in prairie areas in the northwestern and north-central parts of Lea County. It is about 15 percent inclusions of Arvana, Slaughter, and Stegall soils.

This soil is similar to Sharvana loamy fine sand, but its surface layer differs in texture and is about 8 inches thick.

Runoff is slow. Soil blowing is a moderate hazard.

This soil is used as irrigated cropland, range, wildlife habitat, and recreational areas. Irrigated capability unit IVs-2; dryland capability unit VIe-8; Sandy range site; wildlife habitat group D.

Sharvana fine sandy loam (0 to 3 percent slopes) (SD).—This soil is on upland plains in the northern part of Lea County. It is about 15 percent inclusions of Arvana, Slaughter, and Stegall soils.

This soil is similar to Sharvana loamy fine sand, but its surface layer differs in texture and is about 8 inches thick.

Runoff is slow. Soil blowing is a moderate hazard.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIe-8; Sandy range site; wildlife habitat group D.

Simona Series

The Simona series consists of well-drained soils that have a fine sandy loam subsoil. These soils are on upland plains and on the tops of mesas and low ridges. They formed in wind-worked, calcareous sediments over fractured caliche. Slopes are 0 to 3 percent. The vegetation consists of short and mid grasses and shrubs. The average annual precipitation is 10 to 13 inches, the average annual air temperature is about 59° to 62° F., and the frost-free season is 190 to 205 days. Elevations range from 3,000 to 4,000 feet. Associated with these soils are Upton, Tonuco, and Cacique soils.

Typically, the surface layer is grayish-brown fine sandy loam about 8 inches thick. In places the surface layer is gravelly fine sandy loam or loamy fine sand. The subsoil is pale-brown fine sandy loam about 8 inches thick. The substratum is white, platy, indurated caliche (fig. 10).

Simona soils are used as range and wildlife habitat. Small areas are used for irrigated cropland.

Simona fine sandy loam, 0 to 3 percent slopes (SE).—This soil is in the southern part of Lea County. Mapped areas are about 45 percent Simona fine sandy loam, 40 percent loamy fine sand, and 15 percent inclusions of Kimbrough and Lea soils.

Representative profile of Simona fine sandy loam, in the east-central part of sec. 10, T. 22 S., R. 33 E., on quarter line, 0.3 mile west of east side of sec. 10:

A1—0 to 8 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, very thin, platy in the upper inch, grading to weak, fine, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; common very fine roots; common very fine interstitial pores; few small angular fragments of hard caliche; common worm casts; moderately alkaline (pH 8.1), strongly calcareous; gradual boundary. 4 to 10 inches thick.

B2—8 to 16 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; soft, very friable when moist, slightly sticky and nonplastic when wet; common very fine and fine roots; common very fine and few fine interstitial pores; many, fine and medium, subangular caliche fragments; many worm casts; moderately alkaline (pH 8.3), strongly calcareous; abrupt boundary. 6 to 10 inches thick.

Ccam—16 inches, white (10YR 8/1) caliche, platy and indurated in the upper 12 inches, grading to nodular, strongly cemented caliche; many masses in upper 12 inches that have brownish internal bands parallel with the surface and in places have a hardness of about 5 (Mohs' scale); calcium carbonate content of more than 50 percent; the lime content decreases 1 to 3 feet below the upper boundary of the horizon.

The texture of the A horizon ranges from loamy fine sand to heavy fine sandy loam. In places there are numerous fragments of caliche. Colors of the A and B horizons range from 5YR to 10YR in hue. Depth to the indurated Ccam horizon ranges from 10 to 20 inches. Some quartzite pebbles occur within the profile.

Permeability is moderately rapid. Runoff is slow to medium. Water intake is rapid, and the available water holding capacity is 1 to 3 inches. Roots penetrate to a depth of 10 to 20 inches over the indurated caliche. Soil blowing is a severe hazard.

This soil is used for range, wildlife, and recreation. Dryland capability unit VIIe-7; Sandy range site; wildlife habitat group K.

Simona fine sandy loam, 0 to 1 percent slopes (Sm).—This soil is on broad low ridges in the eastern part of Lea County. Included in mapping are small areas of Lea soils.

This soil is similar to Simona fine sandy loam, 0 to 3 percent slopes, except for slope. The surface layer is brown fine sandy loam about 7 inches thick.

Permeability is moderately rapid. Runoff is slow. Water intake is rapid, and the available water holding capacity is 1 to 3 inches. Roots penetrate to depths of 10 to 20 inches. Soil blowing is a severe hazard.

Figure 10.—Profile of Simona fine sandy loam. Caliche gravel occurs throughout the profile but makes up less than 15 percent of the surface layer. Depth to indurated caliche is about 18 inches.

This soil is used as range, irrigated cropland, wildlife habitat, and recreational areas. Irrigated capability unit IVs-2; dryland capability unit VIIe-7; Sandy range site; wildlife habitat group D.

Simona fine sandy loam, 1 to 3 percent slopes (Sn).—This soil is on low ridges in the south-central part of Lea County. Included in mapping are small areas of Lea and Kimbrough soils.

The soil is similar to Simona fine sandy loam, 0 to 3 percent slopes.

Runoff is medium, and water erosion is a moderate hazard.

This soil is used as range, wildlife habitat, and recreational areas. It is also suitable for irrigated cropland. Irrigated capability unit IVs-2; dryland capability unit VIIe-7; Sandy range site; wildlife habitat group D.

Simona-Upton association (0 to 3 percent slopes) (SR).—This soil association is on ridges, foot slopes, and fans. It is about 50 percent Simona gravelly fine sandy loam and about 25 percent Upton gravelly loam. Included in mapping are small areas of Stegall, Slaughter, and Kimbrough soils.

The Simona soil is shallow. It is similar to Simona fine sandy loam, 0 to 3 percent slopes, except that the surface layer is more gravelly.

A representative profile of Upton gravelly loam is described under the heading "Upton Series."

Soils in this association are used as range, wildlife habitat, and recreational areas. Simona soil: Dryland capability unit VIIe-7; Shallow (SD) range site; wildlife habitat group K. Upton soil: Dryland capability unit VIIs-1; Shallow (SD) range site; wildlife habitat group K.

Slaughter Series

The Slaughter series consists of well-drained soils that have a clay loam to clay subsoil over indurated caliche at a depth of 10 to 20 inches. These soils formed in moderately fine textured, calcareous material on upland plains. Slopes are 0 to 1 percent. The vegetation is short grasses, forbs, and shrubs. The annual precipitation is 12 to 16 inches, and the annual air temperature is 58° to 60°F. The frost-free season is 190 to 205 days. Elevations range from 3,600 to 4,400 feet. Associated soils include Stegall, Lea, Sharvana, and Kimbrough soils.

Typically, the surface layer is dark grayish-brown loam about 2 inches thick. The subsoil is dark-brown heavy clay loam to light clay about 13 inches thick. The substratum is pinkish-white indurated caliche.

Some of the acreage is cultivated and irrigated. These soils are used chiefly as range and wildlife habitat.

Slaughter loam (0 to 1 percent slopes) (So).—This soil is on plains in the northern part of Lea County.

Representative profile of Slaughter loam, in the southwest corner of sec. 21, T. 13 S., R. 36 E.:

A1—0 to 2 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure to strong, medium, granular; soft, friable when moist, sticky and plastic when wet; many fine roots; common worm casts; neutral (pH 6.9), noncalcareous; abrupt boundary. 1 to 4 inches thick.

B21t—2 to 5 inches, dark-brown (10YR 4/3) heavy clay loam, dark brown (10YR 3/3) when moist; strong, medium, subangular blocky structure and moderate, medium, blocky; hard, very firm when moist, sticky and plastic when wet; few fine roots; thin, discontinuous, patchy clay films; common organic stains on surfaces of peds; neutral (pH 7.1), noncalcareous; clear boundary. 3 to 6 inches thick.

B22t—5 to 15 inches, dark-brown (7.5YR 4/2) light clay, dark brown (7.5YR 3/2) when moist; strong, medium, subangular blocky structure; very hard, very firm when moist, sticky and plastic when wet; few fine roots; nearly continuous thin clay films on surface of peds; neutral (pH 7.3), noncalcareous; abrupt boundary. 6 to 10 inches thick.

Ccam—15 inches, pinkish-white (7.5YR 8/2) indurated caliche.

The A horizon ranges from loam to silty clay loam or clay loam and from brown to dark grayish brown in hues of 10YR to 7.5YR. The B2t horizon ranges from clay to clay loam and is 35 to 45 percent clay. It ranges from reddish brown to dark grayish brown or dark brown in hues of 5YR to 10YR. A thin B3ca horizon occurs in some places. The depth to indurated caliche ranges from 10 to 20 inches.

This soil is slowly permeable. Runoff is slow, and water intake rate is very slow. The erosion hazard is slight. The available water holding capacity is 2 to 3.5 inches. Roots penetrate to a depth of 10 to 20 inches.

The soil is used for irrigated crops, range, and wildlife. Irrigated capability unit IVs-2; dryland capability unit VIs-2; Loamy range site; wildlife group E.

Springer Series

The Springer series consists of well-drained soils that have a fine sandy loam subsoil. These soils formed in wind-deposited sediments on upland plains and alluvial fans. Slopes are 0 to 3 percent. The vegetation consists of mid and tall grasses and shrubs. The average annual precipitation is 12 to 15 inches, the average annual air temperature is 58° to 60°F., and the frost-free season is 195 to 205 days. Elevations range from 3,600 to 4,400 feet. These soils are associated with Brownfield, Tivoli, and Arvana soils.

Typically, the surface layer is brown loamy fine sand about 14 inches thick. In places it is fine sand. The subsoil is reddish-brown, yellowish-red, and light reddish-brown fine sandy loam about 46 inches thick. Lime concretions are common below a depth of 42 inches. The substratum is white caliche.

The Springer soils in Lea County are mapped only with Brownfield soils.

They are used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in some areas.

Representative profile of Springer loamy fine sand in an area of Brownfield-Springer association, in the northeast quarter of sec. 2, T. 9 S., R. 34 E.:

A1—0 to 14 inches, brown (7.5YR 5/4) loamy fine sand, dark brown (7.5YR 4/4) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine interstitial pores; neutral (pH 7.0), noncalcareous; clear boundary. 12 to 20 inches thick.

B21t—14 to 22 inches, reddish-brown (5YR 5/4) fine sandy loam, reddish brown (5YR 4/4) when moist; weak, fine, granular structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common fine interstitial pores; common worm casts; neutral (pH 7.2), noncalcareous; clear boundary. 6 to 15 inches thick.

B22t—22 to 42 inches, yellowish-red (5YR 5/6) fine sandy loam, yellowish red (5YR 4/6) when moist; weak, fine, subangular blocky structure; slightly hard, friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine interstitial pores; neutral (pH 7.3), noncalcareous; clear boundary. 15 to 24 inches thick.

B3ca—42 to 60 inches, light reddish-brown (5YR 6/4) fine sandy loam, reddish brown (5YR 5/4) when moist; weak, fine, granular structure; slightly hard, firm when moist, slightly sticky and slightly plastic when wet; few fine roots; common calcium carbonate concretions; few fine interstitial pores; mildly alkaline (pH 7.7), slightly calcareous; clear boundary. 10 to 20 inches thick.

Cca—60 inches, white (5YR 8/1), soft caliche; many calicum carbonate concretions.

The A horizon ranges from brown to reddish brown in hues of 5YR to 7.5YR, and from fine sand to loamy fine sand. Reaction ranges from neutral to mildly alkaline. The B2t horizon ranges in texture from light fine sandy loam to heavy sandy loam. The B2t horizon ranges from yellowish red or red to reddish brown in hues of 2.5YR to 5YR. The clay content is less than 18 percent. The Cca horizon is at a depth of 45 to 79 inches. In some areas segregated lime is within a depth of 30 inches.

Stegall Series

The Stegall series consists of well-drained soils that have a heavy clay loam to clay subsoil. These soils formed in water-deposited sediments derived from the Southern High Plains. They are underlain by platy indurated caliche. The nearly level Stegall soils are in swales and depressions that lead to small playa lakes or sink holes. Slopes are 0 to 1 percent. The vegetation consists of short grasses, forbs, and shrubs. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60°F., and the frost-free season is 190 to 205 days. Elevations range from 3,600 to 4,400 feet. These soils are associated with Kimbrough, Lea, and Slaughter soils.

Typically, the surface layer is grayish-brown loam about 9 inches thick. In places it is silty clay loam. The subsoil is dark-brown, dark grayish-brown, and brown heavy clay loam about 19 inches thick. The substratum is platy indurated caliche (fig. 11). The soil is noncalcareous to a depth of about 24 inches.

Stegal soils are used as cropland, range, wildlife habitat, and recreational areas.

Stegall loam (0 to 1 percent slopes) (St).—This soil is on uplands in the northern half of Lea County.

Representative profile of Stegall loam, NE¼SE¼ sec. 31, T. 17 S., R. 38 E.:

A1—0 to 9 inches, grayish-brown (10YR 5/2) loam, very dark brown (10YR 2/2) when moist; very weak, very fine, subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; neutral (pH 6.7), noncalcareous; abrupt boundary. 7 to 10 inches thick.

B21t—9 to 18 inches, dark-brown (10YR 3/3) heavy clay loam, very dark brown (10YR 2/2) when moist; moderate, fine, subangular blocky structure; hard, very firm when moist, sticky and plastic when wet; faint mottlings or organic matter staining, dark grayish brown (10YR 4/2) to very dark grayish brown (10YR 3/2) when moist; neutral (pH 7.0), noncalcareous; gradual boundary. 8 to 10 inches thick.

B22t—18 to 24 inches, dark grayish-brown (10YR 4/2) heavy clay loam, dark brown (10YR 3/3) when moist; moderate, very fine, subangular blocky structure; hard, very firm when moist, sticky and plastic when wet; neutral (pH 7.3), noncalcareous; abrupt boundary. 5 to 9 inches thick.

B3ca—24 to 28 inches, brown (10YR 5/3) heavy clay loam, dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; fragments of hard caliche intermixed; mildly alkaline (pH 7.8), strongly calcareous; abrupt boundary. 0 to 7 inches thick.

Ccam—28 inches, platy indurated caliche.

The A horizon ranges from loam to light clay loam and from grayish brown to brown. The B horizon ranges from dark grayish brown or dark brown to reddish brown and from heavy clay loam to clay. The underlying indurated caliche is fragmental and platy and is at a depth of 20 to 36 inches.

This soil is moderately permeable. Water intake is slow, and runoff is slow. Available water holding capacity is 5 to 7 inches. Roots penetrate to a depth of 20 to 36 inches. Soil blowing is a moderate hazard.

This soil is used as cropland, range, and wildlife habitat. Irrigated capability unit IIe-5; dryland capability unit IVec-2; Loamy range site; wildlife habitat group E.

Stegall silty clay loam (0 to 1 percent slopes) (Su).—This soil occupies low positions within swales and playa lakes. It is similar to Stegall loam, but its surface layer differs in texture and is about 5 inches thick. Included with this soil in mapping are small areas of Slaughter loam and Stegall loam.

Stegall silty clay loam is used as cropland, range, wildlife habitat, and recreational areas. Irrigated capability unit IIe-5; dryland capability unit IVec-2; Clayey range site; wildlife habitat group E.

Stegall and Slaughter soils (0 to 1 percent slopes) (SS).—This mapping unit is about 40 percent Stegall loam, 35 percent Slaughter loam, 15 percent inclusions of Stegall silty clay loam, and 10 percent inclusions of Portales, Kimbrough, and Arvana soils. Some areas are mostly Stegall soils, some areas are mostly Slaughter soils, and other areas contain both soils.

The Slaughter soil is described under the heading "Slaughter Series."

These Stegall and Slaughter soils are used as range, wildlife habitat, and recreational areas. Stegall soil: Dryland capability unit IVec-2; Loamy range site; wildlife habitat group E. Slaughter soil: Dryland capability unit VIs-2; Loamy range site; wildlife habitat group E.

Stony Rolling Land

Stony rolling land (SY) occurs as small areas in the southern part of Lea County. It consists of shallow to very shallow, gravelly and stony soils that formed in material weathered from calcareous shale and sandstone, of Triassic age, that in many places are capped with cemented or indurated caliche. The soil ranges from loamy sand to fine sandy loam and is 15 to 35 percent stones. In some places it overlies calcareous sandstone interbedded with red, green, and blue sandy shale. In other places it is as much as 24 inches thick over calcareous, red sandstone interbedded with red clay or weakly cemented shale. These materials crop out at the

lower elevations and near the bases of red-bed escarpments.

Stony rolling land is associated with the Largo-Pajarito complex. It generally occupies positions above these soils, forming high, sloping exposures of these shallow soils of the Triassic red beds. The landscape is one of undulating to rolling, somewhat convex slopes and knolls cut by numerous gullies. The slope gradient is 1 to 15 percent. The vegetation consists of scattered trees and shrubs.

Runoff is very rapid, and the hazard of water erosion is severe. Soil blowing is a moderate hazard.

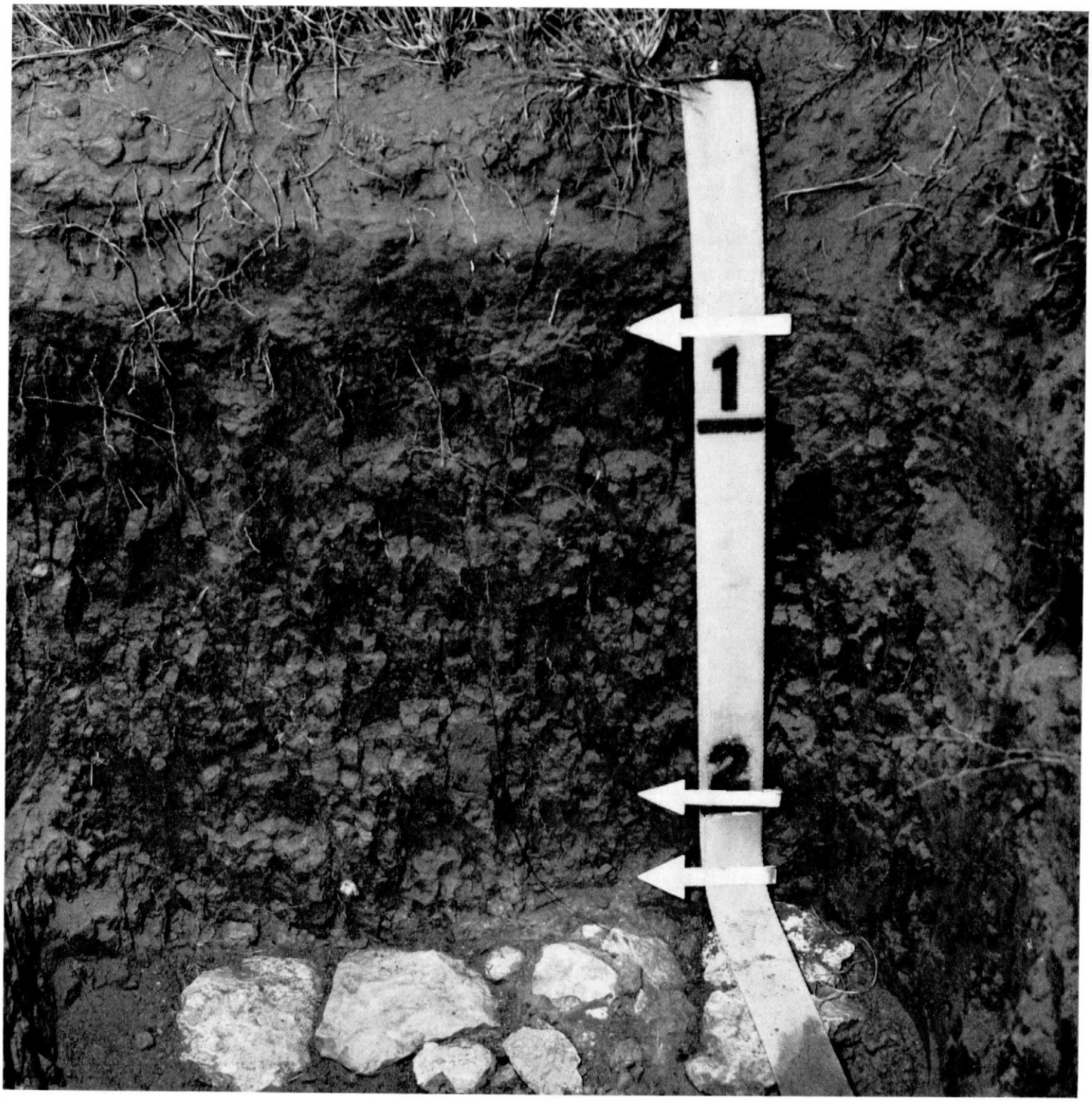

Figure 11.—**Profile of Stegall loam. The blocky subsoil rests abruptly on thick beds of indurated caliche at a depth of about 28 inches.**

Stony rolling land has little agricultural value and is suitable only as range and wildlife habitat. A few sites are suitable for the construction of ranch ponds, but strata or lenses of sandstone make many sites unsuitable for ponds. Dryland capability unit VIIs-3; Breaks range site; wildlife habitat group I.

Tivoli Series

The Tivoli series consists of excessively drained, loose fine sands. These soils formed in accumulations of recent windblown sands. They are extensive in the sand country in the eastern and northern parts of Lea County. Slopes are 0 to 12 percent. The vegetation consists of mid and tall grasses and shrubs. The average annual precipitation is 12 to 15 inches, the average annual air temperature is 58° to 60°F., and the frost-free season is 190 to 205 days. Elevations range from 3,500 to 4,400 feet. Tivoli soils are associated with Brownfield, Springer, and Gomez soils.

Typically, the surface layer is light yellowish-brown fine sand about 5 inches thick. The subsoil is pink fine sand about 31 inches thick. The substratum, to a depth of 60 inches, is very pale brown, loose fine sand.

Tivoli soils are used as range, wildlife habitat, and recreational areas.

Tivoli soils and Dune land, 0 to 12 percent slopes (Td).—This mapping unit is in the northern part of Lea County. It is about 45 percent Tivoli fine sand and 45 percent Dune land. Some areas are mostly Tivoli fine sand, some areas are mostly Dune land, and other areas contain both Tivoli fine sand and Dune land.

Included in mapping are small areas of Brownfield and Patricia fine sands and Amarillo-Gomez fine sands. The Tivoli fine sand is undulating. Dune land is similar to Active dune land. Some dunes are stabilized, but others are actively eroding.

Representative profile of Tivoli fine sand in an area of Tivoli soils and Dune land, 0 to 12 percent slopes, in the northeast corner of sec. 9, T. 10 S., R. 38 E.:

A1—0 to 5 inches, light yellowish-brown (10YR 6/4) fine sand, yellowish brown (10YR 5/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine roots; neutral (pH 6.7), noncalcareous; gradual, wavy boundary. 4 to 8 inches thick.

C1—5 to 36 inches, pink (7.5YR 7/4) fine sand, light brown (7.5YR 6/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; common fine roots; many coarse sand lenses; neutral (pH 7.0), noncalcareous; gradual, wavy boundary. 30 to 100 inches thick.

C2—36 to 60 inches, very pale brown (10YR 7/4) fine sand, light yellowish brown (10YR 6/4) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; common lenses of coarse sand; neutral (pH 7.2), noncalcareous.

Colors vary in hues of 5YR to 10YR. Organic-matter content of the A horizon ranges from 0.1 to 0.8 percent; texture is coarse to fine sand. The sand is 4 to 10 feet or more deep.

Tivoli soils are rapidly permeable. Runoff is very slow. Water intake is very rapid, and the available water holding capacity is 3 to 4.5 inches. Soil blowing is a very severe hazard. Roots penetrate to a depth of 60 inches or more.

Tivoli soils are used as range, wildlife habitat, and recreational areas. Tivoli soil: Dryland capability unit VIIe-1; Sand Hills (HP) range site; wildlife habitat group H. Dune land: Dryland capability unit VIIIe-1.

Tivoli-Brownfield fine sands, 0 to 5 percent slopes (TB).—This soil complex is about 50 percent Tivoli fine sand and about 40 percent Brownfield fine sand. The undulating Tivoli soil is in dune areas. Brownfield fine sand is in concave areas between low dunes. The Tivoli soil is similar to the Tivoli fine sand in Tivoli soils and Dune land, 0 to 12 percent slopes. The Brownfield soil is similar to the Brownfield fine sand in Brownfield and Patricia fine sands.

Included in mapping are small areas of Springer and Gomez soils.

The soils in this complex are used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in these areas. Tivoli soil: Dryland capability unit VIIe-1; Sandy Hills (HP) range site; wildlife habitat group H. Brownfield soil: Dryland capability unit VIIe-1; Deep Sand range site; wildlife habitat group H.

Tonuco Series

The Tonuco series consists of excessively drained loamy fine sands 10 to 20 inches thick over indurated caliche. The surface layer is loamy fine sand to fine sand and is underlain by loamy fine sand. These noncalcareous, coarse-textured soils formed in wind-deposited sands over thick, fractured indurated caliche. They are on plains and sloping ridges throughout the shallow sand country in the southern part of Lea County. Slopes are 0 to 3 percent. The vegetation consists of mid grasses, forbs, and shrubs. The average annual precipitation is 10 to 13 inches, the average annual air temperature is about 59° to 62°F., and the frost-free season is 190 to 205 days. Elevations range from 3,200 to 3,900 feet. These soils are associated with Palomas, Cacique, and Simona soils.

Typically, the surface layer is yellowish-red loamy fine sand about 12 inches thick. In places it is fine sand. The next layer is yellowish-red loamy sand about 5 inches thick. The substratum is indurated caliche.

Tonuco soils are used as range, wildlife habitat, and recreational areas. Indian artifacts can be found in some areas.

Tonuco loamy fine sand (0 to 3 percent slopes) (TF).—This gently undulating soil is on uplands, ridges, and level prairies. Included in mapping are areas of Simona, Berino, and Cacique soils.

Representative profile of Tonuco loamy fine sand, about 0.2 mile west of the entrance road to gas plant in the southeastern part of Eunice, about half a mile west of the southeast corner of sec. 34, T. 21 S., R. 37 E.:

A1—0 to 12 inches, yellowish-red (5YR 5/6) loamy fine sand, yellowish red (5YR 4/6) when moist; very weak, medium, subangular blocky and weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; few small pockets of lighter colored sand intermixed; many fine roots; few organic stains; neutral (pH 7.1), noncalcareous; clear boundary. 8 to 12 inches thick.

AC—12 to 17 inches, yellowish-red (5YR 5/6) loamy sand, yellowish red (5YR 4/6) when moist; weak, medium, subangular blocky and weak, coarse, prismatic struc-

ture; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common organic stains; neutral (pH 7.3), noncalcareous; abrupt boundary. 4 to 8 inches thick.

IICcam—17 inches, white (5YR 8/1), indurated caliche, fractured in places.

The soil ranges from 10 to 20 inches in thickness. The A horizon ranges from 5YR to 7.5YR in hue, and the AC horizon from 2.5YR to 7.5YR. Typically, the soil is neutral, but ranges from neutral to mildly alkaline. There are a few segregated lime films on some peds. In places quartzose gravel and caliche fragments occur above the indurated caliche.

Permeability is very rapid. Runoff is very slow, and water intake is rapid. The available water holding capacity is 1 to 2 inches. The effective rooting depth is 10 to 20 inches. Soil blowing is a severe hazard.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-7; Sandy range site; wildlife habitat group K.

Tonuco loamy fine sand (0 to 3 percent slopes) (To).—This gently undulating soil is on upland plains and ridges in the east-central part of Lea County. Included in mapping are small areas of Simona, Berino, and Cacique soils.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-7; Sandy range site; wildlife habitat group K.

Tonuco fine sand, hummocky (0 to 3 percent slopes) (TE).—This soil consists of low sand hummocks intermingled with areas where the sand is very shallow over fragmentary and fractured indurated caliche. The caliche is exposed in places. The soil in the hummocks is similar to Tonuco loamy fine sand, but its surface layer differs in texture and is about 8 inches thick.

Included in mapping are areas of Simona, Berino, Cacique, Maljamar, and Palomas soils.

Soil blowing is a very severe hazard.

This soil is used for range, wildlife, and recreational purposes. Some Indian artifacts are found in this area. Dryland capability unit VIIe-7; Deep Sand range site; wildlife habitat group K.

Upton Series

The Upton series consists of well-drained gravelly loams underlain by indurated caliche at a depth of 6 to 20 inches. These nearly level to gently sloping soils are on ridges, divides, fans, and foot slopes. They formed in calcareous gravelly loam and wind-deposited materials over indurated caliche. Slopes are 0 to 3 percent. The vegetation is principally a sparse cover of short and mid grasses and shrubs. The average annual precipitation is 10 to 13 inches, the average annual air temperature is 60° to 62°F., and the frost-free season is 190 to 200 days. Elevations range from 3,000 to 4,000 feet. Associated soils include Kimbrough and Simona soils.

Typically, the surface layer and subsoil are grayish-brown gravelly loam about 8 inches thick. The substratum is white indurated caliche.

The Upton soils in this county are mapped only with Simona soils. They are used as range and wildlife habitat. Indian artifacts can be found in some areas.

Representative profile of Upton gravelly loam within an area of Simona-Upton association, in the north wall of a caliche pit in the northwest quarter of sec. 33, T. 20 S., R. 37 E., about 2.5 miles north of Oil Center:

A1—0 to 1 inch, grayish-brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; mildly alkaline (pH 7.9), slightly calcareous; abrupt boundary. 0 to 6 inches thick.

B2—1 to 8 inches, grayish-brown (10YR 5/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; hard, very friable when moist, nonsticky and nonplastic when wet; moderately alkaline (pH 8.1), strongly calcareous; abrupt boundary. 6 to 14 inches thick.

Ccam—8 inches, white (10YR 8/1), indurated caliche; cementation decreases below about 35 inches.

The depth to the indurated caliche ranges from 6 to 20 inches. Colors range within hues of 7.5YR to 10YR throughout the soil. The A horizon has weak, thin, platy structure to weak, fine, subangular blocky.

Upton soils are moderately permeable. Surface runoff is medium, and water intake is rapid. Available water holding capacity is 1 to 3 inches. Root depth is 6 to 20 inches. Erosion is a moderate hazard.

Wink Series

The Wink series consists of well-drained soils that have a sandy loam subsoil. These soils formed in strongly calcareous, wind-deposited and water-deposited, sandy sediments in shallow basins. Slopes are 0 to 3 percent. The vegetation consists of mid grasses and shrubs. The average annual precipitation is 12 to 15 inches, the average annual air temperature is 60° to 62° F., and the frost-free season is 190 to 205 days. Elevations range from 3,100 to 3,400 feet. Jal, Kermit, and Midessa soils are associated with the Wink soils.

Typically, the surface layer is brown fine sand about 12 inches thick. In places it is loamy fine sand or fine sandy loam. The subsoil is brown sandy loam about 11 inches thick. The substratum (fig. 12), to a depth of 60 inches, is white sandy loam that has a high lime content.

Wink soils are used for range, wildlife, and recreational areas.

Wink fine sand (0 to 3 percent slopes) (WF).—This gently undulating soil is in the southern part of Lea County. Included in mapping are areas of Jal, Drake, Kermit, and Midessa soils.

Representative profile of Wink fine sand, 0.25 mile south, 100 feet east of the northwest corner of sec. 7, T. 20 S., R. 37 E.:

A1—0 to 12 inches, brown (10YR 5/3) fine sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry or moist, nonsticky and nonplastic when wet; many fine roots; moderately alkaline (pH 8.0), slightly calcareous; gradual boundary. 10 to 15 inches thick.

B2—12 to 23 inches, brown (10YR 5/3) sandy loam, dark brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; moderately alkaline (pH 8.2), strongly calcareous; gradual boundary. 10 to 21 inches thick.

Cca—23 to 60 inches, white (10YR 8/2), soft caliche of sandy loam texture, light gray (10YR 7/2) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; upper part contains few, fine, weakly cemented lime concretions; strongly alkaline (pH 8.5), strongly calcareous.

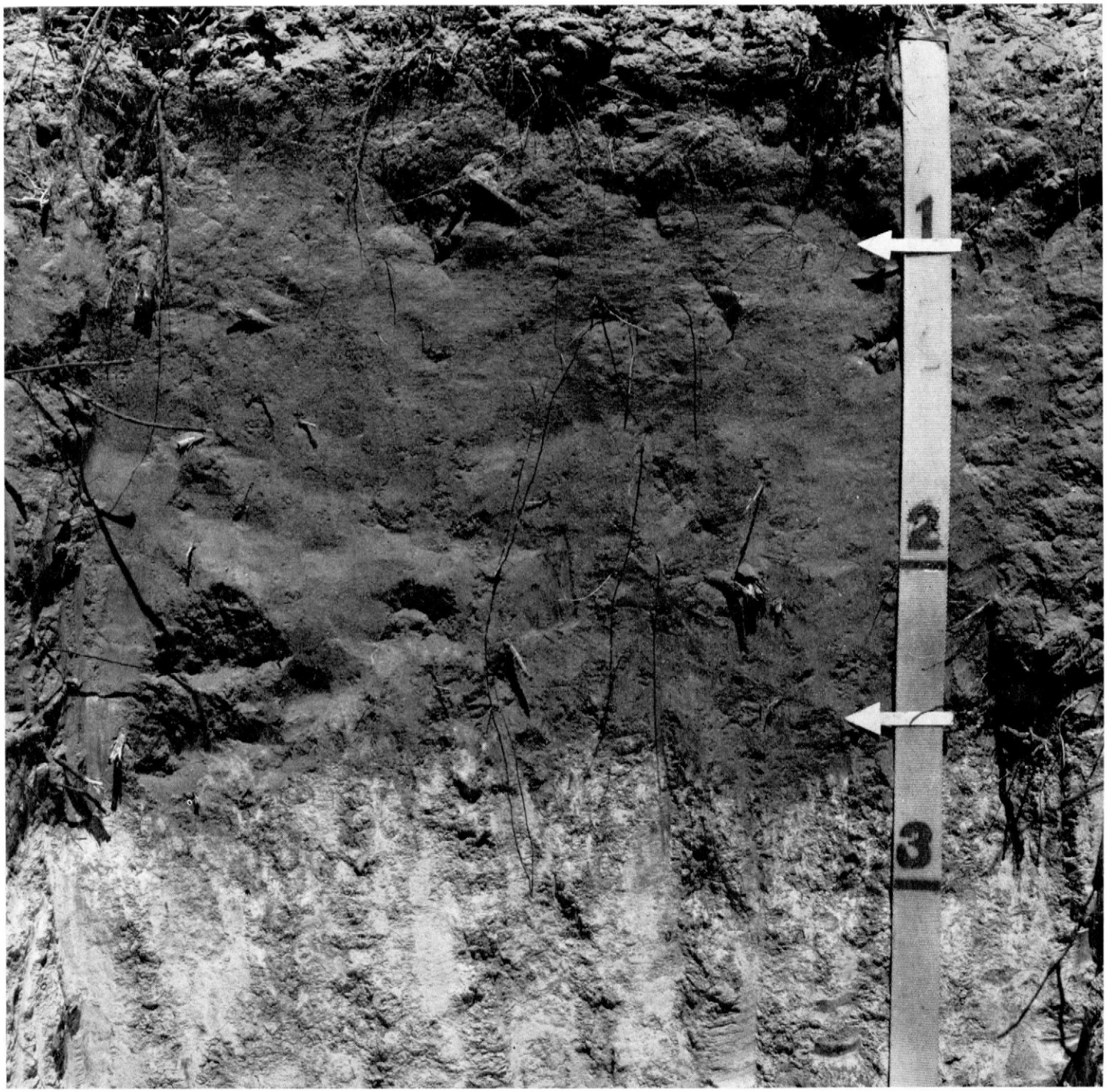

Figure 12.—Profile of Wink sand. The Cca horizon is at a depth of about 30 inches.

The A horizon ranges from fine sand to loamy sand and from brown to pale brown. It is calcareous in places. The B horizon ranges from brown to pale brown. The Cca horizon is light gray or white. Depth to the Cca horizon ranges from 20 to 36 inches.

This soil is moderately permeable. Runoff is very slow. Water intake is rapid, and total available water holding capacity is 2 to 4 inches. Roots penetrate to a depth of 20 to 35 inches. Soil blowing is a severe hazard.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-2; Deep Sand range site; wildlife habitat group F.

Wink loamy fine sand (0 to 3 percent slopes) (WK).—This soil is similar to Wink fine sand, but it differs in texture of the surface layer and is about 7 inches thick. It is undulating in places. Included in mapping are small tracts of Berino, Cacique, Midessa, and Jal soils.

This soil is used as range, wildlife habitat, and recreational areas. Dryland capability unit VIIe-2; Deep Sand range site; wildlife habitat group F.

Zita Series

The Zita series consists of well-drained soils that have a heavy loam subsoil. These soils are in depressions and swales. They formed in calcareous, wind-deposited silty material on the Southern High Plains. Slopes are 0 to 1 percent. Vegetation consists of short and mid grasses. The average annual precipitation is 12 to 16 inches, the average annual air temperature is 58° to 60° F., and the frost-free season is 195 to 205 days. Elevations range from 3,600 to 4,000 feet. These soils are associated with Portales and Lea soils.

Typically, the surface layer is dark-brown loam about 15 inches thick. In places it is fine sandy loam. The subsoil is dark grayish-brown heavy loam about 20 inches thick. The substratum, to a depth of 60 inches, is very pale brown loam that has a high lime content.

Zita soils are used as cropland, range, wildlife habitat, and recreational areas.

Zita loam (0 to 1 percent slopes) (Zt).—This soil is in broad swales and other concave areas in the north-central part of Lea County. Included in mapping are small tracts of Portales and Mansker soils.

Representative profile of Zita loam, in the northeast quarter of sec. 5, T. 16 S., R. 37 E.:

A11—0 to 1 inch, very dark grayish-brown (10YR 3/2) silt loam, very dark brown (10YR 2/2) when moist; moderate, thin, platy structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; neutral (pH 7.2), noncalcareous; clear boundary. 0 to 2 inches thick.

A12—1 to 15 inches, dark-brown (10YR 3/3) loam, very dark brown (10YR 3/2) when moist; strong, medium, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many worm casts in upper part, becoming common with depth; mildly alkaline (pH 7.7), noncalcareous; diffuse boundary. 10 to 18 inches thick.

B2—15 to 35 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark grayish brown (10YR 3/2) when moist, becoming brown (7.5YR 5/4) with depth; strong, medium, granular structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common worm casts in upper part, becoming few with depth; moderately alkaline (pH 8.3), strongly calcareous; diffuse boundary. 15 to 20 inches thick.

Cca—35 to 60 inches, very pale brown (10YR 8/3), loamy, soft caliche, very pale brown (10YR 7/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; many fine tubular pores; many fine concretions and soft bodies of lime, the number decreasing below a depth of 50 inches; moderately alkaline (pH 8.4), strongly calcareous.

The A horizon ranges from light to heavy loam and commonly contains thin layers of silt loam. Reaction is neutral to mildly alkaline. Color ranges from dark brown to very dark grayish brown within 7.5YR and 10YR hues. The B horizon is dark grayish brown to brown. It is less than 1 percent organic matter. Depth to the Cca horizon is 25 to 40 inches.

This soil is moderately permeable. Runoff is slow. Water intake is moderate, and the available water holding capacity is 5 to 7 inches. Soil blowing is a moderate hazard. Rooting depth to the strong lime zone is 25 to 40 inches.

This soil is used as cropland, range, wildlife habitat, and recreational areas. Irrigated capability unit IIe-3; dryland capability unit IIIec-2; Loamy range site; wildlife habitat group B.

Zita fine sandy loam (0 to 1 percent slopes) (Zf).—This soil is like Zita loam, but its surface layer differs in texture and is about 12 to 15 inches thick. Included in mapping are small tracts of Portales and Mansker soils.

Soil blowing is a moderate hazard.

This soil is used for cultivation, range, wildlife, and recreation. Irrigated capability unit IIe-9; dryland capability unit IIIe-2; Sandy range site; wildlife habitat group B.

Use and Management of the Soils

This section contains information on use and management of the soils for irrigated crops, dryland crops, range, wildlife, and engineering. It explains the system by which the Soil Conservation Service groups soils according to their suitability for general field crops and describes management of irrigated soils and dryland soils, as grouped according to this system. Engineering properties, interpretations, and classifications of each soil in the county are given in the tables and interpretive engineering charts in the engineering section.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The groups are made according to the limitations of the soils when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to rice, cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, all kinds of soil are grouped at three levels, the capability class, subclass, and unit. These levels are described in the following paragraphs.

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

Class I soils have few limitations that restrict their use. (There are no class I soils in Lea County.)

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture or range, woodland, or wildlife. (There are no class V soils in Lea County.)

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial crop production and restrict their use to recreation, wildlife, or water supply, or to use for esthetic purposes.

Capability Subclasses are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c* 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-3 or IIIe-6. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

In the following pages the capability units in Lea County are described and suggestions for the use and management of the soils are given. The soils are grouped both according to suitability for use under irrigation and according to suitability for dryland farming.

Management of Irrigated Soils

This section describes the management needed on the irrigated soils of the county to control erosion, to maintain tilth and fertility, and to use irrigation water efficiently. The irrigated soils are mainly in the northeastern part of Lea County in the vicinity of Tatum, Lovington, and Hobbs. The principal irrigated crops are grain sorghum, cotton, alfalfa, forage sorghum, and barley.

Irrigation.—In Lea County irrigation water is obtained from wells that are 90 to 150 feet deep. The water is commonly pumped from a depth of 60 to 100 feet at a rate of 400 to 1,800 gallons of water per minute. The quality of the water is good. Depth to ground water has been generally decreasing in recent years. About half of the pumps are powered by natural gas and the rest by electricity, butane, or diesel fuel. Relatively low lifts, good pump yields, and economical fuel reduce overall costs per acre-foot in Lea County (*5*).

Irrigation systems must be designed to distribute water evenly over the fields without causing erosion. Water should be applied in amounts the soil can hold in the root zone of the crop. A sprinkler irrigation system is the most common irrigation system in Lea County. It is more practical than other irrigation systems on sandy soils, such as Patricia fine sand, which are difficult to level. A few furrow and border irrigation systems are used on nearly level clayey soils, such as the Stegall soils.

A well designed conservation irrigation system minimizes erosion and limits loss of water. Planning an irrigation system requires knowledge of how fast the soil can absorb water, how much water it can hold, and how much water is available to plants. A Stegall silty clay loam, for example, absorbs water more slowly than a Gomez loamy fine sand. Technical help in planning a conservation irrigation system is available through the local office of the Soil Conservation Service.

Crop residue management.—Leaving crop residue on or near the surface helps control erosion and improves the soil. Protection is especially needed in fall, winter, and spring, when the hazard of soil blowing is most severe. After harvest the residue is usually left on the soil throughout the winter. When the seedbed is prepared in the spring, the residue is incorporated into the soil. Leaving crop residue on the surface protects the soil from erosion, improves the water intake rate, reduces evaporation of soil moisture, helps maintain the organic-matter content and plant nutrients, and preserves soil structure.

The amount of residue needed to protect the soil varies according to the texture of the surface layer. Soils having a sandy surface layer, such as Patricia fine sand, need more crop residue than do soils with a loamy surface layer, such as Lea loam.

Conservation cropping systems.—Conservation cropping systems are used to improve or maintain tilth; to limit erosion; and to help control weeds, insects, and disease. A cropping system is a sequence of crops in which soil-improving crops balance soil-depleting crops. The frequency of growing soil-improving crops depends on the severity of the erosion hazard and the limitations of the soil. A deep, loamy soil, such as Amarillo loam, 0 to 1 percent slopes, does not need a soil-improving crop in the rotation as often as a shallow, sandy soil, such as Sharvana loamy fine sand. Grasses, alfalfa, and sweetclover are soil-improving crops. They should be fertilized and the residue incorporated into the soil in the last year of the rotation. Small grain and sorghum can be used as

soil-improving crops if large amounts of residue are returned to the soil, if nitrogen is added to hasten decomposition, and if large amounts of residue are turned under.

Minimum tillage.—Minimum tillage maintains soil structure, reduces soil compaction, and keeps pore space. Tilling the soils when wet, especially soils like Stegall silty clay loam, causes surface compaction. Surface compaction can be avoided by reducing the number of tillage operations, by not tilling when the soil is wet, and by varying the depth of tillage.

Irrigated capability units

The 16 irrigated capability units in Lea County are described in the following pages. The description of each unit includes the names of the represented soil series, but this does not mean that all the soils of a named series are in that unit. To find the capability classification of any given soil, refer to the "Guide to Mapping Units" at the back of the survey.

IRRIGATED CAPABILITY UNIT IIe-1

Only Amarillo loam, 0 to 1 percent slopes, is in this unit. This is a well-drained soil that has a subsoil of heavy sandy clay loam. It formed in water-deposited and wind-deposited materials on alluvial fans and uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 8 to 10 inches. The effective rooting depth is 60 inches or more. Soil blowing is a moderate hazard.

This soil is used for irrigated and dryland crops, range, and wildlife. Cotton, small grain, alfalfa, forage sorghum, and grain sorghum are grown under irrigation. Some fruit is grown.

Good management of irrigation water is essential. Water is generally applied through a system of pipelines or open ditches, or through a surface system of level borders, graded borders, or level furrows.

Yields can be improved by growing a high-residue, soil-improving crop 1 year in 3 and by applying fertilizer according to the results of soil analysis. Row crops or small grain or a combination of the two can be grown the other 2 years. Stubble-mulch tillage increases the rate of water intake and retards loss of moisture, soil material, and plant nutrients. Crop residues left on the surface help to control soil blowing. Both mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on this soil. Russian-olive, juniper, and Siberian elm are suitable trees for windbreaks. Young trees need protection from grazing and burning.

IRRIGATED CAPABILITY UNIT IIe-2

Only Amarillo fine sandy loam, 0 to 1 percent slopes, is in this unit. This is a well-drained soil that has a sandy clay loam subsoil. It formed in sandy, water-deposited and wind-deposited materials on uplands and alluvial fans.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 7 to 9 inches. The effective rooting depth is more than 60 inches. Soil blowing is a moderate hazard unless adequate cover is maintained.

This soil is used for irrigated crops, range, wildlife, and recreation. It is suited to cotton, small grain, alfalfa, forage sorghum, and grain sorghum. Some fruit is grown.

Good management of irrigation water is essential. Level furrows, level borders, or sprinklers are used for irrigating.

Yields can be improved by growing a high-residue, soil-improving crop 1 year in 3, or grasses and legumes 1 year in 3, and by applying fertilizer according to the results of soil analysis. Crop residue should be left on the surface during periods when soil blowing is critical. Also, emergency tillage may be needed. Such tillage roughens the surface and increases water intake and water storage. Both mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on this soil. Juniper, Siberian elm, and Russian-olive are well suited to windbreaks. Young trees need protection from grazing and burning.

IRRIGATED CAPABILITY UNIT IIe-3

This unit consists of soils of the Arvana, Lea, Portales, and Zita series. These soils are on uplands. They are well drained and have a subsoil of light clay loam or sandy clay loam. They formed in wind-deposited and water-deposited, calcareous sediments. The Arvana soil and the Lea soil are underlain by hard caliche, and the Portales soil and the Zita soil are underlain by thick beds of soft caliche. Slopes are 0 to 1 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 5 to 11 inches. The effective rooting depth is 20 to 40 inches to the indurated caliche in the Arvana and Lea soils. Roots commonly penetrate into the lime zone of the Portales and Zita soils. Soil blowing is a moderate hazard.

These soils are used for irrigated and dryland crops, range, wildlife, and recreation. They are suitable for cotton, small grain, alfalfa, and forage and grain sorghums.

A suitable cropping system provides a high-residue, soil-improving crop 1 year in 3, and the residue is left on the soil, or grasses and legumes 1 year in 3. Yields can be improved by applying fertilizer according to the results of soil analysis. Stubble-mulch tillage reduces surface runoff, increases the rate of water intake, and reduces loss of moisture, soil material, and plant nutrients. Barren areas may require emergency tillage to reduce the effects of soil blowing. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Water is generally applied through a surface system of level borders, graded borders, or furrows. Sprinklers can be used, but care is needed to prevent crusting and erosion.

Field and farm windbreaks can be established on these soils. Russian-olive and Siberian elm are well suited to windbreaks. Young trees need protection from grazing and burning.

IRRIGATED CAPABILITY UNIT IIe-5

This unit consists of nearly level, well-drained soils of the Stegall series. These soils have a heavy clay loam subsoil. They formed in water-deposited sediments on uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderately slow, runoff is slow, and the available water holding capacity is 5 to 7 inches. The effective rooting depth is 20 to 36 inches over the indurated caliche. Soil blowing is a moderate hazard.

The soils are used for irrigated and dryland crops, range, wildlife, and recreation. They are suitable for cotton, sorghum, small grain, and alfalfa.

A cropping system of 1 year of cotton and 2 years of grain sorghum is generally practiced. Legumes or other soil-improving crops can be included in the rotation. Stubble-mulch tillage increases the rate of water intake and reduces loss of moisture, soil material, and plant nutrients. Yields can be improved by applying fertilizer according to the results of soil analysis. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Water is generally applied through a system of pipelines or open lined ditches or through a surface system of level borders, graded borders, or furrows.

Indurated caliche at a depth of 20 to 36 inches makes the establishment of windbreaks difficult. Russian-olive and Siberian elm, however, are suitable trees for windbreaks.

IRRIGATED CAPABILITY UNIT IIe-9

This unit consists of soils in the Arvana, Lea, Portales, and Zita series. These soils formed in wind-deposited and water-deposited, calcareous sediments on uplands. They are well drained and have a loam, sandy clay loam, or light clay loam subsoil underlain by a limy substratum. The Lea and Arvana soils are underlain by indurated caliche, and the Portales and Zita soils are underlain by thick beds of soft caliche.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 5 to 10 inches. Rooting depth in the Arvana and Lea soils is restricted by the indurated caliche at a depth of 20 to 40 inches. Roots commonly penetrate the lime zone of the Portales and Zita soils. Soil blowing is a moderate hazard unless adequate cover is maintained.

These soils are used for irrigated and dryland crops, range, wildlife, and recreation. The major crops are cotton, grain sorghum, and alfalfa. Small grain and corn are also grown.

Yields can be improved by applying fertilizer according to the results of soil analysis and by growing a high-residue, soil-improving crop 1 year in 3. Row crops or small grain can be grown the other 2 years. Grasses and legumes or cover and green manure crops can be included in the rotation. Stubble-mulch tillage increases the rate of water intake and reduces loss of moisture, soil material, and plant nutrients. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Water is generally applied through a system of pipelines or open ditches or through a surface system of level borders, graded borders, or furrows. Also, sprinklers are used for irrigating.

Field and farm windbreaks can be established on these soils. Russian-olive and Siberian elm are well suited. Young trees need protection from grazing and burning.

IRRIGATED CAPABILITY UNIT IIIe-4

Only Amarillo fine sandy loam, 1 to 3 percent slopes, is in this unit. This is a well-drained soil that has a sandy clay loam subsoil. It formed in water-deposited and wind-deposited materials on alluvial fans and uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is medium, and the available water holding capacity is 7 to 9 inches. Effective rooting depth is more than 60 inches. Soil blowing is a moderate hazard unless adequate cover is maintained.

This soil is used for irrigated and dryland crops, range, wildlife, and recreation. The major crops are cotton, grain sorghum, and small grain. Corn and truck crops are also grown.

A suitable cropping system is one that provides a high-residue, soil-improving crop half the time or a deep-rooted legume, such as alfalfa, in rotation with small grain half the time. Yields can be improved by applying fertilizer according to the results of soil analysis. Stubble-mulch tillage slows surface runoff, increases the rate of water intake, and reduces loss of moisture, soil material, and plant nutrients. Emergency tillage may be required to reduce the effects of soil blowing where plant residues have been removed. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. This soil can be irrigated through a system of pipelines or open ditches or through a surface system of level borders, graded borders, or furrows. Sprinkler systems are effective also.

Field and farm windbreaks can be established on this soil. Juniper, Siberian elm, and Russian-olive are well suited. Young trees need protection from grazing and burning.

IRRIGATED CAPABILITY UNIT IIIe-5

Only Mansker loam, 0 to 1 percent slopes, is in this unit. This is a well-drained light clay loam having a substratum that is high in lime content. It formed in strongly calcareous, wind-deposited and water-deposited materials on uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 4 to 6 inches. Effective rooting depth is 12 to 20 inches to the strong lime zone. In irrigated areas, however, some roots penetrate the lime zone. Soil blowing is a moderate hazard unless adequate cover is maintained.

This soil is used for irrigated crops. It is suitable for cotton, grain sorghum, and alfalfa. Grain sorghum becomes chlorotic in places because of the high lime content.

A suitable cropping system is one that provides a high-residue crop or a cover and green manure crop 2 years in 3, or a soil-improving crop 1 year in 2. A rotation of grasses and legumes 2 years in 3 is also suitable. Yields

can be improved by applying fertilizer according to the results of soil analysis. Stubble-mulch tillage increases the rate of water intake and reduces loss of moisture, soil material, and plant nutrients. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. This soil is generally irrigated through a system of level borders, graded borders, or level furrows. Sprinkler irrigation is also suitable, although some compaction is likely.

Field and farm windbreaks can be established on this soil. Russian-olive and Siberian elm are well suited.

IRRIGATED CAPABILITY UNIT IIIe-6

Only Portales loam, 1 to 3 percent slopes, is in this unit. This is a well-drained soil having a light clay loam subsoil and a substratum that is high in lime content. It formed in strongly calcareous, wind-deposited and water-deposited sediments on uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate, runoff is medium, and the available water holding capacity is 9 to 11 inches. Effective rooting depth is 20 to 36 inches to the strong lime zone. In irrigated areas, however, roots commonly penetrate into the lime zone. Erosion is a moderate hazard.

This soil is used for irrigated crops, range, wildlife, and recreation. The major crops are grain sorghum, cotton, and alfalfa. Small grain and vegetables are also grown.

A suitable cropping system is one that provides a high-residue, soil-improving crop 1 year in 2. A rotation that provides grasses and legumes or cover and green manure crops half the time is also suitable. Yields can be improved by applying fertilizer according to the results of soil analysis. Stubble-mulch tillage is a good conservation practice on this soil. Emergency tillage may be required if plant residue is sparse. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. A level system of borders or furrows should be used. After it is installed, the suggested cropping system and rotation can be reduced to 1 year in 3. If a sprinkler irrigation system is considered, onsite investigation is required to determine the feasibility of diversions, grassed waterways, terraces, or farming on the contour.

Windbreaks can be established on this soil. Russian-olive and Siberian elm are well suited.

IRRIGATED CAPABILITY UNIT IIIe-7

This unit consists of soils of the Arvana, Gomez, and Portales series. These are well-drained soils that have a fine sandy loam, sandy clay loam, or light clay loam subsoil. They formed in wind-deposited and water-deposited, calcareous sediments on upland plains. Slopes are generally 1 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate to moderately rapid, runoff is medium, and the available water holding capacity is 4 to 10 inches. The effective rooting depth is 20 to 34 inches for the Arvana soils and 20 to 40 inches to the strong lime zone for the Gomez and Portales soils. In irrigated areas, however, roots commonly penetrate the strong lime zone. Soil blowing is a moderate hazard unless adequate cover is maintained.

These soils are used for irrigated crops. The major crops are cotton, grain sorghum, and alfalfa. Corn and truck crops are also grown.

A suitable cropping system is one that provides a high-residue crop 2 years in 3 or a soil-improving crop 1 year in 2. Residue is left on the soil. Emergency tillage may be required for control of erosion. Yields can be improved by applying fertilizer according to the results of soil analysis. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Either surface or sprinkler irrigation is suitable. Graded borders or level borders may be needed on the stronger slopes.

These soils are suitable for windbreaks. Juniper, Siberian elm, and Russian-olive are well suited.

IRRIGATED CAPABILITY UNIT IIIe-10

Only Amarillo loamy fine sand, 0 to 3 percent slopes, is in this unit. This is a well-drained soil that has a sandy clay loam subsoil. It formed in sandy, water-laid and wind-laid deposits on uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is very slow, and the available water holding capacity is 6 to 8 inches. The effective rooting depth is 60 inches or more. Soil blowing is a severe hazard unless adequate cover is maintained.

This soil is used for irrigated crops. The major crops are cotton and grain sorghum. Alfalfa, truck crops, fruit trees, and small grain are also grown.

A high residue crop should be grown 2 years in 3 or a soil-improving crop half the time. Grasses and legumes in rotation 2 years in 3 is an alternate system. Emergency tillage leaves the surface rough and helps prevent soil blowing. Deep plowing is a temporary measure that also resists blowing. Yields can be improved by applying fertilizer according to the results of soil analysis. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Sprinkler irrigation is suitable. In nearly level areas the water can be carried through and then spread by level or graded furrows.

This soil is suitable for windbreaks. Juniper, Siberian elm, and Russian-olive are suitable trees for planting.

IRRIGATED CAPABILITY UNIT IVe-6

This unit consists of soils of the Arvana and Sharvana series. These soils formed in wind-deposited and alluvial, sandy, calcareous sediments on uplands. They are well drained and have a sandy clay loam subsoil. Slopes are commonly 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is very slow, and the available water-holding capacity is 2 to 5 inches. Effective rooting depth is 12 to 34 inches over indurated caliche. Soil blowing is a severe hazard unless adequate cover is maintained.

These soils are used for irrigated crops, range, and wildlife. The major crops are cotton and grain sorghum.

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Alfalfa, small grain, fruit trees, and truck crops are also grown.

A suitable cropping system is one that provides a high-residue crop 2 years in 3 or a soil-improving crop half the time. All residue is left on the soil. Emergency tillage is necessary during periods of critical soil blowing. Grasses and legumes in rotation 2 years in 3 is another choice. The use of soil-improving crops 1 year in 2 and cover and green manure crops 2 years in 3 is still another choice. Yields can be improved by applying fertilizer according to the results of soil analysis. Stubble-mulch tillage slows surface runoff and reduces loss of moisture and soil nutrients. Emergency tillage is a process of deep plowing, chiseling, and turning the soil to roughen it. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Sprinkler irrigation is suitable. Ditches or pipes that carry water to level or graded furrows can be used in nearly level areas.

The Arvana soils are suitable for growing windbreaks. Juniper, Siberian elm, and Russian-olive are suitable for this purpose. The Sharvana soils are not suited to growing windbreaks because they are too shallow over indurated caliche.

IRRIGATED CAPABILITY UNIT IVe–7

Only Mansker loam, 1 to 3 percent slopes, is in this unit. This is a well-drained soil that has a light clay loam subsoil. It formed in strongly calcareous windborne and waterborne, medium-textured to moderately fine textured sediments. It is on uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is medium, and the available water holding capacity is 4 to 6 inches. The effective rooting depth is 12 to 20 inches to the strong lime zone. In irrigated areas, however, roots commonly penetrate the lime zone. Soil blowing is a moderate hazard.

This soil is used for irrigated crops, range, and wildlife. It is better suited to tame pastures than to other crops. Cotton, sorghum, alfalfa, and small grain are commonly grown.

A suitable cropping system is one that provides a high-residue, soil-improving crop 1 year in 2, and the residue is left on the soil. Grasses and legumes in rotation, soil-improving crops combined with cover and green manure crops, and soil-improving crops and mulching are all beneficial in the cropping system. Stubble-mulch tillage slows surface runoff, increases the rate of water intake, and reduces loss of moisture, soil material, and plant nutrients. Yields can be improved by applying fertilizer according to the results of soil analysis. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Irrigation water is generally applied through a surface system of level borders, graded borders, or furrows. Sprinklers are also effective. This soil is difficult to grade because it is shallow.

This soil is suitable for windbreaks. Siberian elm and Russian-olive are suitable for this purpose.

IRRIGATED CAPABILITY UNIT IVe–8

Only Amarillo loamy fine sand, 0 to 3 percent slopes, eroded, is in this unit. This is a well-drained soil that has a sandy clay loam subsoil. It formed in mixed deposits on uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is very slow, and the available water holding capacity is 5 to 7 inches, depending upon the severity of erosion. The effective rooting depth is 60 inches or more. Soil blowing is a severe hazard unless adequate cover is maintained.

This soil is used mainly for range and wildlife, but it is also used for irrigated crops, such as small grain and forage sorghum.

A suitable cropping system is one that provides a high-residue crop 2 years in 3. Another suitable system consists of growing grasses and legumes in rotation. Emergency tillage, or roughening the surface, may be needed. Stubble-mulch tillage reduces loss of moisture, soil material, and plant nutrients. Yields can be improved by applying fertilizer according to the results of soil analysis. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Sprinkler irrigation is the most effective method of irrigating this soil.

Field and farm windbreaks can be established on this soil. Juniper, Russian-olive, and Siberian elm are well suited.

IRRIGATED CAPABILITY UNIT IVe–9

Only Arch loam is in this unit. This is a well-drained, heavy loam. It formed in alluvium modified by water-deposited calcium carbonates. It occurs as nearly level, concave areas.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow, and the total available water holding capacity is 3 to 5 inches. The effective rooting depth is 10 to 20 inches to the strong lime zone. Some roots penetrate the lime zone in irrigated areas. Soil blowing is a severe hazard unless adequate cover is maintained.

Large tracts of this soil are used for range and wildlife. The soil is also used for irrigated crops. Small grain, forage and grain sorghum, legumes, and cotton are grown. Lime-induced chlorosis is a common limitation, especially in growing sorghum.

A suitable cropping system is one that provides a high-residue, soil-improving crop at least half the time, and the residue is left on the soil. Grasses and legumes in rotation 2 years in 3 is another suitable system. Stubble-mulch tillage slows surface runoff, increases the rate of water intake, and reduces loss of moisture, soil material, and plant nutrients. Yields can be improved by applying fertilizer according to the results of soil analysis. Emergency tillage may be required to reduce the effects of soil blowing. Mechanical and chemical means are used to control weeds.

Good management of water is essential. This soil can be irrigated through a surface system of level borders, graded borders, or furrows, or by sprinklers.

Field and farm windbreaks can be established. Juniper and Siberian elm are suitable for this purpose.

IRRIGATED CAPABILITY UNIT IVe-11

This unit consists of soils of the Gomez series and the Patricia part of the Brownfield and Patricia fine sands. These soils are well drained and have a fine sandy loam and sandy clay loam subsoil.

The Gomez soil formed in calcareous, water-deposited, sandy sediments, and the Patricia soil formed in wind-deposited, sandy materials on the High Plains. These soils are undulating to gently sloping.

The average annual precipitation is 12 to 15 inches, and the frost-free season is 195 to 205 days. Permeability is moderate to moderately rapid, runoff is very slow, and the total available water holding capacity is 3 to 8 inches. The effective rooting depth for the Gomez soil is 20 to 40 inches over the strong lime zone. In irrigated areas, however, some roots penetrate the lime zone. Effective rooting depth for the Patricia soil is 60 inches or more. Soil blowing is a severe hazard unless adequate cover is maintained.

These soils are used mainly for range, wildlife, and recreation. They are also used for irrigated crops. Grain sorghum, cotton, alfalfa, and truck crops are grown.

The cropping system selected should provide enough residue to protect the soils. Either a closely spaced, high-residue crop grown continuously or a soil-improving crop 2 years in 3 is suitable. Crop residue use is important. Stubble-mulch tillage slows surface runoff, increases the rate of water intake, and reduces loss of moisture, soil material, and plant nutrients. Yields can be improved by applying fertilizer according to the results of soil analysis. Emergency tillage may be needed to reduce soil blowing. Deep plowing, chiseling, and turning the soil improve the texture and water-holding capacity. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Sprinkler irrigation is the most suitable.

The soils in this unit are suitable for windbreaks. Siberian elm and Russian-olive are suited to this purpose.

IRRIGATED CAPABILITY UNIT IVs-2

This unit consists of well-drained, nearly level to undulating soils of the Kimbrough, Sharvana, Simona, and Slaughter series. These soils are fine sandy loams to heavy clay loams that are underlain by indurated caliche at a depth of 10 to 20 inches. They formed in wind-deposited and water-deposited sediments of the High Plains.

The average annual precipitation is 10 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is slow in the Slaughter soil, moderately rapid in the Simona soil, and moderate in the other soils. Runoff is slow to medium, and the available water holding capacity is 1.5 to 3.5 inches. The effective rooting depth is 10 to 20 inches to indurated caliche. Soil blowing is a slight to moderate hazard unless adequate cover is maintained.

These soils are used for range, wildlife, and recreation. They are also used for irrigated crops, such as small grain and sorghum.

A rotation of a high-residue crop or a cover and green manure crop 2 years in 3, or a soil-improving crop 1 year in 2, or grasses and legumes 2 years in 3 is a suitable cropping system. Stubble-mulch tillage increases the rate of water intake and reduces loss of moisture, soil material, and plant nutrients. Mechanical and chemical means are used to control weeds.

Good management of irrigation water is essential. Water is generally applied through pipelines or open ditches to a surface system of level borders, graded borders, or level furrows.

These soils are too shallow to be suitable for growing windbreaks.

Management of Dryland Soils

This section describes the management needed on the dryland soils of the county to control erosion and to maintain tilth and fertility. Inadequate and irregular rainfall, torrential showers, and high winds of long duration are the main hazards in use of the soils for dryland crops. The principal dryland crops are grain sorghum and cotton.

Crop residue management.—Good management of crop residue is necessary to protect the soils from soil blowing, to conserve moisture, and to control weeds.

In Lea County strong winds for prolonged periods in spring cause loss of soil through continual blowing and loss of moisture through evaporation. The quantity of crop residue needed is least on noncalcareous loamy soils, such as Amarillo loam, 0 to 1 percent slopes. The quantity needed increases on sandy soils, such as Arvana loamy fine sand, 0 to 3 percent slopes, and on limy soils, such as Arch loam.

Emergency tillage.—A rough surface is more resistant to soil blowing than a smooth one. A rough surface slows the surface velocity of the wind and traps particles blown from more exposed areas. Listing or chiseling to roughen the surface is effective on soils that have a clayey or loamy surface layer, such as Portales loam. Emergency tillage is largely ineffective. At best, its effectiveness on sandy soils, such as Amarillo loamy fine sand, 0 to 3 percent slopes, is brief.

Terracing and contour farming.—Heavy rains, sometimes 1 to 2 inches an hour, are common in Lea County. Terracing and contour farming help to reduce runoff, retaining the moisture for crop use. In contour farming, the plowing, planting, and other cultivation follow the natural contour of the land, established terraces, or contour strips. Terracing and contour farming are more important on sloping soils than on nearly level soils.

Cropping systems.—A good cropping system utilizes available moisture efficiently, protects the soil from blowing and from water erosion, helps control weeds, insects, and diseases, and contributes to a practical long-term management plan.

Dryland capability units

The 28 dryland capability units in Lea County are described in the following pages. The names of the soil series represented are mentioned in the description of each unit, but this does not mean that all the soils of a series named are in that unit. To find the capability classification of any given soil, refer to the "Guide to Mapping Units" at the back of this survey.

DRYLAND CAPABILITY UNIT IIIe–1

This unit consists of soils of the Amarillo series. These soils formed on uplands in old alluvium and mixed, sandy wind-laid deposits. They are well drained and have a sandy clay loam subsoil. The slope range is 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow to medium, and the available water holding capacity is 7 to 9 inches. Roots penetrate to a depth of 60 inches or more. Soil blowing is a moderate hazard unless adequate cover is maintained.

These soils are used for range, wildlife, recreation, irrigated crops, and dryland crops. Cotton and grain sorghum are the main crops.

Leaving residue on the surface during periods when soil blowing is critical is an important practice. Emergency tillage that roughens the surface is needed during periods of strong winds, or when the amount of residue is inadequate. If stripcropping is practiced, use alternate strips of grain sorghum and cotton. Rotate the strips each year. A suitable cropping system is one that provides a high-residue crop 2 years in 3 or a high-residue crop 1 year in 2 in areas that are stripcropped, and the residue is left on the soil. Alternate systems are (1) grasses and legumes 2 years in 3, (2) closely spaced, high-residue crops half the time and stubble mulching each year, or (3) mulching 2 years in 3 and emergency tillage as needed. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited to this purpose. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IIIe–2

Only Zita fine sandy loam is in this capability unit. This is a well-drained soil that has a heavy loam subsoil. It formed in wind-deposited calcareous materials, on uplands of the Southern High Plains, over thick beds of soft caliche.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 8 to 10 inches. The rooting depth is 25 to 40 inches to the strong lime zone. Soil blowing is a moderate hazard unless adequate cover is maintained.

This soil is used for range, wildlife habitat, and dryland and irrigated farming. It is suited to grain sorghum and cotton.

Leaving residue on the surface during periods when soil blowing is critical is an important practice. Emergency tillage, such as listing or chiseling to roughen the surface, is needed, particularly if the amount of residue is inadequate. If stripcropping is practiced, use alternate strips of grain sorghum and cotton. Rotate the strips each year.

A suitable cropping system provides a high-residue crop 2 years in 3, and the residue is left on the soil. If the soil is stripcropped, a high-residue crop is grown 1 year in 2. Alternate cropping systems are (1) grow grasses and legumes 2 years in 3, (2) stubble mulch the soil 2 years in 3, or (3) grow close-spaced, high-residue crops year after year, and practice stubble mulching each year. Terracing, contour farming, and stripcropping in sloping areas help in conserving moisture and reducing the hazard of soil blowing. Mechanical and chemical means are used to control weeds.

This Zita soil is suitable for growing field and farmstead windbreaks. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IIIec–1

Only Amarillo loam, 0 to 1 percent slopes, is in this unit. This is a well-drained soil that has a sandy clay loam subsoil. It formed in mixed deposits on alluvial fans and on uplands.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 8 to 10 inches. Roots penetrate to a depth of 60 inches or more. Soil blowing is a moderate hazard.

Grain sorghum and cotton are the major dryland crops. The soil is also used for irrigated crops, range, wildlife, and recreation.

A suitable cropping system is one that provides a high-residue crop half the time, and the residue is left on the soil, or grasses and legumes in rotation 1 year in 2. Another suitable system provides a closely spaced, high-residue crop and stubble mulching and emergency tillage as required. Terracing and contour farming help in distributing water and reducing the erosion hazard. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on this soil. Juniper, Russian-olive, and Siberian elm are well suited to this purpose. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IIIec–2

Only Zita loam is in this capability unit. This is a well-drained soil that has a heavy loam subsoil. It formed in wind-deposited calcareous materials on uplands of the Southern High Plains.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is slow, and the available water holding capacity is 8 to 10 inches. Roots penetrate to a depth of 25 to 40 inches to soft caliche. Soil blowing is a moderate hazard.

This soil is used for irrigated crops, range, wildlife, and recreation. The major crops are grain sorghum and cotton.

A suitable cropping system provides a high-residue crop half the time, and the residue is left on the soil. Alternate systems are (1) grasses and legumes in rotation 2 years in 3, (2) close-spaced, high-residue crops continuously, or (3) mulching with straw, burs, or other trashy materials 1 year in 2. Terracing and contour cultivation help in distributing water and reducing the hazard of soil blowing. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on this soil. Juniper, Russian-olive, and Siberian elm are well suited to this purpose. Irrigation is essential in establish-

ing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IVec-2

This unit consists of soils in the Arvana, Lea, and Stegall series. These are well-drained soils that have a sandy clay loam, loam, or heavy clay loam subsoil. They formed in mixed deposits over indurated caliche. They are on uplands and in swales of the Southern High Plains. Slopes are 0 to 1 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is slow to moderate, runoff is slow, and the available water holding capacity is 5 to 7 inches. Roots penetrate to a depth of 20 to 40 inches. Soil blowing is a moderate hazard.

These soils are used for range, wildlife, recreation, and dryland and irrigated farming.

A suitable cropping system provides a high-residue crop 2 years in 3, and the residue is left on the soil. Alternate systems are (1) grasses and legumes in rotation 2 years in 3, (2) close-spaced, high-residue crops and stubble mulching every year, or (3) mulching with straw, burs, stalks, or manure on 2 years in 3. If emergency tillage is required to control soil blowing, listing or chiseling will roughen the surface and reduce this hazard. In some places terracing and contour farming are desirable. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited to these soils. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IVe-2

This unit consists of soils in the Portales and Stegall series. These are well-drained soils that have a clay loam subsoil. They formed in strongly calcareous, mixed material on uplands of the Southern High Plains. Slopes are 0 to 3 percent.

The average annual precipitation ranges from 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate in the Portales soil and moderately slow in the Stegall soil. Runoff is slow to medium, and the available water holding capacity is 4 to 11 inches. Roots penetrate to a depth of 20 to 36 inches over soft or indurated caliche. Soil blowing is a moderate hazard.

These soils are used for cropland, range, wildlife, and recreation. They are suited to dryland small grain, cotton, and sorghum.

A suitable cropping system provides a high-residue crop 3 years in 4, and the residue is left on the soil. Alternate systems are (1) grasses and legumes in rotation 3 years in 4, (2) close-spaced, high-residue crops and stubble mulching continuously, or (3) mulching with burs, straw, or manure 3 years in 4. If emergency tillage is required to control soil blowing, chiseling or listing will roughen the surface and reduce this hazard. Terracing and contour farming are essential in the more sloping areas. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IVe-3

This unit consists of soils in the Portales series. These are well-drained soils that have a light clay loam subsoil. They formed in calcareous, mixed deposits on uplands of the Southern High Plains. Slopes range from 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate, runoff is slow to medium, and the available water holding capacity is 8 to 10 inches. Roots penetrate to a depth of 20 to 36 inches to the strong lime zone. Soil blowing is a severe hazard.

These soils are used for range, wildlife, recreation, and farming. They are suited to dryland grain sorghum and cotton.

A suitable cropping system provides a high-residue crop 3 years in 4, and the residue is left on the soil. Alternate systems are (1) grasses and legumes in rotation 3 years in 4, (2) high-residue crops 2 years in 3 and stripcropping for control of soil blowing, or (3) closely spaced, high-residue crops and stubble mulching continuously. Emergency tillage is needed to roughen the surface and help control soil blowing. Terracing to conserve and spread water is desirable in the nearly level areas and is essential in most of the sloping areas. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IVe-4

This unit consists of soils in the Amarillo series. These are well-drained soils that have a sandy clay loam subsoil. They formed in old alluvium and mixed sandy deposits on uplands. Slopes are 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate, runoff is very slow, and the available water holding capacity is 6 to 8 inches. Roots penetrate to a depth of 60 inches and more. Soil blowing is a severe hazard.

These soils are used mainly for range, wildlife, and recreation. Some tracts are used for dryland and irrigated farming. They are suited to dryland grain sorghum and cotton.

A suitable cropping system provides a high-residue crop 3 years in 4, and the residue is left on the soil. Alternate systems are (1) grasses and legumes in rotation 3 years in 4, (2) high-residue crops 2 years in 3 and stripcropping for control of soil blowing, or (3) mulching 3 years in 4. Emergency tillage is essential for control of soil blowing. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IVe–5

This capability unit consists of well-drained soils that have a loamy fine sand surface layer, a sandy clay loam subsoil, and indurated caliche at 20 to 34 inches. These soils are in the Arvana series. They formed in wind-deposited and water-deposited, sandy calcareous materials on uplands. Slopes are 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate in the subsoil. Runoff is very slow, and the available water holding capacity is 5 to 7 inches. Roots penetrate to a depth of 20 to 40 inches. Soil blowing is a severe hazard unless adequate cover is maintained.

These soils are used for irrigated and dryland crops, range, and wildlife. They are suited to alfalfa, small grain, cotton, sorghum, wildlife, and recreation.

Yields can be improved by growing a soil-improving crop at least 3 years in 4. Crop residues returned to the soil help maintain organic matter, soil structure, and water intake. Emergency tillage may be necessary to control soil blowing. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT IVe–6

This capability unit consists of well-drained soils that have a fine sandy loam, sandy clay loam, or heavy loam subsoil. These soils are in the Arvana, Gomez, and Lea series. They formed in wind-deposited and alluvial materials on alluvial fans and uplands of the Southern High Plains. They are underlain by thick beds of caliche or lacustrine deposits. Slopes are 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate to moderately rapid. Runoff is slow to medium, and the available water holding capacity is 3.5 to 6 inches. Roots penetrate to a depth of 20 to 40 inches to the indurated or soft caliche. Soil blowing is a moderate hazard unless adequate cover is maintained.

These soils are used as range, wildlife habitat, and cropland. They are suited to dryland grain sorghum and cotton.

A suitable cropping system provides a high-residue crop 2 years in 3, and the residue is returned to the soil. Alternate systems are (1) grasses and legumes in rotation 2 years in 3, (2) closely spaced, high-residue crops and stubble mulching every year, (3) mulching with straw, manure, burs, or stalks 2 years in 3, or (4) high-residue crops and stripcropping 1 year in 2. Emergency tillage to roughen the surface is essential during windy seasons. Terracing and contour farming are desirable in nearly level areas to spread water and conserve moisture; they are essential in some of the sloping areas. Mechanical and chemical means are used to control weeds.

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIe–1

This capability unit is made up of Mixed alluvial land, which is unconsolidated, stratified alluvium along Monument Draw.

The average annual precipitation is 12 to 14 inches, and the frost-free season is 190 to 205 days. Permeability is moderate to rapid. Runoff is slow, and the available water holding capacity is 4 to 7 inches. Roots penetrate to a depth of 40 to 60 inches and more.

Mixed alluvial land is used as range and wildlife habitat.

Field and farm windbreaks can be established. Suitable trees for windbreaks are Russian-olive, Rocky Mountain juniper, and Siberian elm. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIe–4

This capability unit consists of well-drained loams, light clay loams, or light fine sandy loams. These soils are in the Arch, Mansker, and Mobeetie series. They formed in strongly calcareous old alluvium and wind-deposited materials on the Southern High Plains. The slope range for Mobeetie soils is 1 to 10 percent. For the rest it is 0 to 3 percent.

The average annual precipitation is 10 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate to moderately rapid. Runoff is slow to rapid, and the available water holding capacity is 3 to 8 inches. Roots penetrate to a depth of 10 to 24 inches to the strong lime zone. Soil blowing is a moderate to severe hazard.

These soils are used for range, wildlife, and recreation. Small tracts are used for irrigated crops.

Proper use of the range, particularly proper stocking, is essential for maximum production. Adequate watering places and proper placement of salt are essential for good distribution of livestock.

Removing brush and shrubs from selected sites increases production and improves plant cover. Reseeding after clearing is desirable. Areas that have been overgrazed or cultivated should also be reseeded to suitable grasses and legumes. Cross fencing is essential to obtain proper distribution of livestock and use of forage. Additional information can be found in the section "Range Management."

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIe–5

This capability unit consists of well-drained soils that have a loamy fine sand and fine sand surface layer over a fine sandy loam and sandy clay loam subsoil. These soils are in the Amarillo, Arvana, Brownfield, Gomez, Patricia, and Springer series. The Arvana soils formed over indurated caliche. The rest formed in wind-deposited and water-deposited, sandy calcareous materials on the Southern High Plains. Slopes are 0 to 3 percent. The surface is undulating and hummocky in places because of severe soil blowing.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. Permeability is moderate to moderately rapid. Runoff is very slow, and the available water holding capacity is 3 to 8 inches. In the Arvana soils roots penetrate to a depth of 20 to 34 inches to the indurated caliche. In the rest they penetrate to a depth of 60 inches and more. Soil blowing is a severe hazard.

These soils are used for range, wildlife, and recreation. Small tracts are used for irrigated crops. Information on the use of these soils for range is given in the section "Range Management."

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIe-8

This capability unit consists of well-drained soils that have a sandy clay loam subsoil. These soils are in the Sharvana series. They formed in wind-deposited and water-deposited materials over indurated caliche. Slopes are 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate. Runoff is very slow to slow, and the available water holding capacity is 2 to 3 inches. Roots penetrate to a depth of 12 to 20 inches. The hazard of erosion is moderate to severe.

These soils are used for range, wildlife, and recreation. The vegetation consists of mid grasses and shrubs. Information on the use and management of these soils for range is given in the section "Range Management."

The soils of this unit are too shallow to be suitable for growing windbreaks.

DRYLAND CAPABILITY UNIT VIs-2

This capability unit consists of well-drained loams and clays that are only 10 to 20 inches deep over fractured, indurated caliche. These soils are in the Kimbrough and Slaughter series. They formed in wind-deposited and water-deposited materials derived from sediments of the Southern High Plains. They are on upland plains. Slopes are 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate to slow. Runoff is slow to medium, and the available water holding capacity is 1.5 to 3.5 inches. Roots penetrate to a depth of 10 to 20 inches. The hazard of erosion is slight to moderate.

These soils are used for range, wildlife, and recreation. A few tracts are used for irrigated crops. Information on the use and management of these soils for range is given in the section "Range Management."

The soils of this unit are too shallow over caliche to be suitable for growing windbreaks.

DRYLAND CAPABILITY UNIT VIIe-1

This capability unit consists of well-drained to excessively drained soils that have a sandy surface layer. These soils are in the Brownfield, Drake, Patricia, Springer, and Tivoli series. They formed in sandy, wind-deposited or water-deposited materials on uplands of the Southern High Plains. Slopes are 0 to 5 percent.

The average annual precipitation is 10 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is moderate to rapid. Runoff is very slow, and the available water holding capacity is 3 to 9 inches. Roots penetrate to a depth of 60 inches or more. The hazard of soil blowing is severe to very severe.

These soils are used for range, wildlife, and recreation.

These soils are too sandy for cultivation, but they support good stands of grass for grazing. The carrying capacity should be restricted because overgrazing and drought cause active soil blowing. Mid and tall grasses, forbs, and shrubs are the principal vegetation.

Proper use of the range, particularly proper stocking, is essential for maximum production. Adequate watering places and salt should be provided throughout the range, in order to improve distribution of grazing. Removing brush and shrubs from selected sites increases production and improves plant cover. Reseeding after clearing is desirable. Cross fencing is essential to obtain proper distribution of livestock and use of forage. Additional information is given in the section "Range Management."

The soils of this unit are poorly suited to growing windbreaks because the hazard of soil blowing is severe or very severe.

DRYLAND CAPABILITY UNIT VIIe-2

This capability unit consists of well-drained soils that have a sandy surface layer underlain by layers of sandy clay loam to sandy loam. These soils are in the Berino, Cacique, Drake, low rainfall variant, Largo, Maljamar, Pajarito, Palomas, Pyote, and Wink series. They formed in wind-borne and wind-laid deposits on uplands and in shallow basins. They are in the southern part of Lea County. Slopes are 0 to 3 percent.

The average annual precipitation is 10 to 15 inches, and the frost-free season is 190 to 205 days. In the Largo soil permeability is moderately slow, runoff is medium, and the erosion hazard is moderate. In the rest permeability is moderate to rapid, runoff is very slow to slow, and soil blowing is a severe hazard. In all the soils the available water holding capacity is 3 to 10 inches. Roots penetrate to a depth of 20 to 60 inches and more

These soils are used for range, wildlife, and recreation. Information on their use and management for range is given in the section "Range Management."

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIIe-3

This capability unit consists of well-drained soils that have a clay loam, sandy loam, or sandy clay loam subsoil. These soils are in the Berino, Cacique, Midessa, and Wink series. They formed in wind-worked sands and water-laid, sandy calcareous sediments on upland plains in the southern part of Lea County. Slopes are 0 to 3 percent.

The average annual precipitation is 10 to 15 inches and the frost-free season is 190 to 205 days. Permeability

is moderate to moderately rapid. Runoff is slow, and the available water holding capacity is 3 to 7 inches. Roots penetrate to a depth of 20 to 60 inches and more. Soil blowing is a moderate hazard.

These soils are used for range, wildlife, and recreation.

The soils in this unit support good stands of mid grasses, forbs, and shrubs. If closely grazed or if droughty, they are subject to active soil blowing. The use and management of these soils for range is described in the section "Range Management."

Field and farm windbreaks can be established on these soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIIe-7

This capability unit consists of well-drained to excessively drained loamy sands and fine sandy loams that are only about 10 to 20 inches deep over fractured, indurated caliche. These soils are in the Simona and Tonuco series. They formed in wind-worked sediments. Slopes are 0 to 3 percent.

The average annual precipitation is 10 to 13 inches, and the frost-free season is 190 to 205 days. Permeability is moderately rapid to very rapid. Runoff is medium to very slow, and the available water holding capacity is 1 to 3 inches. Roots penetrate to a depth of 10 to 20 inches. Soil blowing is a severe to very severe hazard.

These shallow soils are not suitable for cultivation. They are used as range and wildlife habitat. The vegetation consists of mid grasses, forbs, and shrubs. The use and management of these soils for range is described in the section "Range Management."

The soils of this unit are too shallow over caliche to be suitable for growing windbreaks.

DRYLAND CAPABILITY UNIT VIIe-10

This capability unit consists of well-drained to excessively drained soils that have a fine sand surface layer. These soils are in the Kermit, Palomas, and Wink series. They formed in sandy, wind-worked and water-laid deposits on upland plains, on fans, and in basins. They are in the southern part of Lea County. Slopes are 0 to 12 percent.

The average annual precipitation is 10 to 15 inches, and the frost-free season is 190 to 205 days. Permeability is moderately rapid to very rapid. Runoff is very slow, and the available water holding capacity is 3 to 8 inches. Roots penetrate to a depth of 20 to 60 inches and more. The hazard of soil blowing is severe to very severe.

These soils are used for range, wildlife, and recreation.

Proper use of the range, particularly proper stocking, is essential for maximum production. Adequate watering places and salt should be provided throughout the range to improve distribution of grazing. Removing brush and shrubs from selected sites increases production and improves plant cover. Reseeding after clearing is desirable. Cross fencing is essential to obtain proper distribution of livestock and use of forage. Additional information is given in the section "Range Management."

The soils in this unit are poorly suited to growing windbreaks because the hazard of soil blowing is severe or very severe.

DRYLAND CAPABILITY UNIT VIIs-1

This capability unit consists of shallow and very shallow, well-drained loams and gravelly loams. These soils are in the Kimbrough, Lea, Potter, Sharvana, and Upton series. They formed in wind-deposited and water-deposited material over indurated caliche. Slopes are 0 to 15 percent.

The average annual precipitation is 10 to 15 inches, and the frost-free season is 190 to 205 days. Permeability is moderate to moderately rapid. Runoff is slow to rapid. Soil blowing is a slight to severe hazard. The available water holding capacity in Lea soils is 5 to 7 inches, and roots penetrate to a depth of 20 to 40 inches. In the rest of the soils the available water holding capacity is 0.5 to 3 inches, and roots penetrate to a depth of 4 to 20 inches.

These soils are used as range and wildlife habitat. They are also used as a source of caliche for construction purposes. Their use and management for range is described in the section "Range Management."

All but Lea soils are too shallow to be suitable for growing windbreaks.

Both field and farm windbreaks can be established on Lea soils. Juniper, Russian-olive, and Siberian elm are well suited. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIIs-2

This capability unit consists of a well-drained Cottonwood loam that is underlain by gypsum at a depth of 4 to 10 inches. This soil formed in thick beds of gypsiferous materials on uplands. Slopes are 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 195 to 205 days. The soil is moderately permeable. Runoff is rapid, and the available water holding capacity is 1 to 2 inches. Roots penetrate to a depth of 4 to 10 inches. Soil blowing is a severe hazard.

This soil is used for range, wildlife, and recreation. Its use and management for range is described in the section "Range Management."

This soil is too shallow to be suitable for growing windbreaks.

DRYLAND CAPABILITY UNIT VIIs-3

Only Stony rolling land is in this capability unit. It is gravelly and stony soil material that is shallow to very shallow over calcareous shale and sandstone. Slopes are 3 to 12 percent.

The average annual precipitation is 12 to 14 inches, and the frost-free season is 190 to 205 days. Runoff is very rapid, and the erosion hazard is severe. The rooting depth is 0 to 20 inches.

Stony rolling land is too shallow over rock to be suitable for growing windbreaks.

DRYLAND CAPABILITY UNIT VIIs-4

Reeves loam is the only soil in this capability unit. It is a nearly level, well-drained soil underlain by gypsiferous material. It formed in old water-laid sediments derived from sedimentary rocks and deposited on uplands. Slopes are 0 to 3 percent.

The average annual precipitation is 12 to 16 inches, and the frost-free season is 190 to 205 days. The soil is moderately permeable. Runoff is slow. The erosion hazard is moderate unless adequate cover is maintained. The available water holding capacity is 2 to 4 inches. Roots penetrate to a depth of 10 to 22 inches.

This soil is used for range, wildlife, and recreation. Short and mid grasses, forbs, and shrubs are the principal vegetation. Information on the use and management of this soil for range is given in the section "Range Management."

Reeves loam is poorly suited to growing field and farm windbreaks. If it is to be used for this purpose, Russian-olive should be selected for planting. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIIs–5

This capability unit consists of well-drained sandy loams that overlie soft caliche. These soils are in the Jal series. They formed in strongly calcareous, alluvial sediments on uplands in the southern part of Lea County. Slopes are 0 to 3 percent.

The average annual precipitation is 10 to 13 inches, and frost-free season is 190 to 205 days. Permeability is moderate. Runoff is slow, and the available water holding capacity is 2 to 4 inches. Roots penetrate to a depth of 20 to 30 inches. Soil blowing is a severe hazard.

These soils are used as range and wildlife habitat. Their use and management for range is described in the section "Range Management."

The soils of this unit are poorly suited to growing field and farm windbreaks because of the rooting depth to soft caliche. Russian-olive and Siberian elm are best suited to these soils. Irrigation is essential in establishing and maintaining windbreaks. Young trees need protection from grazing and burning.

DRYLAND CAPABILITY UNIT VIIIe–1

Only Active dune land is in this capability unit. It consists of coarse-textured, loose sands that have accumulated into large sand dunes. It is in the northern, eastern, and southern parts of Lea County. Slopes are 5 to 12 percent or more.

The average annual precipitation is 10 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is very rapid, and runoff is very slow. Soil blowing is active and is a severe hazard.

Active dune land is suitable only for nonagricultural uses, such as recreational areas. It is unsuitable for growing windbreaks because the hazard of soil blowing is very severe.

Further information is given in the section "Descriptions of the Soils."

DRYLAND CAPABILITY UNIT VIIIe–2

Only Badland, barren eroded areas, is in this capability unit. It consists of soft, wind-deposited and water-deposited materials exposed by accelerated and geologic erosion. It is in the southern part of Lea County, near San Simon Sink and several of the salt lakes bordering Eddy County. Slopes are 15 to 30 percent.

The average annual precipitation is 10 to 12 inches, and the frost-free season is 190 to 205 days. Runoff is very rapid, and the erosion hazard is very severe.

Badland is suitable only as recreational areas. Some Indian artifacts can be found.

Additional information is given in the section "Descriptions of the Soils."

DRYLAND CAPABILITY UNIT VIIIw–1

Only Playas is in this capability unit. It consists of silty and clayey, water-laid sediments in undrained basins. Slopes are 0 to 1 percent.

The average annual precipitation is 10 to 16 inches, and the frost-free season is 190 to 205 days. Permeability is very slow.

Playas is unsuitable for growing windbreaks because of the overflow hazard. To some extent it is a source of water for livestock and wildlife. It is also used as recreational areas.

Estimated Yields

Estimated average yields per acre of principal crops on irrigated and nonirrigated soils are shown in table 2 and table 3. These are estimates of yields that can be expected over a number of years. The estimates are based on information from research; from interviews with farmers who keep annual records; and from others who have knowledge of the soils, crops, and yields in Lea County.

The following are factors in moderately high level management:

1. A cropping system that provides adequate high-residue and soil-improving crops.
2. Adapted crop varieties or strains, planted at the proper time and at the correct planting rate.
3. Suitable amounts and kinds of fertilizer applied at the proper time.
4. Careful tillage, at the right time, with the right kinds of implements, in such a way as to utilize crop residues, control weeds, and prevent excessive compaction.
5. Proper management or use of chemicals, or both, for control of insects and plant diseases.
6. Application of irrigation water by means of a planned irrigation system in amounts and at times that are in accord with the needs of crops.
7. Harvesting at the proper time with equipment which is correctly operated.

Yields higher than those given are not uncommon and can be obtained in favorable seasons under high level management. Yields may change in the future as new crop varieties are developed to tolerate the diseases, insects, and droughty conditions common to this area.

Range Management [2]

Approximately 90 percent of Lea County is in native grass. More than half of the agricultural income is derived from the livestock industry.

[2] W. W. HAMMOND, district conservationist, Soil Conservation Service, helped write this section.

TABLE 2.—*Estimated average acre yields of principal crops grown on irrigated soils under a moderately high level of management*

[Only soils that are suitable for and generally used for growing crops under irrigation are listed]

Symbol	Soil	Cotton	Alfalfa	Grain sorghum	Feed sorghum	Barley
		Lb. of lint	*Tons*	*Lb.*	*Tons*	*Bu.*
Ad	Amarillo loamy fine sand, 0 to 3 percent slopes	900	5.5	4,500	20	45
Af	Amarillo fine sandy loam, 0 to 1 percent slopes	1,250	7	5,500	30	80
Ag	Amarillo fine sandy loam, 1 to 3 percent slopes	1,100	6.5	5,000	24	75
Ah	Amarillo loam, 0 to 1 percent slopes	1,400	7.5	5,500	25	90
Am	Arch loam	600	4	2,000	15	35
An	Arvana loamy fine sand, 0 to 3 percent slopes	700	5	4,000	20	45
Ap	Arvana fine sandy loam, 0 to 1 percent slopes	1,250	6.5	5,000	24	70
Ar	Arvana fine sandy loam, 1 to 3 percent slopes	1,100	6	4,500	22	60
At	Arvana loam, 0 to 1 percent slopes	1,300	6.5	5,500	24	90
Br	Brownfield and Patricia fine sands, eroded	600	4	3,000	15	50
Go	Gomez loamy fine sand	600	4	2,000	14	----
Gs	Gomez fine sandy loam	700	5	5,000	18	40
Kb	Kimbrough loam, 0 to 1 percent slopes	800	----	4,000	15	----
La	Lea fine sandy loam	1,100	7	5,000	25	70
Le	Lea loam	1,150	7	5,500	30	75
Ma	Mansker loam, 0 to 1 percent slopes	750	5	2,500	18	----
Me	Mansker loam, 1 to 3 percent slopes	600	5	3,000	15	50
Pe	Portales fine sandy loam, 0 to 1 percent slopes	1,000	7	4,200	20	70
Pf	Portales fine sandy loam, 1 to 3 percent slopes	800	6	4,000	18	65
Ph	Portales loam, 0 to 1 percent slopes	1,000	7	5,000	30	75
Po	Portales loam, 1 to 3 percent slopes	900	6	4,000	18	70
Sf	Sharvana loamy fine sand	500	----	3,000	13	40
Sh	Sharvana fine sandy loam	800	----	4,000	18	55
Sm	Simona fine sandy loam, 0 to 1 percent slopes	800	----	3,500	15	50
So	Slaughter loam	700	----	4,000	18	55
St	Stegall loam	1,100	6.5	5,500	25	80
Su	Stegall silty clay loam	1,000	6	4,500	20	70
Zf	Zita fine sandy loam	1,200	7	4,500	20	70
Zt	Zita loam	1,100	7	6,000	30	75

The county is about equally divided into two land resource areas: the Southern High Plains and the Southern Desertic Basins, Plains, and Mountains.

The northern part of Lea County is in the Southern High Plains. About 500,000 acres is in native grasses. The soil-air-moisture relationship in this area is favorable for the production of short, mid, and tall grasses. Much of the acreage is short grass range. The soils are gravelly loams that are very shallow over indurated caliche. In some areas in the northern part of the county, the soils are sandy and are underlain by sandy clay loam or sand. Some of these sandy soils support tall and mid grasses.

The southern part of Lea County is in the Southern Desertic Basins, Plains, and Mountains. About 1,160,000 acres of this area is grassland. Most of the acreage is made up of sandy soils that are deep over caliche or sandy clay loam. Soil blowing is severe to very severe, and there are large areas of hummocks and dunes. A few, small, rough areas of exposed red beds and sandy soils, underlain by Triassic red beds, support short and mid grasses. In the central part of this acreage are large areas of gravelly, limy soils, on low ridges, that are shallow over indurated caliche. These soils support a cover of short grass.

The rangeland in Lea County is used mostly for cattle production. Cow-calf-steer operations are mostly in the northern part of the county, and cow-calf-steer-yearling operations are dominant in the southern part. Ranches average about 10,000 acres in size and support about 225 animal units.

On many ranches grazing crop stubble and small grain supplements the forage produced on the rangeland. In winter the native forage is often supplemented with protein concentrates. Creep feeding of calves and yearlings to increase market weight is practiced on some ranches.

The native vegetation in many parts of the county has been greatly depleted by continued, excessive use.

Much of the acreage that was once open grassland is now covered with weeds, brush, and cactus. The amount of forage is less than half of that originally produced. By controlling brush, managing the grazing, and using other good range management, based on soil potentials, the original productivity of the native grassland can be restored.

Range sites and condition classes

A range site is an area of rangeland that produces a distinctive kind and amount of vegetation. Each site differs from the others in ways that significantly affect productivity and management requirements.

Range condition is determined by comparing the present vegetation on a site with the potential vegetation, which is the most productive combination of forage plants that will grow on the soils of that site. The purpose of determining range condition is to provide an approximate

TABLE 3.—*Estimated average acre yields of principal crops grown on nonirrigated soils under a moderately high level of management*

[Only soils that are suitable for and generally used for growing dryland crops are listed]

Symbol	Soil	Cotton	Grain sorghum
		Lb. of lint	*Lb.*
Ad	Amarillo loamy fine sand, 0 to 3 percent slopes.	165	1,200
Af	Amarillo fine sandy loam, 0 to 1 percent slopes.	180	1,400
Ag	Amarillo fine sandy loam, 1 to 3 percent slopes.	175	1,300
Ah	Amarillo loam, 0 to 1 percent slopes	225	1,500
An	Arvana loamy fine sand, 0 to 3 percent slopes.	160	1,200
Ap	Arvana fine sandy loam, 0 to 1 percent slopes.	175	1,300
Ar	Arvana fine sandy loam, 1 to 3 percent slopes.	170	1,200
At	Arvana loam, 0 to 1 percent slopes	175	1,250
Gs	Gomez fine sandy loam	150	800
La	Lea fine sandy loam	160	850
Le	Lea loam	170	1,200
Pe	Portales fine sandy loam, 0 to 1 percent slopes.	160	1,200
Pf	Portales fine sandy loam, 1 to 3 percent slopes.	160	1,000
Ph	Portales loam, 0 to 1 percent slopes	180	1,300
Po	Portales loam, 1 to 3 percent slopes	160	1,100
St	Stegall loam	175	1,200
Zf	Zita fine sandy loam	200	1,300
Zt	Zita loam	225	1,500

measure of deterioration in the plant cover and a basis for predicting the degree of improvement possible. Four condition classes are defined to indicate the degree to which the existing vegetation differs from the potential vegetation. *Excellent* indicates that 76 to 100 percent of the existing vegetation on the site is of the same composition as the potential vegetation; *good*, that the percentage is between 51 and 75; *fair*, that the percentage is between 26 and 50; and *poor*, that the percentage is less than 25.

Potential forage production depends on the range site. Current production depends on range condition and moisture supply. Knowledge of the range site and range condition class allows a rancher to evaluate his range and determine the needs for improvement.

The potential vegetation is made up of decreasers and increasers. Decreasers are plants that decrease in relative abundance when closely grazed. They generally are the tallest, the most productive, and the most palatable of the perennial grasses and forbs.

Increasers are plants that increase in relative abundance as the more desirable plants are reduced. Plants that increase at first may subsequently decrease if moderately heavy to heavy use is continued. They are commonly shorter, and some are less palatable than the decreaser plants.

Invaders are plants that become established only after the more desirable vegetation has been depleted. Many are woody plants, but some are herbaceous annuals and perennials. Invaders are not part of the potential plant community.

The 12 range sites recognized in Lea County are described in the following pages. The names of the soil series represented are given at the beginning of each description, but the listing of a series name does not necessarily mean that all the soils of that series are in that range site. To find what range site a given soil is in, refer to the "Guide to Mapping Units" at the back of the survey. Active dune land, Badland, and Playas are not assigned to range sites because they are not suitable for use as range.

BOTTOMLAND RANGE SITE

This range site consists of one land type, Mixed alluvial land, which is on the flood plains of Monument Draw and its tributaries. It is in the Southern Desertic Basins, Plains, and Mountains Land Resource Area. Mixed alluvial land is a mixture of alluvial soils that vary in thickness and texture. The surface layer is predominantly of medium texture, but is sandy in some places. Water intake is moderate or rapid, and the available water holding capacity is 4 to 7 inches.

Decreasers make up about half the potential vegetation. Vine-mesquite, blue grama, and side-oats grama are the major decreasers; winterfat and fourwing saltbush are decreasers of lesser importance. Buffalograss, mat muhly, tobosa, and silver bluestem are the major increasers; three-awn, burrograss, and American tarbush are increasers of less abundance.

On sites that have deteriorated and are in poor condition, the vegetation is dominantly common mesquite, catclaw, and other thorny shrubs.

Where this site is in excellent condition, the total annual yield of all vegetation ranges from 3,000 pounds per acre (air dry) in favorable years to 800 pounds in unfavorable years. Of these totals, species that provide forage for cattle amount to about 2,700 pounds in favorable years and 720 pounds in unfavorable years.

BREAKS RANGE SITE

This range site consists of one land type, Stony rolling land, which is along the escarpment of the Southern High Plains and the Southern Desertic Basins, Plains, and Mountains Resource Areas. Stony rolling land is made up of very shallow, rolling, red-bed soils and outcrops of Triassic red-bed sandstone, shale, and calcareous sand commonly capped with cemented or indurated caliche. The soils are very shallow and have a sandy or gravelly surface layer. Water intake is rapid, but water-holding capacity is less than 1 inch. The substratum is caliche, sandstone, shale, or red sandy clay. Accelerated erosion is common. Vegetation is sparse.

Decreasers make up 60 to 70 percent of the potential vegetation. Black grama, blue grama, hairy grama, and side-oats grama are the major decreasers; bush muhly and winterfat are decreasers of lesser importance. The major increasers are curly mesquite and Hall's panicum. Less abundant increasers are tridens, tobosa, and one-seed juniper.

On sites that have deteriorated and are in poor condition, the vegetation is dominantly broom snakeweed, yucca, cholla cactus, common mesquite, and dropseed.

Where this site is in excellent condition, the total annual yield of forage ranges from 1,100 pounds per acre (air dry) in favorable years to 350 pounds per acre in

unfavorable years. Of these totals, species that provide forage for cattle amount to about 900 pounds in favorable years and 300 pounds in unfavorable years.

CLAYEY RANGE SITE

This range site consists of Stegall silty clay loam, which is in the depressions and playas in the Southern High Plains. The surface layer is silty clay loam, the subsoil is clay loam, and indurated caliche is at a depth of 20 to 36 inches. Slopes are 0 to 1 percent. Permeability is moderately slow. Water intake rate is slow, and the available water holding capacity is 5 to 7 inches. Soil blowing is a moderate hazard.

Decreasers make up about 40 percent of the vegetation. Plains muhly, side-oats grama, vine-mesquite, and western wheatgrass are the major decreasers. Blue grama, buffalograss, broom snakeweed, and tobosa are the major increasers. Less abundant increasers are three-awn, ring muhly, and cactus.

On sites that have deteriorated and are in poor condition, the vegetation is mostly buffalograss, tobosa, cactus, and common mesquite.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 1,500 pounds per acre (air dry) in favorable years to 400 pounds per acre in unfavorable years. About 95 percent of the total yield provides forage for cattle.

DEEP SAND RANGE SITE

This range site consists of soils of the Amarillo, Arvana, Berino, Brownfield, Cacique, Gomez, Maljamar, Palomas, Patricia, Pyote, Tonuco, and Wink series. There are areas of this site in both the major resource areas. The soils have a surface layer of loamy fine sand or fine sand and a subsoil of sandy loam, fine sandy loam, sandy clay loam, or loamy sand. Slopes are 0 to 12 percent, and the surface is undulating or hummocky in places. Permeability is moderate to very rapid, water intake is rapid, and the available water holding capacity is 1 to 10 inches. Soil blowing is a severe hazard. Dunes form if the natural cover is destroyed.

Decreasers make up about 60 percent of the potential vegetation. Black grama, side-oats grama, and little bluestem are the major decreasers; bush muhly, plains bristlegrass, and sand bluestem are decreasers of lesser importance. The major increasers are blue grama, hairy grama, shin oak, and yucca. Less abundant increasers are dropseed, three-awn, sand paspalum, and sand sagebrush.

On sites that have deteriorated and are in poor condition, the vegetation is mostly yucca, sand sagebrush, shin oak, broom snakeweed, and three-awn.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 2,000 pounds per acre (air dry) in favorable years to 600 pounds per acre in unfavorable years. Of these totals, species that provide forage for cattle amount to about 1,800 pounds in favorable years and 500 pounds in unfavorable years.

GYP FLATS RANGE SITE

This range site consists of the Cottonwood soil in the Reeves-Cottonwood association, which occupies benchlike areas near dry salt lakes. It is in the Southern Desertic Basins, Plains, and Mountains Land Resource Area. The Cottonwood soil is calcareous and is underlain by thick beds of gypsiferous material at a depth of less than 10 inches. Permeability is moderate, water intake is moderate, runoff is rapid, and the available water holding capacity is 1 to 2 inches.

Decreasers make up about 70 percent of the potential vegetation. Black grama, blue grama, gyp grama, and alkali sacaton are the major decreasers. Fourwing saltbush, Mormon-tea, and bush muhly are decreasers of lesser importance. Gypgrass, coldenia, broom snakeweed, and three-awn are the major increasers. Less abundant increasers are yucca, tarbush, and burrograss.

On sites that have deteriorated and are in poor condition, the vegetation is mostly creosotebush, common mesquite, and cactus.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 400 pounds per acre (air dry) in favorable years to 50 pounds in unfavorable years. Of these totals, species that provide forage for cattle amount to about 350 pounds in favorable years and 40 pounds in unfavorable years.

LIMY RANGE SITE

This range site consists of nearly level to gently sloping soils of the Jal series. These soils are in basins in the Southern Desertic Basins, Plains, and Mountains Land Resource Area. They have a sandy loam surface layer over soft caliche. Permeability is moderate, water intake is rapid, and the available water holding capacity is 2 to 4 inches. Soil blowing is a severe hazard.

Decreasers make up about 60 percent of the potential vegetation. Black grama, blue grama, side-oats grama, fourwing saltbush, and alkali sacaton are the major decreasers. Bush muhly, plains bristlegrass, and winterfat are decreasers of lesser importance. Dropseed, buffalograss, and three-awn are the major increasers. Less abundant increasers are burrograss, ear muhly, fluffgrass, broom snakeweed, tobosa, and yucca.

On sites that have deteriorated and are in poor condition, the vegetation is mostly creosotebush, tarbush, burroweed, broom snakeweed, and three-awn.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 475 pounds per acre (air dry) in favorable years to 50 pounds per acre in unfavorable years. Of these totals, species that provide forage for cattle amount to about 450 pounds in favorable years and 45 pounds in unfavorable years.

LOAMY RANGE SITE

This range site consists of soils of the Amarillo, Arvana, Largo, Lea, Midessa, Portales, Reeves, Slaughter, Stegall, and Zita series. It occupies plains interspersed with small draws and natural depressions. It is extensive in the Southern High Plains and inextensive in the Southern Desertic Basins, Plains, and Mountains Land Resource Area. The soils are nearly level to gently sloping. They range from shallow to deep over caliche or other strongly calcareous material. The surface layer is loam and the subsoil is clay to loam or sandy clay loam. Permeability is slow to moderate, water intake is very slow to moderate, and the available water holding capacity is 2 to 11 inches. These soils are well drained. Erosion is a slight to moderate hazard.

Decreasers make up about 70 percent of the potential vegetation. Black grama, side-oats grama, and vine-mesquite are the major decreasers. Arizona cottontop and winterfat are decreasers of lesser importance. The major increasers are blue grama, buffalograss, tobosa, and ring muhly. Less abundant increasers are broom snakeweed, three-awn, and hairy grama.

On sites that have deteriorated and are in poor condition, the vegetation is mostly common mesquite, cactus, and three-awn.

Where this site is in excellent condition in the Southern High Plains Land Resource Area, the total annual yield of vegetation ranges from 1,200 pounds per acre (air dry) in favorable years to 270 pounds per acre in unfavorable years. Where this site is in excellent condition in the Southern Desertic Basins, Plains, and Mountains Land Resource Area, the total annual yield of vegetation ranges from 970 pounds per acre in favorable years to 250 pounds in unfavorable years. About 95 percent of the total yield provides forage for cattle.

SAND HILLS (HP) RANGE SITE

This range site consists of soils of the Brownfield, Patricia, Springer, and Tivoli series. It is in the Southern High Plains Land Resource Area. The soils have a loose fine sand surface layer over layers of sandy clay loam to fine sand. Slopes are 0 to 12 percent or more. Permeability is moderate to rapid. Water intake is rapid to very rapid, runoff is very slow, and available water holding capacity is 3 to 8 inches. Soil blowing is a severe to very severe hazard. Dunes are common.

Decreasers make up about 70 percent of the potential vegetation. Giant dropseed, little bluestem, plains bristlegrass, side-oats grama, and sand bluestem are most common. Blue grama, dropseed, sand sagebrush, and shin oak are the major increasers. Yucca, hairy grama, and three-awn are less abundant increasers.

On sites that have deteriorated and are in poor condition, the vegetation is mostly yucca, sand sagebrush, and common mesquite.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 1,800 pounds per acre (air dry) in favorable years to 400 pounds in unfavorable years. Of these totals, species that provide forage for cattle amount to about 1,600 pounds in favorable years and 350 pounds in unfavorable years.

SAND HILLS (SD) RANGE SITE

This range site consists of soils in the Kermit series. It is extensive in the Southern Desertic Basins, Plains, and Mountains Land Resource Area. The soils are loose fine sands to a depth of 60 inches or more. Slopes are 0 to 12 percent. These are areas of undulating to billowy, stabilized dunes 4 to 15 feet high. Permeability is very rapid. Water intake is rapid, runoff is very slow, and available water holding capacity is 3 to 4 inches. Soil blowing is a very severe hazard.

Decreasers make up about 55 percent of the potential vegetation. Giant dropseed, cane bluestem, and side-oats grama are the major decreasers. Needle-and-thread, plains bristlegrass, and black grama are decreasers of lesser importance. The major increasers are spike dropseed, mesa dropseed, sand dropseed, and hairy grama. Less abundant are blue grama, silver blue-stem, three-awn, sand muhly, and shin oak.

On sites that have deteriorated and are in poor condition, the vegetation is mostly common mesquite, sand sagebrush, yucca, shin oak, and western ragweed.

The total annual yield of all vegetation on this site, in excellent condition, ranges from 1,100 pounds per acre (air dry) during favorable years to 200 pounds per acre during unfavorable years.

SANDY RANGE SITE

This range site consists of soils of the Amarillo, Arch, Arvana, Berino, Cacique, Drake, Drake, low rainfall variant, Gomez, Lea, Mansker, Midessa, Mobeetie, Pajarito, Portales, Sharvana, Simona, Tonuco, Wink, and Zita series. It occurs in both of the major resource areas. The surface layer is fine sandy loam or loamy fine sand in all but Arch and Mansker soils which have a loam surface layer that is high in lime content. All soils are well drained. Permeability is moderate to moderately rapid except in Tonuco soils where it is very rapid. Runoff is very slow to medium except in Mobeetie soils where it is medium to rapid. Water intake is moderate to rapid. Available water holding capacity is 1 to 10 inches. Slopes are 0 to 5 percent, except for Mobeetie soils, which range from 1 to 10 percent.

Decreasers make up about 70 percent of the potential vegetation. Black grama, side-oats grama, and little bluestem are the major decreasers. Bush muhly, sand bluestem, and vine-mesquite are less important decreasers. The major increasers are blue grama, dropseed, three-awn, and ring muhly. Less abundant are hairy grama, catclaw mimosa, and yucca.

On sites that have deteriorated and are in poor condition, the vegetation is mostly yucca, common mesquite, cactus, three-awn, and burrograss.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 1,400 pounds per acre (air dry) in favorable years to 200 pounds in unfavorable years. The vegetation usable as forage for cattle is about 1,200 pounds per acre in favorable years and 150 pounds per acre in unfavorable years.

SHALLOW (HP) RANGE SITE

This range site consists of soils of the Kimbrough and Potter series. It is on low hills or convex ridges bordering large level plains in the Southern High Plains Land Resource Area. The soils have a loam, gravelly fine sandy loam, or gravelly loam surface layer. Water intake is moderate. Effective rooting depth ranges from 4 to 20 inches to indurated or cemented caliche. Runoff is slow to medium on the Kimbrough soils and rapid on the Potter soils. The available water holding capacity is 0.5 to 3.5 inches. Erosion is a slight hazard on the Kimbrough soils and a severe hazard on the Potter soils.

Decreasers make up about 60 percent of the potential vegetation. Black grama, side-oats grama, and New Mexico feathergrass are the major decreasers. Mormon-tea, needle-and-thread, and little bluestem are decreasers of lesser importance. Major increasers are blue grama, hairy grama, and tobosa. Less abundant are sand dropseed, yucca, and tridens.

On sites that have deteriorated and are in poor condition, the vegetation is mostly broom snakeweed, tridens, and three-awn.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 700 pounds per acre (air dry) in favorable years to 200 pounds in unfavorable years. About 90 percent of the total yield provides forage for cattle.

SHALLOW (SD) RANGE SITE

This range site consists of soils of the Simona and Upton series. It is on ridges, foot slopes, and fans in the Southern Desertic Basins, Plains, and Mountains Land Resource Area. The soils are gravelly loam or gravelly fine sandy loam over indurated caliche at a depth of 6 to 20 inches. Permeability is moderate to moderately rapid. Runoff is slow to medium, water intake is rapid, and the available water holding capacity is 1 to 3 inches. Erosion is a moderate to severe hazard.

Decreasers make up about 60 percent of the potential vegetation. Black grama, blue grama, and bush muhly are the major decreasers. Of lesser importance are sideoats grama, New Mexico feathergrass, and winterfat. The major increasers are three-awn, sand dropseed, tobosa, and creosotebush. Less abundant are burrograss, fluffgrass, tridens, and range ratany.

On sites that have deteriorated and are in poor condition, the vegetation is mostly creosotebush, common mesquite, three-awn, and tridens.

Where this site is in excellent condition, the total annual yield of vegetation ranges from 550 pounds per acre (air dry) during favorable years to 125 pounds in unfavorable years. About 90 percent of the total yield provides forage for cattle.

Wildlife Suitability [3]

Lea County is not endowed with widespread, high quality wildlife habitat. It has potential, however, for good quality habitat for antelope, dove, ducks, and scaled quail. Sites for fish ponds are limited, as are shallow impoundments for waterfowl. The irrigated lands offer potential food plots for dove and scaled quail. Where water for flooding is available and the soils are suitable for cultivation, duck fields can be developed.

This section indicates in a general way the capability of the various soils to provide food and cover for wildlife. It provides a broad basis for the selection of areas to be developed or improved as wildlife habitat. An onsite appraisal should be made prior to any specific planning.

Wildlife habitat groups

The soils in the county are grouped into 12 different wildlife habitat groups. In table 4 the soils in each group are rated on their suitability for nine types of wildlife habitat. The ratings show only the potential of the soils to provide the habitat necessary to support desired populations of animals. They do not necessarily reflect existing use.

[3] CARL H. THOMAS, biologist, Soil Conservation Service, helped write this section.

TABLE 4.—*Suitability of soils for elements of wildlife habitat*

Wildlife group and map symbols	High mountain forest vegetation	Foothill shrubs and trees	Tall or short prairie grass	Semidesert shrubs and grass
Group A Aa, BD.	Poor	Poor	Poor	Poor
Group B AB, Ad, Af, Ag, Ah, AL, GM, Go, Gs, PC, Pe, Pf, PG, Ph, Po, Zf, Zt.	Poor	Poor	Good	Poor
Group C Ae, Ao, AS, AV, BH, Br, BS, Dr, MU.	Poor	Poor	Fair	Poor
Group D Am, An, Ap, Ar, At, AW, Kb, La, Le, Ma, Me, MK, SA, SD, Sf, Sh, Sm, Sn.	Poor	Poor	Good	Poor
Group E PS, So, St, Su, SS.	Poor	Poor	Good	Poor
Group F Ak, AU, BN, BO, Bp, GF, MF, PT, PU, WF, WK.	Poor	Poor	Good	Poor
Group G BE, BF, MM, MN.	Poor	Poor	Poor	Fair
Group H KD, KE, KM, PY, TB, Td.	Poor	Poor	Poor	Fair
Group I LP, SY.	Poor	Poor	Fair	Fair
Group J JA, RE, RT.	Poor	Poor	Fair	Good
Group K Kc, Kg, Kh, KN, KO, Ks, KU, KX, MW, SE, SR, TE, TF, To.	Poor	Poor	Good	Fair
Group L Pb.	Poor	Poor	Poor	Poor

Wildlife habitat types

Each group is rated good, fair, or poor for each type of habitat. The ratings for the various classes of vegetation are based on suitability for specified key plants. Soils suitable for vigorous growth of a wide variety of the key plants are rated good. Soils suitable for the growth of several species are rated fair. Soils that support none or a very few of the key species are rated poor. The key plants for each class of vegetation are as follows:

High mountain forest vegetation—fir, spruce, aspen, ponderosa pine, snowberry, buffaloberry, mountain-mahogany, sedges, skunkbush sumac, serviceberry, cliffrose, bluegrass, and fescue.

Foothill shrubs and trees—pinyon pine, one-seed juniper, blue grama, side-oats grama, mountain-mahogany, Gambel oak, and shrub live oak.

Tall or short prairie grass—blue grama, bluestem, buffalograss, vine-mesquite, western wheatgrass, galleta, tobosa, cliffrose, serviceberry, and skunkbush sumac. (Sunflower, croton, and pigweed grow in disturbed or ponded depressions.)

Semidesert shrubs and grasses—alkali sacaton, three-awn, sand sagebrush, Apache-plume, creosotebush, and cactus.

Domestic seed and grain crops—barley, corn, oats, grain sorghum, wheat, Japanese millet, and proso millet.

Domestic grass and hay crops—alfalfa, clover, tall wheatgrass, tall fescue, smooth brome, orchardgrass, and weeping lovegrass.

Wetland plants—salty bulrush, saltgrass, and cattail. Submerged or floating aquatics are not included.

The ratings for water impoundments reflect the suitability of the soils as sites for ponds and reservoirs (see table 7 in the section "Soils in Engineering") and also the capacity of the soils for producing plants on which waterfowl feed. Shallow impoundments are 3 feet or less in depth, and deep impoundments more than 3 feet.

The suitability ratings for wildlife significant in Lea County can be interpreted as follows:

> Poor—It is very expensive or impractical to create, improve, or maintain the desired habitat. The soils have severe limitations that would require a high degree of intensive management to overcome, or would be impossible or impracticable to overcome.
> Good to fair—The needed habitat can be created, improved, or maintained. There are moderate soil limitations that affect the maintenance, establishment, or improvement of the habitat, but under moderately intensive management and frequent attention, satisfactory results can be obtained.
> Excellent—The needed habitat can generally be easily created, improved, or maintained. There are slight or no soil limitations that affect the maintenance, establishment, or improvement of the habitat.

Each wildlife habitat group in Lea County is briefly described in the following pages. Each description gives the soil characteristics that influence land use and kinds and patterns of vegetation, the present land use and vegetation, and the suitability for kinds of wildlife significant in Lea County.

and for significant kinds of wildlife, by wildlife habitat groups

Domestic seed and grain crops		Domestic grass and hay crops		Wetland plants	Shallow water impoundments	Deep water impoundments
Irrigated	Nonirrigated	Irrigated	Nonirrigated			
Poor	Poor	Poor	Poor	Poor	Poor	Poor.
Good	Fair	Good	Fair	Poor	Fair	Fair.
Poor	Poor	Poor	Poor	Poor	Fair	Fair.
Fair	Poor	Fair	Poor	Poor	Poor	Poor.
Good	Fair	Good	Fair	Poor	Fair	Poor.
Poor	Poor	Poor	Poor	Poor	Fair	Fair.
Poor	Poor	Poor	Poor	Poor	Fair	Poor.
Poor	Poor	Poor	Poor	Poor	Poor	Poor.
Poor	Poor	Poor	Poor	Poor	Poor	Poor.
Poor	Poor	Poor	Poor	Poor	Poor	Poor.
Poor	Poor	Poor	Poor	Poor	Poor	Poor.
Poor	Poor	Poor	Poor	Fair	Good	Good.

The names of the soil series represented are mentioned in the description of each wildlife habitat group, but the listing of the series name does not necessarily indicate that all soils of a series are in the same wildlife habitat group. To find the wildlife habitat group for a given soil, refer to the "Guide to Mapping Units" at the back of this survey.

WILDLIFE HABITAT GROUP A

This group is made up of Active dune land and Badland. These are barren sand dunes and barren steep slopes of wind-deposited and water-deposited materials. Vegetation is sparse.

This group is poor habitat for antelope, deer, dove, quail, duck, and fish.

WILDLIFE HABITAT GROUP B

This group consists of the Amarillo, Arvana, Gomez, Portales, and Zita soils that are used for irrigated and dryland crops, range, wildlife, and recreation. These are well-drained soils that have a surface layer of loam to fine sandy loam and a subsoil of fine sandy loam to light clay loam. The Arvana soils are underlain by indurated caliche at a depth of 20 to 34 inches; the other soils have soft caliche at a depth of 20 to 56 inches. Permeability is moderately rapid, runoff is very slow to medium, and the available water holding capacity is 3 to 11 inches.

Irrigated areas have potential for good food production for dove and quail. The soils hold water fairly well for fishponds and shallow water impoundments for ducks. The grasses and forbs of the prairies offer potential antelope range.

The soils of this group are excellent as habitat for antelope, dove, and quail; fair to good as habitat for duck and fish; and poor as habitat for deer.

WILDLIFE HABITAT GROUP C

This group consists of Amarillo, Arvana, Berino, Brownfield, Drake, Gomez, Patricia, and Springer soils that are used mainly as range and wildlife habitat. A few tracts are irrigated and used as cropland. These are well-drained soils that have a loamy fine sand or fine sand surface layer over layers of sandy clay loam to fine sandy loam. They are undulating or hummocky and severely eroded. Permeability is moderate to moderately rapid, runoff is very slow to slow, and the available water holding capacity is 3 to 8 inches.

The soils of this group are good to fair as habitat for duck, fish, and antelope and poor for deer, dove, and quail.

WILDLIFE HABITAT GROUP D

This group consists of the Arch, Arvana, Kimbrough, Lea, Mansker, Sharvana, and Simona soils that are used for irrigated or dryland crops, range, and wildlife. These are well-drained soils that have a loam to loamy fine sand surface layer over layers of sandy clay loam, loam, or fine sandy loam. Indurated or soft caliche is at a depth of 10 to 40 inches. Permeability is moderate to moderately rapid, runoff is slow to medium, and the available water holding capacity is 1 to 7 inches.

Shallow water impoundments for ducks can be constructed in all but the Kimbrough, Sharvana, and Simona soils. The soils are not suitable for deeper water impoundments for fish.

The soils of this group are excellent as habitat for antelope; fair to good as habitat for dove, quail, and duck; and poor as habitat for deer and fish.

WILDLIFE HABITAT GROUP E

This group consists of Portales, Slaughter, and Stegall soils that are used for irrigated cropland, range, and wildlife. A few small tracts are used for dryland crops. These are well-drained soils that have a loam or silty clay loam surface layer and a light clay loam to clay subsoil. Indurated caliche is at a depth of 10 to 40 inches in the Slaughter and Stegall soils. The Portales soil has soft caliche at a depth of 20 to 36 inches. Permeability is moderate to slow, runoff is slow, and the available water holding capacity is 2 to 11 inches.

The soils of this group are excellent as habitat for antelope, dove, and quail; fair to good as habitat for duck; and poor as habitat for fish and deer.

WILDLIFE HABITAT GROUP F

This group consists of Amarillo, Brownfield, Gomez, Maljamar, Palomas, Patricia, Pyote, Springer, and Wink soils that are used for range, wildlife, and recreation. A few scattered tracts are used for irrigated cropland. These are well-drained soils that have a fine sand or loamy fine sand surface layer and a sandy loam to sandy clay loam subsoil. The hazard of soil blowing is severe to very severe. Permeability is moderate to moderately rapid, runoff is very slow, and the available water holding capacity is 3 to 9 inches.

The soils of this group are good to fair as habitat for antelope, dove, quail, duck, and fish and poor as habitat for deer.

WILDLIFE HABITAT GROUP G

This group consists of Berino, Cacique, Midessa, and Wink soils that are used for range, wildlife, and recreation. These are well-drained soils that have a fine sandy loam or loamy fine sand surface layer and a fine sandy loam, sandy clay loam, or clay loam subsoil. Soft caliche is at a depth of 20 to 60 inches in all but Cacique soils, which have indurated caliche at a depth of 20 to 34 inches. Permeability is moderate to moderately rapid, and the available water holding capacity is 3 to 10 inches.

The soils of this group are good to fair as habitat for dove, quail, and duck and poor as habitat for antelope, deer, and fish.

WILDLIFE HABITAT GROUP H

This group consists of Brownfield, Kermit, Palomas, Pyote, Wink, and Tivoli soils that are used for range, wildlife, and recreation. These are well-drained to excessively drained soils that have a fine sand surface layer over layers of fine sand to sandy clay loam. They are hummocky or undulating and are intermingled with sand dunes. The hazard of soil blowing is severe to very severe. Permeability is very rapid to moderate, runoff is very slow, and the available water holding capacity is 3 to 8 inches.

The soils of this group are good to fair as habitat for dove and quail and poor as habitat for antelope, deer, duck, and fish.

WILDLIFE HABITAT GROUP I

This group consists of Stony rolling land and Largo and Pajarito soils that are used for range, wildlife, and recreation. These are well-drained soils that have a loam or loamy fine sand surface layer over layers of light silty clay loam to light fine sandy loam. The hazard of erosion is moderate to severe. Permeability is moderately slow to moderately rapid, and the available water holding capacity is 5 to 7 inches.

The soils of this group are good to fair as habitat for antelope, dove, and quail and poor as habitat for deer, duck, and fish.

WILDLIFE HABITAT GROUP J

This group consists of Cottonwood, Jal, and Reeves soils and the Drake low rainfall variant. These soils are used for range, wildlife, and recreation. They are well-drained loams to sandy loams over soft caliche or gypsum at a depth of 4 to 24 inches. Permeability is moderate, runoff is slow to rapid, and the available water holding capacity is 1 to 4 inches.

The soils of this group are good to fair as habitat for antelope and quail and poor as habitat for deer, dove, duck, and fish.

WILDLIFE HABITAT GROUP K

This group consists of Kimbrough, Lea, Mobeetie, Potter, Sharvana, Simona, Tonuco, and Upton soils that are used for range, wildlife, and recreation and also as a source of caliche for construction material. These are well-drained to excessively drained loams to gravelly fine sandy loams or loamy fine sands. All but Mobeetie soils are 4 to 40 inches deep over indurated or cemented caliche. Mobeetie soils are more than 60 inches deep over caliche. Permeability is moderate to very rapid, runoff is slow to rapid, and the available water holding capacity is 0.5 to 8 inches.

The soils of this group are excellent as habitat for antelope; good to fair for dove and quail; and poor as habitat for deer, duck, and fish.

WILDLIFE HABITAT GROUP L

Playas is the only mapping unit in this group. Rainfall and runoff provide intermittent water for duck resting places. Ponds can be built within the Playas to confine the water to a smaller area and reduce evaporation.

Playas is excellent as habitat for duck and fish and poor as habitat for antelope, deer, dove, and quail.

Soils in Engineering [4]

This section will be of special interest to engineers, contractors, farmers, and others who use soils as structural or foundation material. Tables 5, 6, and 7 describe and interpret soil properties that affect the construction and maintenance of roads and airports, pipelines, building foundations, water storage facilities, erosion control structures, drainage systems, and sewage disposal systems. Among the soil properties most significant in engineering are permeability, shear strength, density, shrink-swell potential, available water capacity, grain-size distribution, plasticity, and reaction.

[4] LUTHER F. MCDOUGAL, area engineer, Soil Conservation Service, helped prepare this section.

The information given in this section can be used in—

1. Planning and designing agricultural drainage systems, farm ponds, irrigation systems, diversion terraces, and other structures for controlling water and conserving soil.
2. Selecting potential locations for highways, airports, pipelines, and underground cables.
3. Locating probable sources of sand or gravel suitable for use as construction material.
4. Selecting potential industrial, commercial, residential, and recreational areas.

It is not intended that this survey will eliminate the need for onsite sampling and testing. The estimates are generally to depths of about 5 feet, and therefore, interpretations normally do not apply to greater depth. Small areas of other soils are included in the mapping units. This survey should be used primarily in planning more detailed field investigations to determine the in-place condition of the soil at the proposed construction site.

Some of the terms used by soil scientists may not be familiar to the engineer; and some words, for example, clay, silt, and sand, have special meanings in soil science. These terms and others are defined in the Glossary.

Engineering test data

Table 5 gives engineering test data for six different soils. These soils were tested by the New Mexico State Highway Department and the Bureau of Public Roads in accordance with standard procedures of the American Association of State Highway Officials (AASHO).

The soils in this table were sampled in several locations and are not necessarily those described in the section "Descriptions of the Soils." The test data for the soil samples in any one location indicate the engineering characteristics of that soil at that specific location. It must be recognized that there may be variations in the physical test characteristics of this soil type at other locations in the survey area. Even for soils sampled in more than one location, the test data probably do not show the maximum range in characteristics of materials that may occur.

The estimated engineering soil classifications are based upon data obtained by mechanical analyses and tests to determine the liquid limit and the plasticity index.

Engineering classification systems

The United States Department of Agriculture system of classifying soil texture is used by agricultural scientists. In some ways this system of classifying soil texture is similar to the two systems used by engineers for classifying soils. The systems used by engineers are explained as follows:

The American Association of State Highway Officials (AASHO) has developed a classification based on the field performance of soils (*2*). In this system the principal interest lies in the field performance of soils as subgrade or foundation for road construction. Soils are classified in seven principal groups. The groups range from A-1 (gravelly soils having high bearing capacity) to A-7 (clayey soils having low strength when wet). Within each group the relative engineering value of the

material is indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. Most highway engineers classify soils in accordance with the AASHO system.

Table 5 shows laboratory classifications for some of the major soils in the county. Table 6 shows classifications for all the soils in the county.

The Unified system of soil classification was developed by the Waterways Experiment Station, Corps of Engineers (*10*). In this system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. For example, in the Unified system the symbol SM represents sands with fines of silt; CL represents clay with low liquid limit; MH represents silts with high liquid limit; and GP represents a poorly graded gravel-sand mixture.

TABLE 5.—*Engineering test data*

[Tests performed by the New Mexico State Highway Department in accordance with standard procedures of the American Association of State Highway Officials (AASHO)]

Soil and location of sample [1]	Parent material	New Mexico State Highway Dept. report no.	Depth from surface	Mechanical analysis [2] Percentage passing sieve—			Liquid limit	Plasticity index	Classification	
				No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			AASHO	Unified [3]
			In.							
Amarillo fine sandy loam—400 ft. S. and 550 ft. E. of NW. corner S½SE¼ sec. 19, T. 15 S., R. 36 E.	Sandy calcareous, alluvial, and eolian sediments of the High Plains.	10526	0–5	100	99	47	[4] S	[5] NP	A–4(2)	SM
		10527	13–24	100	99	44	S	NP	A–4(2)	SM
		10528	33–40	100	73	44	28	8	A–4(2)	SC
Brownfield fine sand—1,200 ft. S. and 100 ft. E. of NW. corner NE¼ sec. 36, T. 18 S., R. 38 E.	Sandy eolian material	10520	0–20	100	97	20	S	NP	A–2–4(0)	SM
		10521	20–32	100	97	42	S	NP	A–4(1)	SM
		10522	32–50	100	96	43	36	17	A–6(4)	SC
Kermit fine sand—50 ft. S. and 100 ft. W., NE. corner SE¼, sec. 24, T. 26 S., R. 36 E.	Eolian sands	10538	0–8	100	99	12	S	NP	A–2–4(0)	SP–SM
		10539	8–60	100	99	12	S	NP	A–2–4(0)	SP–SM
Lea loam—850 ft. NW. of windmill, 600 ft. E. of county road, NW¼ SW¼ sec. 18, T. 15 S., R. 36 E.	Medium-textured, neutral to mildly alkaline High Plains sediments over indurated caliche.	10532	0–4	100	99	60	20	4	A–4(5)	CL–ML
		10533	4–14	100	99	71	27	9	A–4(7)	CL
		10534	23–34	100	99	58	26	9	A–4(5)	CL
Portales loam—750 ft. N. and 50 ft. E. of SW. corner SE¼, sec. 18, T. 15 S., R. 36 E.	Calcareous windborne and waterborne sediments of the High Plains.	10529	0–8	100	99	65	24	9	A–4(6)	CL
		10530	8–16	100	99	81	33	14	A–6(10)	CL
		10531	25–45	100	99	67	29	12	A–6(7)	CL
Stegall loam—100 ft. N. and 100 ft. E. of SW. corner sec. 32, T. 15 S., R. 36 E.	Water-laid High Plains sediments over fractured, indurated caliche.	10523	0–6	100	99	78	25	7	A–4(8)	ML–CL
		10524	11–20	100	99	80	27	15	A–6(10)	CL
		10525	20–26	100	99	79	40	16	A–6(10)	CL

[1] The samples of Kermit and Lea soils were taken at the locations of the profiles described in the section "Descriptions of the Soils." The samples of other soils were taken at locations other than those of the profiles described.

[2] Mechanical analysis according to AASHO Designation: T 88 (*2*). Results obtained by this procedure may differ from results obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedures, 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 more than 2 millimeters in diameter. In the SCS procedure, the fine material is analyzed by the pipette method and the material more than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming the textural classes of the soils.

[3] SCS and BPR have agreed that any soil that has a plasticity index within 2 points of the A-line is to be given a borderline classification. CL–ML is an example of such a borderline classification.

[4] S indicates that the soil is sandy and the liquid limit cannot be determined.

[5] NP indicates that the soil is nonplastic.

Estimated engineering properties

Table 6 gives a brief description of the soils of Lea County and estimates of some properties that affect engineering work. Information taken from the soil survey, knowledge of the individual soils of the county, and the test data shown in table 5 were used as a basis for describing the soils and estimating their properties.

The names of the soil series and the map symbols are listed alphabetically in table 6. Depth to indurated caliche is shown. The soils in Lea County are all deep to ground water.

In the column that shows depth from the surface, the layers indicated are fairly typical of all the layers in all the soils of any one series. Estimates of some properties are not given for the upper layer, because the material from this layer may be salvaged and used later as topsoil. Also the upper layer may be incorporated with the underlying layers in many engineering structures.

The three columns in table 6 under the heading "Classification" indicate soil texture as it is classified by soil scientists and by engineers.

The estimated percentage of soil material passing sieves No. 4, No. 10, and No. 200 reflects the normal range for a given series. Most soils will fall within the range given. However, the grain size of any soil varies considerably. It should not be assumed, therefore, that all samples of a specific soil will fall within the range shown, nor that the engineering classification will invariably be as shown.

The rates of permeability given in table 6 are based on the movement of water through the soil in its undisturbed state. The rates depend largely on the texture and structure of the soil.

Available water capacity is 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.

Reaction refers to the degree of acidity or alkalinity of a soil, expressed as a pH value. The pH values and relative terms used to describe soil reaction are explained in the Glossary.

Salinity affects not only the suitability of a soil for crops, but also its stability when used as a construction material and its corrosiveness to other materials. Estimates of salinity are based on estimates of electrical conductivity of saturated soil extract.

Shrink-swell potential is an indication of the volume change to be expected when the moisture content of soil material changes. In general, soils that have a high shrink-swell potential present hazards to the maintenance of engineering structures. Clean, structureless sands and gravels and most other nonplastic or slightly plastic soils have a low shrink-swell potential.

Corrosion potential refers to the potential danger to uncoated metal or concrete structures from chemical action that dissolves or weakens the structural material. Steel and concrete pipes, for example, may corrode if they are buried in soil, and a given material corrodes more rapidly in some kinds of soil than in others. Pipes that are in more than one kind of soil or that pass through more than one soil horizon are more likely to be damaged by corrosion than pipes that are buried entirely in one kind of soil or that are in only one soil horizon. The corrosivity of soil for uncoated steel pipe is commonly determined by electrical resistivity to flow of current, total acidity, soil drainage, and soil texture. Three corrosivity classes, *low*, *moderate*, and *high*, are referred to in making the interpretations.

Low refers to well-drained and somewhat excessively to excessively drained, coarse-textured to medium-textured soils having electrical resistivity in ohms per centimeter at field capacity of more than 5,000; or total acidity of less than 8 percent; or conductivity saturation extract of less than 1 millimho per centimeter at 25 degrees centigrade.

Moderate refers to well-drained, moderately fine textured and medium-textured soils having electrical resistivity in ohms per centimeter at field capacity of 2,000 to 5,000; or total acidity of 8 to 12 percent; or conductivity saturation extract of 1 to 4 millimhos per centimeter at 25 degrees centigrade.

High refers to well drained and moderately well drained soils that have fine textured, moderately fine textured, and medium-textured control sections, or to poorly drained soils, all having electrical resistivity in ohms per centimeter at field capacity of less than 2,000; or total acidity of more than 12 percent; or conductivity saturation extract of greater than 4 millimhos per centimeter at 25 degrees centigrade.

Engineering interpretations

Estimates of the suitability of soils for specified engineering uses are given in table 7. Features or characteristics that are likely to affect design and use in construction were considered, and evaluations were based on data shown in table 5, on estimates of soil properties given in table 6, and on field performance. Following are explanations of the items in table 7.

The suitability of soils as a source of topsoil is rated as *good*, *fair*, or *poor*. Ratings are based mainly on characteristics and thickness of the surface layer. They are intended for use by nurserymen, landscape architects, highway engineers, and others concerned with establishing vegetation on slopes, road shoulders, waterways, lawns, and golf courses.

Criteria used in determining the ratings are soil properties, such as texture, reaction, natural fertility, organic-matter content, slope, and depth to indurated caliche. A rating of *good* refers to nearly level soils that have fine sandy loam to loam texture, high natural fertility, and a pH of 6.3 to 7.8 and are more than 1 percent organic matter and more than 40 inches thick over indurated caliche. A rating of *fair* refers to sandy loams or silty clay loams that have moderate fertility, slopes of 5 to 25 percent, and a pH of 7.8 to 8.4 and are 0.5 to 1 percent organic matter and 20 to 40 inches thick over indurated caliche. A rating of *poor* refers to shallow, steep loamy fine sands and coarser textured and gravelly soils that are low in fertility and organic-matter content.

Suitability of a soil as a source of sand is based on the likelihood that specific areas of the soil contain sand deposits. The ratings do not indicate the quality or the size of the deposit.

TABLE 6.—*Estimated engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear in the

Soil series and map symbols	Depth to bedrock or indurated caliche	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Ft.	*In.*			
Active dune land: Aa	>5	0–60	Fine sand	SP	A–3
*Amarillo: Ad, Ae, Af, Ag, Ah, Ak, AB, AL, AS, AU. For Arvana part of AB, AL, and AS, see Arvana series; for Gomez part of Ak and AU, see Gomez series.	>5	0–36 36–60	Sandy clay loam Chalky loam	SM or SC SC	A–4 or A–6 A–4
*Arch: Am, AV. For Drake part of AV, see Drake series.	>5	0–16 16–60	Loam Soft caliche (clay loam to silty clay loam).	ML or CL CL	A–4 or A–6 A–6
*Arvana: An, Ao, Ap, Ar, At, AW. For Lea part of AW, see Lea series.	1½–3	0–28 28	Sandy clay loam Indurated caliche.	SC	A–6
Badland: BD. Variable: no estimates of properties.					
*Berino: BE, BF, BH. For Cacique part of BE, BF, and BH, see Cacique series.	>5	0–48 48–60	Sandy clay loam Soft caliche (sandy clay loam)	SC SC	A–6 A–6
*Brownfield: Bp, BN, Br, BO, BS. For Patricia part of Br, Bp, and BN, see Patricia series; for Springer part of BO and BS, see Springer series.	>5	0–22 22–63	Fine sand Sandy clay loam	SM SM or SC	A–1 or A–2 A–4 or A–6
Cacique. Mapped only with Berino soils.	1½–3	0–12 12–28 28	Loamy fine sand Sandy clay loam Indurated caliche.	SM SC	A–2 or A–4 A–6
Cottonwood. Mapped only with Reeves soils.	(2)	0–8 8	Loam Gypsum.	ML	A–4
Drake: Dr	>5	0–30 30–60	Fine sandy loam Sandy clay loam	ML SC	A–4 A–6
Drake, low rainfall variant. Mapped only with Jal soils.	>5	0–12 12–60	Loamy fine sand Sandy clay loam	SM SC	A–2 A–6
Gomez: GF, Go, GM, Gs	>5	0–15 15–22 22–60	Loamy fine sand Fine sandy loam Soft caliche (fine sandy loam)	SM SM SM	A–2 A–4 A–4
*Jal: JA. For Drake part of JA, see Drake, low rainfall variant.	>5	0–12 12–60	Sandy loam Soft caliche (loam texture)	SM ML	A–2 or A–4 A–4
*Kermit: KD, KE, KM. For Palomas part of KD, see Palomas series; for Dune land part of KM, see Active dune land; for Wink part of KE, see Wink series.	>5	0–60	Fine sand	SP–SM or SM	A–2 or A–3
*Kimbrough: Kb, KN, Kc, Kg, KO, Kh, KU, Ks, KX. For Sharvana part of Ks and KX, see Sharvana series; for Lea part of Kh and KU, see Lea series.	½–1½	0–6 6	Gravelly loam Indurated caliche.	SM, SC, or ML	A–4
*Largo: LP. For Pajarito part of LP, see Parjarito series.	2 to 5	0–30 30	Loam, silty clay loam, and clay loam. Shale.	ML or CL	A–4 or A–6

See footnotes at end of table.

properties of the soils

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions first column of table. Symbol > means more than]

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of uncoated steel [1]
No. 4	No. 10	No. 200						
			In./hr.	*In./in. of soil*	*pH*	*Mmhos./cm.*		
100	100	0–5	>20	0. 04–0. 06	6. 6–7. 8	0–1	Low	Low.
100	100	40–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 3	0–1	Moderate	Moderate.
95–100	90–100	40–50	0. 63–2. 0		7. 9–8. 4	0–1	Low	Low.
100	100	78–80	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	0–2	Moderate	Moderate.
100	100	85–95	0. 63–2. 0		8. 5–9. 0	0–4	Moderate	High.
100	100	35–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 3	0–1	Moderate	Moderate.
100	100	35–45	0. 63–2. 0	0. 14–0. 16	6. 6–7. 8	0–2	Moderate	Moderate.
100	100	35–50	0. 63–2. 0		7. 9–8. 4	0–2	Moderate	Moderate.
100	100	20–30	6. 3–20. 0	0. 06–0. 08	6. 6–7. 3	0–1	Low	Low.
100	100	40–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 8	0–1	Moderate	Moderate.
100	100	25–50	2. 0–6. 3	0. 09–0. 15	6. 6–7. 3	0–1	Low	Low.
100	100	35–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 3	0–1	Moderate	Moderate.
100	100	60–80	0. 63–2. 0	0. 16–0. 18	8. 5–9. 0	8–15	Low	High.
100	100	50–60	0. 63–2. 0	0. 13–0. 15	7. 4–7. 8	0–4	Low	Moderate.
100	100	35–45	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	0–4	Moderate	Moderate.
100	100	20–35	6. 3–20. 0	0. 08–0. 10	7. 4–7. 8	0–4	Low	Moderate.
100	100	35–45	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	0–4	Moderate	Moderate.
100	100	15–30	6. 3–20. 0	0. 05–0. 09	6. 6–7. 8	0–1	Low	Low.
100	100	35–50	2. 0–6. 3	0. 13–0. 15	7. 4–7. 8	0–1	Low	Low.
100	100	35–50	2. 0–6. 3		7. 9–8. 4	0–2	Low	Moderate.
100	100	30–40	2. 0–6. 3	0. 11–0. 13	7. 9–8. 4	0–2	Low	Moderate.
100	100	50–65	0. 63–2. 0		8. 5–9. 0	0–4	Low	Moderate.
100	100	5–15	>20. 0	0. 04–0. 06	6. 6–7. 3	0–1	Low	Low.
85–95	75–90	40–60	0. 63–2. 0	0. 12–0. 18	7. 4–7. 8	0–2	Low	Low to moderate.
100	100	65–85	0. 2–0. 63	0. 17–0. 19	7. 4–8. 4	0–1	Moderate	Moderate.

TABLE 6.—*Estimated engineering*

Soil series and map symbols	Depth to bedrock or indurated caliche	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
	Ft.	*In.*			
Lea: La, Le	1½–3½	0–26	Loam	ML or CL	A–4
		26	Indurated caliche.		
*Maljamar: MF	3½–>5	0–24	Fine sand	SM	A–2
		24–50	Sandy clay loam	SC	A–6
For Palomas part of MF, see Palomas series.		50	Indurated caliche.		
Mansker: Ma, MK, Me	>5	0–10	Loam	ML	A–4
		10–19	Clay loam	CL	A–6
		19–60	Soft caliche (light clay loam texture).	CL	A–6
*Midessa: MM, MN	>5	0–22	Clay loam	CL	A–6
		22–60	Soft caliche (clay loam texture)	CL	A–6
For Wink part of MN, see Wink series.					
Mixed alluvial land: MU					
Variable; no estimates of properties.					
*Mobeetie: MW	>5	0–60	Fine sandy loam	SM	A–4
For Potter part of MW, see Potter series.					
Pajarito	>5	0–16	Loamy fine sand	SM	A–2
		16–60	Fine sandy loam	SM	A–4
Mapped only with Largo soils.					
Palomas	>5	0–16	Fine sand	SM	A–2
		16–60	Fine sandy loam and sandy clay loam.	SM or SC	A–4
Mapped only with Kermit and Maljamar soils.		60–66	Soft caliche (sandy loam)	SM	A–2 or A–4
Patricia	>5	0–16	Fine sand	SM	A–1 or A–2
		16–70	Sandy clay loam	SM or SC	A–4 or A–6
Mapped only with Brownfield soils.					
Playas: Pb					
Variable; no estimates of properties.					
*Portales: Pe, Pf, Ph, PC, Po, PG, PS	>5	0–26	Loam and clay loam	CL	A–6
		26–60	Soft caliche (loam texture)	CL	A–6
For Stegall part of PS, see Stegall series; for Gomez part of PG, see Gomez series.					
Potter	½–1	0–4	Gravelly fine sandy loam	SM	A–2
		4	Fragmental platy caliche.		
Mapped only with Mobeetie soils.					
*Pyote: PT, PU, PY	>5	0–30	Fine sand or loamy fine sand	SP–SM or SM	A–2 or A–3
		30–60	Fine sandy loam	SM	A–4
For Maljamar part of PU, see Maljamar series; for Dune land part of PY, see Active dune land.					
*Reeves: RE, RT	(3)	0–12	Loam	ML	A–4
		12–16	Light clay loam	CL	A–6
For Cottonwood part of RT, see Cottonwood series.		16–60	Gypsum and chalky loam.		
Sharvana: Sf, SA, Sh, SD	1–2	0–16	Sandy clay loam	SC	A–6
		16	Indurated caliche.		
*Simona: Sm, SE, Sn, SR	1–1½	0–16	Fine sandy loam	SM	A–2 or A–4
For Upton part of SR, see Upton series.		16	Indurated caliche.		
Slaughter: So	1–2	0–15	Heavy clay loam and clay	CL	A–6
		15	Indurated caliche.		
Springer	>5	0–14	Loamy fine sand	SM	A–2
		14–60	Fine sandy loam	SM	A–4
Mapped only with Brownfield soils.		60	Soft caliche.		
*Stegall: St, Su, SS	1½–3	0–28	Clay loam	CL	A–6
		28	Indurated caliche.		
For Slaughter part of SS, see Slaughter series.					

See footnotes at end of table.

properties of the soil—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of uncoated steel [1]
No. 4	No. 10	No. 200						
			In./hr.	*In./in. of soil*	*pH*	*Mmhos./cm.*		
100	100	60–75	0. 63–2. 0	0. 16–0. 18	6. 6–8. 4	0–2	Moderate	Moderate.
100	100	15–25	6. 3–20. 0	0. 05–0. 07	6. 6–7. 3	0–1	Low	Low.
100	100	35–45	0. 63–2. 0	0. 14–0. 16	6. 6–7. 3	0–1	Moderate	Moderate.
100	100	60–75	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	0–2	Moderate	Moderate.
100	100	70–80	0. 63–2. 0	0. 19–0. 21	7. 9–8. 4	0–2	Moderate	Moderate.
100	100	70–80	0. 63–2. 0	----------	7. 9–8. 4	0–2	Moderate	Moderate.
100	100	70–80	0. 63–2. 0	0. 19–0. 21	7. 4–8. 4	0–2	Moderate	Moderate.
100	100	70–80	0. 63–2. 0	----------	7. 9–8. 4	0–2	Moderate	Moderate.
100	100	40–50	2. 0–6. 3	0. 13–0. 15	7. 9–8. 4	0–1	Low	Low.
100	100	20–30	6. 3–20. 0	0. 09–0. 11	7. 4–7. 8	0–1	Low	Low.
100	100	35–50	2. 0–6. 3	0. 13–0. 15	8. 5–9. 0	0–1	Low	Low.
100	100	20–30	6. 3–20. 0	0. 05–0. 07	6. 6–7. 3	0–1	Low	Low.
100	100	35–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 8	0–1	Moderate	Moderate.
100	100	30–40	0. 63–2. 0	----------	7. 4–7. 8	0–2	Low	Moderate.
100	100	20–30	6. 3–20. 0	0. 06–0. 08	6. 6–7. 3	0–1	Low	Low.
100	100	40–50	0. 63–2. 0	0. 14–0. 16	5. 6–8. 4	0–1	Moderate	Moderate.
100	100	65–75	0. 63–2. 0	0. 17–0. 19	7. 4–8. 4	0–2	Moderate	Moderate.
100	100	65–75	0. 63–2. 0	----------	7. 9–8. 4	0–2	Moderate	Moderate.
85–95	70–85	20–30	0. 63–2. 0	0. 10–0. 12	7. 4–7. 8	0–2	Low	Moderate.
100	100	5–30	6. 3–20. 0	0. 06–0. 08	6. 6–7. 3	0–1	Low	Low.
100	100	40–50	2. 0–6. 3	0. 13–0. 15	6. 6–7. 3	0–1	Low	Low.
100	100	60–75	0. 63–2. 0	0. 19–0. 21	7. 4–7. 8	4–8	Moderate	High.
100	100	70–80	0. 63–2. 0	0. 13–0. 15	7. 9–8. 4	8–15	Moderate	High.
100	100	35–50	0. 63–2. 0	0. 14–0. 16	6. 6–7. 3	0–1	Moderate	Moderate.
80–100	75–100	20–50	2. 0–6. 3	0. 09–0. 15	7. 9–8. 4	0–1	Low	Low.
100	100	75–95	0. 06–0. 2	0. 16–0. 18	6. 6–7. 3	0–1	High	High.
100	100	20–30	6. 3–20. 0	0. 05–0. 09	6. 6–7. 8	0–1	Low	Low.
100	100	40–50	2. 0–6. 3	0. 13–0. 15	6. 6–7. 8	0–1	Low	Low.
100	100	70–80	0. 06–0. 2	0. 17–0. 19	6. 6–7. 8	0–4	High	High.

TABLE 6.—*Estimated engineering*

Soil series and map symbols	Depth to bedrock or indurated caliche	Depth from surface	Classification		
			Dominant USDA texture	Unified	AASHO
Stony rolling land: SY Variable; no estimates of properties.					
	Ft.	*In.*			
*Tivoli: TB, Td For Dune land part of Td, see Active dune land; for Brownfield part of TB, see Brownfield series.	>5	0–60	Fine sand	SP–SM or SM	A–2 or A–3
Tonuco: TE, To, TF	1–1½	0–17 17	Loamy fine sand Indurated caliche.	SM	A–2
Upton Mapped only with Simona soils.	½–1½	0–8 8	Gravelly loam Indurated caliche.	SM or ML	A–4
Wink: WF, WK	>5	0–12 12–23 23–60	Fine sand Sandy loam Soft caliche (sandy loam)	SM SM SM	A–2 A–2 or A–4 A–2 or A–4
Zita: Zf, Zt	>5	0–35 35–60	Loam Soft caliche (loam)	ML or CL ML or CL	A–6 A–6

[1] Based on following conductivity classes:

Class	*Conductivity mmhos./cm.*
Low	0–1
Moderate	1–4
High	Over 4

TABLE 7.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have

Soil series and map symbols	Suitability as a source of—			Degree of limitation for—	
	Topsoil	Sand	Road fill	Filter fields	Sewage lagoons
Active dune land: Aa	Poor: texture; low organic-matter content.	Good	Good if soil binder is added.	Slight: may contaminate ground water.	Severe: very rapid permeability; blowing sand.
*Amarillo: Ad, Ae, Af, Ag, Ah, Ak, AB, AL, AS, AU. For Arvana part of AB, AL, and AS, see Arvana series. For Gomez part of Ak and AU, see Gomez series.	Good to poor: texture.	Unsuitable: mainly fine-grained material.	Fair to poor (A–4 and A–6): moderate shrink-swell potential.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
*Arch: Am, AV For Drake part of AV, see Drake series.	Fair: low fertility; high lime content.	Unsuitable: mainly fine-grained material.	Poor (A–6): highly plastic.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
*Arvana: An, Ao, Ap, Ar, At, AW For Lea part of AW, see Lea series.	Good to poor: texture.	Unsuitable: mainly fine-grained material.	Fair to poor (A–4 and A–6): moderate shrink-swell potential.	Severe: indurated caliche at a depth of 1½ to 3 feet.	Severe: indurated caliche at a depth of 1½ to 3 feet.
Badland: BD. Variable; no interpretations.					
*Berino: BE, BF, BH For Cacique part of BE, BF, and BH, see Cacique series.	Fair to poor: texture.	Unsuitable: mainly fine-grained material.	Poor (A–6)	Slight to moderate: moderate permeability.	Moderate: texture; moderate permeability.

properties of the soils—Continued

Percentage passing sieve—			Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of uncoated steel [1]
No. 4	No. 10	No. 200						
			In./hr.	*In./in. of soil*	*pH*	*Mmhos./cm.*		
100	100	5–15	6. 3–20. 0	0. 05–0. 07	6. 6–7. 3	0–1	Low	Low.
100	100	15–30	>20. 0	0. 08–0. 10	6. 6–7. 3	0–1	Low	Low.
85–95	75–90	40–60	0. 63–2. 0	0. 10–0. 12	7. 4–7. 8	0–1	Low	Low to moderate.
100	100	20–30	2. 0–20. 0	0. 06–0. 08	7. 9–8. 4	0–1	Low	Low.
100	100	30–40	2. 0–6. 3	0. 11–0. 13	7. 9–8. 4	0–2	Low	Low to moderate.
100	100	30–40	2. 0–6. 3	----------	8. 4–9. 0	0–2	Low	Low to moderate.
100	100	60–75	0. 63–2. 0	0. 16–0. 18	6. 6–8. 4	0–1	Moderate	Moderate.
100	100	60–75	0. 63–2. 0	----------	7. 9–8. 4	0–2	Moderate	Moderate.

[2] Gypsum within a depth of 1 foot.
[3] Gypsum at a depth of 1½ to 2½ feet.

interpretations

different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil features affecting—							
Highway location	Dikes and levees	Farm ponds		Irrigation	Leveling and benching	Foundations for low buildings	Pipelines
		Reservoir area	Embankment				
Loose sand hinders hauling operations; drifting sand.	Blowing sand; very rapid permeability.	Blowing sand; very rapid permeability.	Blowing sand; very rapid permeability; lacks soil binder.	Undulating topography; hazard of soil blowing.	Undulating topography; hazard of soil blowing.	Instability; erosion hazard.	Drifting sands; hazard of sloughing.
Features generally favorable.	Features generally favorable.	Moderate permeability; requires compaction or lining.	Features generally favorable.	Features generally favorable.	Features generally favorable.	Moderate shrink-swell potential.	Features generally favorable.
Soft caliche at a depth of 10 to 20 inches; erosion hazard; highly plastic.	Moderate erosion hazard.	Moderate permeability; high lime content.	Moderate erosion hazard; difficult to compact.	Soft caliche at a depth of 10 to 20 inches.	Moderate erosion hazard; soft caliche at a depth of 10 to 20 inches.	Low shear strength when wet; moderate shrink-swell potential.	Corrosive; moderate erosion hazard.
Indurated caliche at a depth of 1½ to 3 feet.	Moderate shrink-swell potential.	Indurated caliche at a depth of 1½ to 3 feet.	Indurated caliche at a depth of 1½ to 3 feet.	Indurated caliche at a depth of 1½ to 3 feet.	Indurated caliche at a depth of 1½ to 3 feet.	Moderate shrink-swell potential.	Indurated caliche at a depth of 1½ to 3 feet.
Moderate shrink-swell potential.	Moderate to severe erosion hazard.	Pervious material; requires compaction; moderate seepage.	Moderate to severe erosion hazard; moderate seepage.	Rapid water intake; moderate to severe erosion hazard.	Moderate to severe erosion hazard.	Moderate shrink-swell potential.	Moderate erosion hazard.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Degree of limitation for—	
	Topsoil	Sand	Road fill	Filter fields	Sewage lagoons
Cacique Mapped only with Berino soils.	Fair to poor: texture	Unsuitable: mainly fine-grained material.	Good to poor (A–2 and A–6): moderate shrink-swell potential.	Severe: indurated caliche at a depth of 1½ to 3 feet.	Severe: depth to indurated caliche is 1½ to 3 feet.
Cottonwood Mapped only with Reeves soils.	Poor: low fertility; reaction.	Unsuitable: fine-grained material.	Fair (A–4): low shear strength; very shallow.	Severe: gypsum within a depth of 1 foot; danger of pollution.	Severe: gypsum within a depth of 1 foot.
Drake: Dr	Poor: low fertility; texture.	Poor: sandy clay loam below a depth of 30 inches.	Fair to poor (A–4 and A–6).	Slight to moderate: moderate permeability.	Moderate: moderate permeability; slopes mainly 2 to 5 percent.
Drake, low rainfall variant Mapped only with Jal soils.	Poor: low fertility; texture.	Unsuitable: mainly fine-grained material.	Fair to poor (A–2 and A–6).	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
Gomez: GF, Go, GM, Gs	Poor: low fertility; texture.	Poor: fine sandy loam below a depth of 15 inches.	Good to fair (A–2 and A–4) if soil binder is added.	Slight	Severe: moderately rapid permeability.
*Jal: JA For Drake part of JA, see Drake, low rainfall variant.	Poor: low fertility; high lime content.	Unsuitable: mainly fine-grained material.	Fair (mainly A–4)	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
*Kermit: KD, KE, KM For Palomas part of KD, see Palomas series. For Dune land part of KM, see Active dune land. For Wink part of KE, see Wink series.	Poor: low fertility; texture.	Good	Good (A–2 and A–3) if soil binder is added.	Slight to moderate: in places slopes exceed 5 percent; pollution of ground water possible.	Severe: very rapid permeability; slopes mainly 0 to 12 percent.
*Kimbrough: Kb, KN, Kc, Kg, KO, Kh, KU, Ks, KX. For Sharvana part of units Ks and KX, see Sharvana series. For Lea part of Kh and KU, see Lea series.	Poor: gravelly; indurated caliche at a depth of ½ foot to 1½ feet.	Unsuitable: indurated caliche at a depth of ½ foot to 1½ feet.	Fair (A–4): depth to indurated caliche is ½ foot to 1½ feet.	Severe: indurated caliche at a depth of ½ foot to 1½ feet.	Severe: indurated caliche at a depth of ½ foot to 1½ feet.
*Largo: LP For Pajarito part of LP, see Pajarito series.	Fair: low fertility	Unsuitable: fine-grained material.	Fair to poor (A–4 and A–6): moderate shrink-swell potential.	Severe: moderately slow permeability.	Moderate: subject to flooding.
Lea: La, Le	Good: moderate fertility.	Unsuitable: mainly fine-grained material.	Fair (A–4): moderate shrink-swell potential.	Severe: indurated caliche at a depth of 1½ to 3½ feet.	Severe: indurated caliche at a depth of 1½ to 3½ feet.
*Maljamar: MF For Palomas part of MF, see Palomas series.	Poor: low fertility; texture.	Poor: sandy clay loam below a depth of 2 feet.	Good to poor (A–2 and A–6).	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
Mansker: Ma, MK, Me	Fair: moderate fertility.	Unsuitable: fine-grained material.	Fair to poor (A–4 and A–6).	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
*Midessa: MM, MN For Wink part of MN, see Wink series.	Fair: moderate fertility.	Unsuitable: mainly fine-grained material.	Poor (A–6)	Slight to moderate: moderate permeability.	Moderate: moderate permeability.

interpretations—Continued

Soil features affecting—							
Highway location	Dikes and levees	Farm ponds		Irrigation	Leveling and benching	Foundations for low buildings	Pipelines
		Reservoir area	Embankment				
Indurated caliche at a depth of 1½ to 3 feet.	Moderate shrink-swell potential.	Indurated caliche at a depth of 1½ to 3 feet; moderate seepage.	Limited fill material.	Moderate to severe erosion hazard; indurated caliche at a depth of 1½ to 3 feet.	Indurated caliche at a depth of 1½ to 3 feet.	Moderate shrink-swell potential.	Indurated caliche at a depth of 1½ to 3 feet.
Gypsiferous material within a depth of 1 foot.	Gypsiferous material.	Soluble gypsum.	Soluble gypsum.	Low water holding capacity.	Gypsum within a depth of 1 foot.	Soluble gypsum.	Gypsum; highly corrosive.
Severe erosion hazard.	Poor stability; piping hazard.	Moderate seepage; piping hazard.	Severe erosion hazard; piping hazard.	Severe erosion hazard; low productivity; 0 to 5 percent slopes.	Severe erosion hazard; cuts limited by high lime content.	Low shear strength; moderate shrink-swell potential below a depth of 30 inches.	Moderately corrosive.
Severe erosion hazard.	Poor stability; piping hazard.	Moderate seepage; piping hazard.	Severe erosion hazard; piping hazard.	Severe erosion hazard; low productivity.	Severe erosion hazard.	Low shear strength; moderate shrink-swell potential below a depth of 12 inches.	Moderately corrosive.
Soft caliche at a depth of 1½ to 3½ feet; severe erosion hazard.	Soft caliche at a depth of 1½ to 3½ feet; severe erosion hazard.	Soft caliche at a depth of 1½ to 3½ feet; high seepage.	High seepage; piping hazard; severe erosion hazard.	Rapid water intake; severe erosion hazard.	Unstable; cuts limited by soft caliche at a depth of 1½ to 3½ feet.	Low shear strength; low shrink-swell potential.	Moderate ditchbank sloughing.
Soft caliche at a depth of 12 inches; severe erosion hazard.	Piping hazard; severe erosion hazard.	Moderate permeability; high seepage; high lime content.	Piping hazard; poor compaction.	Severe erosion hazard; rooting depth 20 to 30 inches.	Severe erosion hazard.	Low shrink-swell potential.	Moderately corrosive; soft caliche at a depth of 12 inches.
Loose sand hinders hauling; very severe erosion hazard.	Very severe erosion hazard.	Very rapid permeability.	Very severe erosion hazard.	Very severe erosion hazard.	Very severe erosion hazard.	Low shrink-swell potential.	Ditchbank sloughing.
Indurated caliche at a depth of ½ foot to 1½ feet.	Indurated caliche at a depth of ½ foot to 1½ feet.	Indurated caliche at a depth of ½ foot to 1½ feet.	Indurated caliche at a depth of ½ foot to 1½ feet.	Indurated caliche at a depth of ½ foot to 1½ feet.	Indurated caliche at a depth of ½ foot to 1½ feet.	Indurated caliche at a depth of ½ foot to 1½ feet.	Indurated caliche at a depth of ½ foot to 1½ feet.
Periodic flooding; erosion hazard.	Unstable: subject to cracking.	Moderate shrink-swell potential; moderately slow permeability.	Fair stability; piping hazard.	Low water intake; erosion hazard.	Subject to flooding.	Subject to flooding; moderate shrink-swell potential.	Subject to flooding.
Indurated caliche at a depth of 1½ to 3½ feet.	Indurated caliche at a depth of 1½ to 3½ feet.	Indurated caliche at a depth of 1½ to 3½ feet.	Indurated caliche at a depth of 1½ to 3½ feet.	Indurated caliche at a depth of 1½ to 3½ feet.	Cuts limited by indurated caliche at a depth of 1½ to 3½ feet.	Moderate shrink-swell potential.	Indurated caliche at a depth of 1½ to 3½ feet.
Sand hinders hauling; severe erosion hazard.	Thick fine sand surface layer.	Moderately permeable below a depth of 2 feet; moderate seepage.	Slight cracking; severe erosion hazard.	Severe erosion hazard.	Severe erosion hazard.	Moderate shrink-swell potential below a depth of 2 feet.	Surface sands; slough or cave-in hazard.
Soft caliche at a depth of 10 to 20 inches.	Moderate shrink-swell potential.	Seepage; soft caliche at a depth of 10 to 20 inches.	High seepage potential; erosion hazard.	Shallow over caliche; low water-holding capacity.	Cuts limited by soft caliche at a depth of 10 to 20 inches.	Moderate shrink-swell potential.	High lime content; corrosive.
Moderate shrink-swell potential.	Moderate shrink-swell potential.	Soft caliche at a depth of 2 to 3 feet; requires compaction.	Poor stability; piping hazard.	Soft caliche at a depth of 2 to 3 feet.	Cuts limited by soft caliche at a depth of 2 to 3 feet.	Moderate shrink-swell potential.	High lime content; corrosive.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Degree of limitation for—	
	Topsoil	Sand	Road fill	Filter fields	Sewage lagoons
Mixed alluvial land: MU. Variable; no interpretations.					
*Mobeetie: MW. For Potter part of MW, see Potter series.	Fair: moderate fertility.	Poor: fine sandy loam material.	Fair (A-4)	Slight to moderate: slopes are 1 to 10 percent.	Severe: moderately rapid permeability; slopes are 1 to 10 percent.
Pajarito. Mapped only with Largo soils.	Poor: low fertility; texture.	Fair to poor: loamy fine sand and fine sandy loam material.	Good to fair (A-2 and A-4).	Slight	Severe: moderately rapid permeability.
Palomas. Mapped only with Kermit and Maljamar soils.	Poor: low fertility; texture.	Poor: sandy clay loam below a depth of 16 inches.	Good to fair (A-2 and A-4).	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
Patricia. Mapped only with Brownfield soils.	Poor: low fertility; texture.	Poor: sandy clay loam below a depth of 16 inches.	Good (A-2) in upper 16 inches; fair to poor (A-4 or A-6) below a depth of 16 inches; moderate shrink-swell potential.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
Playas: Pb. Variable; no interpretations.					
*Portales: Pe, Pf, Ph, PC, PS, PG, Po. For Stegall part of PS, see Stegall series. For Gomez part of PG, see Gomez series.	Fair: high lime content.	Unsuitable: mainly fine-grained material.	Poor (A-6): moderate shrink-swell potential.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.
Potter. Mapped only with Mobeetie soils.	Poor: low fertility; gravelly.	Unsuitable: limited material.	Good	Severe: fragmented platy caliche at a depth of 6 to 12 inches.	Severe: platy caliche at a depth of 6 to 12 inches.
*Pyote: PT, PU, PY. For Maljamar part of PU, see Maljamar series. For Dune land part of PY, see Active dune land.	Poor: low fertility; texture.	Fair to poor: fine sand and fine sandy loam.	Good (A-2) if soil binder is added; fair (A-4) below a depth of 30 inches.	Slight	Severe: moderately rapid permeability.
*Reeves: RE, RT. For Cottonwood part of RT, see Cottonwood series.	Poor: low fertility; saline.	Unsuitable: fine-grained material.	Fair to poor (A-4 and A-6): unstable.	Severe: gypsum at a depth of 1½ to 2½ feet; danger of pollution.	Severe: moderate permeability; gypsum at a depth of 1½ to 2½ feet.
Sharvana: Sf, SA, Sh, SD	Poor: 1 to 2 feet to indurated caliche.	Unsuitable: limited material; some fine-grained material.	Fair to poor (A-4 and A-6): moderate shrink-swell potential in subsoil; shallow.	Severe: indurated caliche at a depth of 1 to 2 feet.	Severe: indurated caliche at a depth of 1 to 2 feet.
*Simona: Sm, SE, SR, Sn. For Upton part of SR, see Upton series.	Poor: fertility is low; shallow over indurated caliche.	Poor: limited fine sandy loam material.	Good to fair (A-2 or A-4) to a depth of 20 inches.	Severe: indurated caliche at a depth of 1 to 1½ feet.	Severe: shallow over indurated caliche.

interpretations—Continued

Soil features affecting—							
Highway location	Dikes and levees	Farm ponds		Irrigation	Leveling and benching	Foundations for low buildings	Pipelines
		Reservoir area	Embankment				
Unstable material; slopes are 1 to 10 percent.	Piping hazard; slopes are 1 to 10 percent.	Moderately rapid permeability.	Moderate erosion hazard; permeability.	Moderately rapid permeability; slopes are 1 to 10 percent.	Moderate erosion hazard; slopes are 1 to 10 percent.	Unstable; low shrink-swell potential.	Slopes are 1 to 10 percent.
Loose, drifting sands; erosion hazard.	Unstable; requires soil binders.	Moderately rapid permeability.	Fair stability; moderate permeability when compacted.	Severe hazard of soil blowing.	Severe hazard of soil blowing.	Low shrink-swell potential.	Ditchbank sloughing.
Drifting sand; sand hinders hauling; erosion hazard.	Moderate shrink-swell potential in subsoil.	Moderate seepage	Slight cracking; erosion hazard.	Severe hazard of soil blowing.	Severe hazard of soil blowing.	Moderate shrink-swell potential below a depth of 16 inches.	Ditchbank sloughing.
Drifting sand; sand hinders hauling; severe erosion hazard.	Moderate shrink-swell potential in subsoil.	Moderate seepage	Slight cracking; severe erosion hazard.	Severe erosion hazard; rapid water intake.	Severe erosion hazard.	Moderate shrink-swell potential below a depth of 16 inches.	Severe erosion hazard; sloughing.
Moderate (A-6) shrink-swell potential.	Moderate shrink-swell potential.	Chalky loam at a depth of 20 to 36 inches; moderate seepage.	Unstable; difficult to compact.	High water-holding capacity; high lime content.	Cuts limited by moderate depth to chalky loam subsoil.	Moderate shrink-swell potential.	High lime content; moderately corrosive.
Platy caliche at a depth of 6 to 12 inches.	Platy caliche at a depth of 6 to 12 inches.	Platy caliche at a depth of 6 to 12 inches; slopes are 5 to 15 percent.	Platy caliche at a depth of 6 to 12 inches.	Platy caliche at a depth of 6 to 12 inches; slopes are 5 to 15 percent.	Platy caliche at a depth of 6 to 12 inches; slopes are 5 to 15 percent	Platy caliche at a depth of 6 to 12 inches; low shrink-swell potential	Platy caliche at a depth of 6 to 12 inches.
Severe erosion hazard; loose, drifting sands.	Unstable; soil binders needed.	Moderately rapid permeability.	Fair stability; moderate permeability when compacted.	Severe hazard of soil blowing; moderately rapid permeability.	Severe hazard of soil blowing.	Low shrink-swell potential.	Severe erosion hazard; ditchbank sloughing.
Gypsiferous materials at a depth of 1½ to 2½ feet; moderate shrink-swell potential.	Gypsum at a depth of 1½ to 2½ feet; unstable.	Gypsum at a depth of 1½ to 2½ feet.	Gypsum at a depth of 1½ to 2½ feet.	Low productivity; gypsum at a depth of 1½ to 2½ feet.	Cuts limited by gypsum at a depth of 1½ to 2½ feet.	Moderate shrink-swell potential; gypsum at a depth of 1½ to 2½ feet.	Corrosive; gypsum at a depth of 1½ to 2½ feet.
Indurated caliche at a depth of 1 to 2 feet; drifting sand.	Indurated caliche at a depth of 1 to 2 feet.	Indurated caliche at a depth of 1 to 2 feet.	Indurated caliche at a depth of 1 to 2 feet.	Indurated caliche at a depth of 1 to 2 feet; low productivity; erosion hazard.	Cuts limited by indurated caliche at a depth of 1 to 2 feet.	Moderate shrink-swell potential; erosion hazard.	Indurated caliche at a depth of 1 to 2 feet.
Indurated caliche at a depth of 1 to 1½ feet; erosion hazard.	Indurated caliche at a depth of 1 to 1½ feet.	Indurated caliche at a depth of 1 to 1½ feet.	Indurated caliche at a depth of 1 to 1½ feet.	Shallow; low water-holding capacity; erosion hazard.	Cuts limited by indurated caliche.	Indurated caliche at a depth of 1 to 1½ feet; erosion hazard.	Shallow over indurated caliche.

TABLE 7.—*Engineering*

Soil series and map symbols	Suitability as a source of—			Degree of limitation for—	
	Topsoil	Sand	Road fill	Filter fields	Sewage lagoons
Slaughter: So	Poor: indurated caliche at a depth of 1 to 2 feet.	Unsuitable: fine-grained material.	Poor (A-6): high shrink-swell potential.	Severe: indurated caliche at a depth of 1 to 2 feet; slow permeability.	Severe: indurated caliche at a depth of 1 to 2 feet.
Springer Mapped only with Brownfield soils.	Poor: low fertility; texture.	Fair to poor: loamy fine sand, fine sand, and fine sandy loam.	Good to fair (A-2 and A-4).	Slight	Severe: moderately rapid permeability.
*Stegall: St, Su, SS For Slaughter part of SS, see Slaughter series.	Fair to poor: indurated caliche at a depth of 1½ to 3 feet; heavy clay loam.	Unsuitable: limited material; fine grained.	Poor (A-6): high shrink-swell potential.	Severe: indurated caliche at a depth of of 1½ to 3 feet; slow permeability.	Severe: indurated caliche at a depth of 1½ to 3 feet.
Stony rolling land: SY	Poor: limited material.	Variable: limited material.	Poor to good: variable.	Severe: slopes; variable material.	Severe: slopes are 3 to 12 percent.
*Tivoli: TB, Td For Dune land part of Td, see Active dune land. For Brownfield part of TB, see Brownfield series.	Poor: low fertility; texture.	Good	Good if soil binder is added.	Slight to moderate: possible contamination of underground water; 0 to 12 percent slopes.	Severe: rapid permeability.
Tonuco: TE, TF, To	Poor: indurated caliche at a depth of of 1 to 1½ feet; texture.	Unsuitable: limited material.	Good to a depth of 17 inches; indurated caliche at a depth of of 1 to 1½ feet.	Severe: indurated caliche at a depth of of 1 to 1½ feet.	Severe: very rapid permeability; indurated caliche at a depth of 1 to 1½ feet.
Upton Mapped only with Simona soils.	Poor: indurated caliche at a depth of 6 to 18 inches; texture.	Unsuitable: limited material; fine-grained material.	Fair (A-4) above indurated caliche.	Severe: indurated caliche at a depth of 6 to 18 inches.	Severe: indurated caliche at a depth of 6 to 18 inches.
Wink: WF, WK	Poor: low fertility; texture.	Poor: fine sand, loamy fine sand, and sandy loam material.	Good to fair (A-2 or A-4).	Slight	Severe: moderately rapid permeability.
Zita: Zf, Zt	Good	Unsuitable: fine-grained material.	Poor (A-6): moderate shrink-swell potential.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.

interpretations—Continued

Soil features affecting—							
Highway location	Dikes and levees	Farm ponds		Irrigation	Leveling and benching	Foundations for low buildings	Pipelines
		Reservoir area	Embankment				
High shrink-swell potential; indurated caliche at a depth of 1 to 2 feet.	Shallow over indurated caliche; cracking hazard.	Indurated caliche at a depth of 1 to 2 feet.	Indurated caliche at a depth of 1 to 2 feet; fair to good stability.	Slow intake; low water-holding capacity; shallow over indurated caliche.	Cuts limited by indurated caliche at a depth of 1 to 2 feet.	High shrink-swell potential.	Shallow over indurated caliche.
Severe erosion hazard.	Severe erosion hazard; piping hazard.	Moderately rapid permeability; seepage.	Poor stability; severe erosion hazard.	Severe erosion hazard; high water intake.	Severe erosion hazard.	Low shrink-swell potential.	Ditchbank sloughing.
Indurated caliche at a depth of 1½ to 3 feet; high shrink-swell potential.	High shrink-swell potential; cracking hazard.	Indurated caliche at a depth of 1½ to 3 feet; seepage.	Fair stability; cracking hazard.	Slow water intake; moderately deep; slow permeability.	Cuts limited by indurated caliche at a depth of 1½ to 3 feet.	High shrink-swell potential.	Indurated caliche at a depth of 1½ to 3 feet.
Rough, broken, and steep; difficult hauling.	Slopes are 3 to 12 percent; stony.	Slopes are 3 to 12 percent; stony.	Slopes are 3 to 12 percent; stony.	Slopes are 3 to 12 percent; stony.	Stony; shallow	Moderate erosion hazard; steep.	May require blasting; stony; shallow.
Severe erosion hazard; loose sand hinders hauling.	Severe erosion hazard; moderate to high permeability when compacted.	Severe erosion hazard; rapid permeability.	Severe erosion hazard; moderate to high permeability when compacted.	Severe erosion hazard; rapid permeability.	Severe hazard of soil blowing.	Slopes are 0 to 12 percent; severe hazard of soil blowing.	Severe erosion hazard; drifting sand; slumping in vertical cuts.
Indurated caliche at a depth of 1 to 1½ feet.	Indurated caliche at a depth of 1 to 1½ feet.	Indurated caliche at a depth of 1 to 1½ feet.	Indurated caliche at a depth of 1 to 1½ feet; moderate permeability when compacted.	Indurated caliche at a depth of 1 to 1½ feet; very rapid permeability.	Cuts limited by indurated caliche at a depth of 1 to 1½ feet.	Low shrink-swell potential; indurated caliche at a depth of 1 to 1½ feet.	Indurated caliche at a depth of 1 to 1½ feet.
Indurated caliche at a depth of 6 to 18 inches.	Indurated caliche at a depth of 6 to 18 inches.	Indurated caliche at a depth of 6 to 18 inches.	Indurated caliche at a depth of 6 to 18 inches.	Indurated caliche at a depth of 6 to 18 inches; low water-holding capacity.	Cuts limited by indurated caliche at a depth of 6 to 18 inches.	Indurated caliche at a depth of 6 to 18 inches; low shrink-swell potential.	Indurated caliche at a depth of 6 to 18 inches.
Severe erosion hazard; loose sand hinders hauling.	Severe erosion hazard; piping hazard.	High lime content; severe erosion hazard; moderately rapid permeability.	High lime content	Moderate water-holding capacity; high intake rate; severe erosion hazard.	Severe hazard of soil blowing.	Low shrink-swell potential.	Corrosive; severe hazard of soil blowing.
Moderate (A-6) shrink-swell potential.	Moderate shrink-swell potential; fair to good stability and compaction.	Soft caliche at a depth of 2 to 3 feet; requires compaction.	Moderate shrink-swell potential; fair to good stability and compaction.	Moderate hazard of soil blowing.	Cuts limited; moderate shrink-swell potential; soft caliche at a depth of 2 to 3 feet.	Moderate shrink-swell potential.	Moderately corrosive.

No soil in Lea County is a suitable source of gravel. There are, however, numerous sources of caliche gravel within delineations of Kimbrough, Potter, Simona, Slaughter, Tonuco, and Upton soils. These soils are 0.5 to 1.5 feet deep over indurated caliche or cemented caliche.

The suitability of soil material for road fill depends on the texture of the material and its natural water content. Compaction characteristics, erodibility, depth to indurated caliche, and presence of indurated caliche within the normal depth of road excavation are features that are considered. Highly plastic soil materials having high natural water content are rated *poor* or *unsuitable*. Soils that are high in silt, clay, and organic-matter content are rated *poor* to *fair* because they are difficult to compact, slow to revegetate, and erode easily on steep embankments. If binder is added, sandy loams and fine sands are rated *good*. The AASHO classification is considered in the ratings.

Limitations of soils for use as filter fields are rated as *slight*, *moderate*, or *severe*. A rating of *slight* indicates that no unfavorable features are present. Ratings are based on soil permeability, landscape, overflow hazard, depth to impervious materials, and the possibility of polluting the water supply.

Limitations of soils for use as sewage lagoons are also rated *slight*, *moderate*, or *severe*. A rating of *slight* indicates that no unfavorable features are present. Factors considered in the ratings were soil permeability, depth to indurated caliche, soil texture, and slope. Soil permeability expresses the movement of water through the soil. Depth to indurated caliche indicates the storage capacity of the soil. Soil texture influences the rate of water intake. Slope affects the degree of runoff and the infiltration rate.

Soil features and qualities that affect highway location are based on the entire profile of undisturbed soils that are not artificially drained. It is assumed that if the surface layer is high in organic-matter content, it will be removed in construction and used for topsoil. Among the factors considered are the amount of organic material, depth to indurated caliche, number of stones, suitability of materials for embankments, overflow hazard, erodibility, stability, ease of hauling, plasticity, salts, and topography. Frost heaving is not a limitation because these soils seldom freeze to significant depths.

Features affecting use of the soils for dikes and levees are based on the erodibility of the soil and the workability of the soil for construction operations. The characteristics of a soil to be considered for dikes and levees are the same as those considered for embankments.

The features affecting use of the soils for constructing farm ponds, irrigation reservoirs, and embankments are the amount of seepage expected and the depth to an inhibiting layer, such as indurated caliche or gypsiferous material.

Soil features affecting use of the soils for irrigation are depth of tillable soils, texture, water intake, permeability, water-holding capacity, soil reaction, internal drainage, and relief. Availability of suitable irrigation water was not considered.

Soil features affecting land leveling and benching are the same as those for irrigation. Depth to material that will restrict the depth of cuts is also considered.

Features that affect the construction of building foundations are shrink-swell potential and shear strength. Soils that are deep and contain rocks are rated according to the kinds of features that can be expected for each soil.

The main features affecting installation of pipelines are erosion, slumping, depth to indurated caliche, and corrosivity.

Recreation

Table 8 shows the degree of limitation of the soils in Lea County for specific recreational purposes and designates the limiting factors if the limitation is moderate or severe. Information about the properties and qualities that commonly affect the use of the soils for recreational purposes is given in the paragraphs that follow.

Soils subject to flooding have severe limitations for campsites and for recreational buildings, such as vacation cottages or rest areas. Only a few areas in Lea County are subject to flooding. Playas and Mixed alluvial land are the most susceptible, but minor flooding occurs in swales where the Arch, Cottonwood, Jal, Largo, Reeves, Slaughter, and Stegall soils are located.

Droughty soils are limited for many recreational uses. Grass cover for playing fields is hard to establish and maintain. Access roads may be excessively dusty, or blocked because of shifting dust or sands. Some of the droughty soils in Lea County are the Tivoli, Kermit, Tonuco, Drake, Arch, Jal, Potter, Kimbrough, Simona, Upton, Cottonwood, and Reeves soils.

The ability of a soil to support a load is important in many kinds of recreational activities. Some soils when wet fail to support access roads and buildings. The Reeves and Cottonwood soils are gypsiferous soils and are included in this category. Loose surface sands and deep ruts in the roads make travel difficult on the deep sandy soils in the northern part of the county—on the Tivoli, Brownfield, and Springer soils, for example—and on the Kermit, Maljamar, and Pyote soils in the southern part. The Gomez, Arch, and Mansker soils in the northern part of the county and the Wink and Jal soils in the southern part are strongly calcareous and are subject to severe soil blowing. These soils do not support adequate roads and trails because of the erosion hazard.

Nearly level, well-drained, permeable soils that are free of stones have slight or no limitations for use as campsites, playgrounds, recreational buildings, roads, and trails. Steep slopes limit the use of soils for many recreational projects, but are necessary for certain specialized sports, such as skiing, climbing, and mountain racing. The steeper areas in Lea County are the Potter, Mobeetie, and Drake soils. The rest of Lea County is nearly level to gently sloping.

Soil depth affects many uses. Soils that are shallow over indurated or soft caliche or gypsum have severe limitations for leveling for intensive play areas, picnic areas, and campsites. Roads, trails, and basements are difficult to construct. Establishing vegetation is very difficult on very shallow soils, and such areas are poor

locations for play areas. The very shallow to shallow soils of Lea County are the Kimbrough, Upton, and Cottonwood; shallow soils are Mansker, Arch, Jal, Reeves, Tonuco, Slaughter, and Sharvana soils. The rest are moderately deep or deep.

Soil texture is an important consideration. High sand content or high clay content in the surface layer is undesirable around campsites, playgrounds, and other areas subject to heavy traffic. Loose sands are susceptible to soil blowing. Clay soils are sticky or plastic when wet and are slow to dry out after a rain. A loam or a fine sandy loam surface layer is the most desirable in heavily used recreational areas.

The presence of stones, rocks, or gravel is another limiting factor in planning recreational facilities. Very stony or gravelly areas are hazardous for foot trails and campsites. The Potter, Kimbrough, and Upton soils have stones and gravel in and on the surface layer. Stony rolling land is severely limited because of rocks and stones and also relief.

In most modern recreational areas, septic tanks are the only means of waste disposal. Some soils are well suited to septic tanks while others are not. Soils that are steep, slowly permeable, poorly drained, or shallow over rock are severely limited for use as septic tank filter fields.

The productivity of soils is an important consideration in locating recreational areas. The ability of the soil to grow grass, trees, and shrubs is determined by the character of the soil and the water supply. Deep, well-drained, level soils that are free of stones and have a permeable subsoil are desirable for recreational development. Such soils are capable of producing shade trees, vigorous sod grass, and edible shrubs for game.

The suitability of a soil for impounding water for fish habitat is a significant factor. Fertile soils or soils in which chemical fertilizers are effective generally make fertile waters. The end result is good fishing in such areas.

The degrees of limitation shown in table 8 are defined as follows:

None to slight means that the soil is relatively free of limitations that affect the intended use or the limitations are easy to overcome.

Moderate means that the soil has moderate limitations resulting from slope, wetness, soil texture, soil depth, gravel, or stones. Normally the limitations can be overcome as a result of good management, planning, and careful design.

Severe means that the soil has severe limitations resulting from steep slopes, flooding, soil texture, or a large number of stones and rocks. Such soils are of doubtful use for the proposed project.

The evaluations given in table 8 are intended to provide a general guide to the selection of suitable sites and to assist in the development of recreational facilities. Other tables, particularly those dealing with engineering interpretations, can be used to supplement table 8.

The following paragraphs explain the evaluations shown in table 8 for use of the soils as campsites, picnic areas, intensive play areas, and trails and paths. The hazard of soil blowing on soils that have a loamy fine sand or a fine sand surface layer is considered in each rating.

Campsites

Campsites are areas suitable for pitching tents or parking camp trailers and for related activities that require minimum site preparation.

These sites require little preparation other than shaping and leveling for tents and camp trailers and for parking. The soils should be suitable for heavy foot traffic, for riding trails, and for some vehicular traffic. Suitability of the soil for supporting vegetation is not considered in the ratings shown in table 8, but it is an important factor in selecting a campsite. The major soil features considered in the evaluations in table 8 are wetness, flood hazard, slope, texture of the surface layer, and number of coarse fragments. The suitability of the soils for sanitary disposal systems and for foundations for low buildings can be found in the engineering interpretations in table 7.

Picnic areas

Picnic areas are subject to heavy foot traffic. Simple utilities, such as picnic tables and grills, are often located in these areas. It is assumed that most vehicular traffic will be confined to access roads. The presence of trees and lakes and the location of the areas in relation to roads and centers of population are not considered in the ratings shown in table 8. Suitability of the soils for growing vegetation is a management factor to be considered in the final evaluation of a site. The major soil features considered are wetness, flood hazard, slope, texture of the surface layer, and number of coarse fragments. Information on the suitability of the soils for utility and service buildings can be found in the engineering interpretations in table 7.

Intensive play areas

In this column of table 8, the soils are evaluated for playgrounds, athletic fields, and other intensive play areas. These are sites of 2 acres or more to be used mainly in providing nearly level areas for organized games. In many cases, parts of these sites are surfaced to provide parking areas and to facilitate their use. Play areas are subject to heavy traffic. They require good drainage, a nearly level, firm surface free of coarse fragments and rock, and a good growth of vegetation in areas that are not surfaced. The soil features considered in table 8 are wetness, flood hazard, permeability, slope, texture of surface layer, depth to indurated caliche, and number of coarse fragments. Information on the suitability of the soils for low buildings, sewage disposal systems, and roadbeds can be found in the engineering interpretations in table 7.

Trails and paths

In the last column in table 8, the soils are evaluated for use as trails, bridle paths, and footpaths in natural settings. The soils should provide good trafficability for both man and animals. Management should be minimal. The major soil features considered in table 8 are wetness, flooding, slope, texture of the surface layer, and number of coarse fragments.

TABLE 8.—*Degree of limitation for selected recreational uses of soils and principal limiting factors*

Soil series and map symbols	Campsites	Picnic areas	Intensive play areas	Trails and paths
Active dune land: Aa	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
*Amarillo:				
Af, Ag, Ah, AL	Slight	Slight	Slight	Slight.
For Arvana part of AL, see Arvana series, Ap.				
Ad, AB	Moderate: soil blowing.	Moderate: soil blowing.	Moderate: soil blowing.	Moderate: soil blowing.
For Arvana part of AB, see Arvana series, An.				
Ae, Ak, AS, AU	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Moderate: soil blowing.
For Arvana part of AS, see Arvana series, Ao. For Gomez part of Ak and AU, see Gomez series, GM.				
*Arch: Am, AV	Severe: flooding	Moderate: flooding.	Moderate: flooding.	Moderate: flooding.
For Drake part of AV, see Drake series.				
*Arvana:				
Ap, Ar, At, AW	Slight	Slight	Moderate: soil blowing; indurated caliche at a depth of 1½ to 3 feet.	Slight.
For Lea part of AW, see Lea series.				
An	Moderate: soil blowing.	Moderate: soil blowing.	Moderate: soil blowing; indurated caliche at a depth of 1½ to 3 feet.	Moderate: soil blowing.
Ao	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Moderate: soil blowing.
Badland: BD	Severe: water erosion; slope.	Severe: water erosion; slope.	Severe: water erosion; slope.	Moderate to severe: water erosion; slope.
*Berino: BF	Slight	Slight	Slight	Slight.
For Cacique part of BF, see Cacique series.				
BE	Moderate: soil blowing.	Moderate: soil blowing.	Moderate: soil blowing.	Moderate: soil blowing.
BH	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
Brownfield: BN, BO, Bp, Br, BS	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
Patricia soils and Springer soils have the same limitations as Brownfield soils.				
Cacique	Slight	Slight	Moderate: indurated caliche at a depth of 1½ to 3 feet.	Slight.
Mapped only with Berino soils.				
Drake: Dr	Moderate: soil blowing.	Moderate: soil blowing.	Severe: soil blowing.	Moderate: soil blowing.
Gomez:				
Gs	Slight	Slight	Slight	Slight.
GF, GM, Go	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
*Jal: JA	Severe: flooding	Moderate: flooding.	Moderate: flooding.	Moderate: flooding.
Mapped only with Drake low rainfall variant.				
Kermit: KD, KE, KM	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
Palomas soils, Wink soils, and Dune land have the same limitations as Kermit soils.				
*Kimbrough:				
Kb, Kc, KN	Slight	Slight	Severe: indurated caliche at a depth of ½ foot to 1½ feet.	Slight.
Kg, Kh, KO, Ks, KU, KX	Moderate: gravelly.	Moderate: gravelly.	Severe: ½ foot to 1½ feet to indurated caliche.	Moderate: flooding.
For Lea part of Kh and KU, see Lea series. For Sharvana part of Ks and KX, see Sharvana series, Sh.				
Largo: LP	Severe: flooding	Moderate: flooding.	Moderate: flooding.	Moderate: flooding.
Pajarito soils have the same limitations as Largo soils.				

TABLE 8.—*Degree of limitation for selected recreational uses of soils and principal limiting factors*—Continued

Soil series and map symbols	Campsites	Picnic areas	Intensive play areas	Trails and paths
Lea: La, Le	Slight	Slight	Moderate: indurated caliche at a depth of 1½ to 3½ feet.	Slight.
Maljamar: MF Palomas soils have the same limitations as Maljamar soils.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
Mansker: Ma, Me, MK	Slight	Slight	Slight	Slight.
Midessa: MM, MN Wink soils have the same limitations as Midessa soils.	Slight	Slight	Slight	Slight.
Mixed alluvial land: MU	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding.
*Mobeetie: MW For Potter part of MW, see Potter series.	Moderate: slope.	Moderate: slope.	Severe: slope.	Slight.
Playas: Pb	Severe: flooding	Severe: flooding	Severe: flooding	Severe: flooding.
*Portales: PC, Pe, Pf, PG, Ph, Po, PS For Gomez part of PG, see Gomez series, GS. For Stegall part of PS, see Stegall series, St.	Slight	Slight	Slight	Slight.
Potter Mapped only with Mobeetie soils.	Moderate: slope; gravelly.	Moderate: slope; gravelly.	Severe: slope; platy caliche at a depth of 6 to 12 inches.	Moderate: slope; gravelly.
Pyote: PT, PU, PY Maljamar soils and Dune land have the same limitations as Pyote soils.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
Reeves: RE, RT Cottonwood soils have the same limitations as Reeves soils.	Severe: flooding	Moderate: flooding.	Moderate: flooding.	Moderate: flooding.
Sharvana: SA, Sf	Moderate: soil blowing.	Moderate: soil blowing.	Severe: indurated caliche at a depth of 1 foot to 2 feet.	Moderate: soil blowing.
SD, Sh	Slight	Slight	Severe: indurated caliche at a depth of 1 foot to 2 feet.	Slight.
Simona: SE, Sm, Sn	Slight	Slight	Severe: indurated caliche at a depth of 1 foot to 1½ feet.	Slight.
SR Upton soils have the same limitations as Simona soils.	Moderate: gravelly.	Moderate: gravelly.	Severe: indurated caliche at a depth of 1 foot to 1½ feet.	Moderate: gravelly.
Slaughter: So	Severe: flooding	Moderate: flooding.	Severe: indurated caliche at a depth of 1 foot to 2 feet.	Moderate: flooding.
*Stegall: SS, St, Su For Slaughter part of SS, see Slaughter series.	Severe: flooding	Moderate: flooding.	Moderate: flooding; indurated caliche at a depth of 1½ to 3 feet.	Moderate: flooding.
Stony rolling land: SY	Moderate: slope; stony.	Moderate: slope; stony.	Severe: slope; stony.	Moderate: stony.
Tivoli: TB, Td Brownfield soils and Dune land have the same limitations as Tivoli soils.	Severe: soil blowing; slope.	Severe: soil blowing.	Severe: soil blowing; slope.	Severe: soil blowing.
Tonuco: TE, TF, To	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing; indurated caliche at a depth of 1 foot to 1½ feet.	Severe: soil blowing.
Wink: WF, WK	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.	Severe: soil blowing.
Zita: Zf, Zt	Slight	Slight	Slight	Slight.

Formation and Classification of the Soils

This section describes the major factors of soil formation and tells how these factors have affected the soils of Lea County. It also defines the current system for classifying soils and classifies the soils of the county according to that system.

Each soil is a three dimensional body, having thickness, breadth, and length. An individual soil ranges from a few square yards to several hundred acres in size. Soils that have similar profiles are classified as a series and are named for a town or geographic feature where the series was first recognized. The Kimbrough, Maljamar, Simona, and Jal series, for example, were first recognized in Lea County, each within the vicinity of a town or geographic feature for which it was named.

Factors of Soil Formation

Soil is a product of the combined action of soil-forming processes on materials deposited or accumulated by natural agencies. The nature of the soil at any location depends upon such factors as climate, plant and animal life, composition of the parent material, relief or lay of the land, and the length of time the forces have acted on the soil material. All of these factors are required for soil formation, but the relative importance of each differs from place to place. For every soil the past combination of the five factors is of major importance to its present character.

The effect of any one factor cannot be set aside and identified. The soil-forming factors interact continually, and the nature of the soil reflects those interactions. Many processes of soil development are not known, but specific characteristics of the soil give meaningful indications of its formation.

Climate and vegetation are active forces of soil formation. They act on the parent material that has accumulated by the weathering of rocks and decaying of organic materials. In time, this parent material is changed into a natural soil body. Relief conditions climate and vegetation.

The interrelationships among the factors of soil formation are complex. Each factor as it occurs in Lea County is described in the paragraphs that follow.

Climate

Precipitation, evaporation, humidity, temperature, and wind have been important in the development of soils in Lea County. The wet climate of past geological ages influenced the type of parent materials. Later, the amount of rainfall lessened and was insufficient to leach out the lime from the soil profiles (*3*). The soil below root depth was rarely moistened. Consequently, many of the soils, such as Mansker soils, have free lime throughout the profile.

Temperature and humidity play an important role in soil formation. The hot, dry weather in summer dries the fine-textured soils, such as Stegall soils, and causes them to shrink and crack. The cracking exposes the soil, and the oxidation and reduction processes then operate at a greater rate. The winter temperatures, although not generally cold enough to freeze the soil to great depth, have a marked effect in the upper few inches. Alternate freezing and thawing causes the soil to crack and take in water. This process results in considerable mechanical mixing of the soil.

Wind is a major factor in the formation of soils in this area. It has affected soil formation from the time it deposited sands over pre-existing alluvium in the Illinoian stage of the Pleistocene epoch to its present shifting of sands on the surface. Kermit and Tivoli soils are typical of the effect of wind in soil formation.

Most of the soils in the southern part of Lea County formed in a dry, hot climate where evaporation processes were very active. There was only a limited amount of leaching of lime and other materials. The soils that formed in this area are shallow and moderately deep over thick accumulations of lime, for example, the Jal, Midessa, and Simona soils. The deep, sandy soils, such as Berino and Maljamar, show evidence of deeply leached salts and formation of sandy clay loam subsoil horizons.

Plant and animal life

Vegetation, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its development. Trees, grasses, shrubs, and crops contribute in building the soil, protecting it from erosion, shading and cooling it and lowering the rate of evaporation, and sending down roots which open the soil and hold it. Organic matter is added to the soil in the form of leaves, roots, stems, and entire plants. Most of it is added to the surface layer where it is broken down by micro-organisms, plants, and soil chemicals. Decaying organic matter is directly related to the dark colors found in the surface soil layer.

Micro-organisms, earthworms, and burrowing insects and animals, such as gophers, mice, and badgers, live on and in the soil and are active agents in the soil-forming processes. The changes that these biological forces bring about depend on the kinds of life and life processes peculiar to each. The kinds of plants and animals that live on and in the soils are determined by environmental factors, such as climate, parent material, and relief.

The soils of Lea County formed under a mixed shrub and mixed grassland type of vegetation. In the northern part of the county, the vegetative types are closely associated with the Southern High Plains Resource Area. In the southern part the vegetative types are associated with the Southern Desertic Basins, Plains, and Mountains Resource Area.

Earthworms are the most noticeable form of animal life in the soil. The importance of their activity is evident in some soil layers. In places worm casts make up about 30 to 40 percent of the subsoil in Amarillo and Lea soils, and even a higher percent in Zita soils. The worm casts are evidence of improved structural conditions in the soil and more rapid movement of air, water, and plant roots through the soil.

Rodents and other burrowing animals have played an important part in the development of some soils. Their work has often mixed surface and subsoil materials, altering the color and the texture and changing the soil structure. Sandy soils, for example, Brownfield soils, are easily burrowed into by rodents and larger animals. Disturbance by animal life in places alters the reaction of a soil layer.

The influence of man and domestic animals on soil formation is very noticeable. The open range was fenced, and livestock population increased rapidly when settlers came into Lea County. Bad management of rangeland and of homestead acreages resulted in severe erosion. The severity of soil blowing can be seen in the sandy areas of Lea County. The eroded condition of these soils retards soil formation and affects their future use. Soil erosion in any form reduces the organic-matter content and alters the soil depth. Irrigation has influenced the character of many of the soils in Lea County. Large areas have been plowed and leveled where irrigation water is available. Poor water management and poorly timed tillage have caused many soils to compact and seal over, thus reducing water intake and the amount of available water for plant growth.

Relief

Relief influences soil formation through its effect on drainage and runoff. In Lea County the relief, or lay of the land, ranges from level in playa lakes to hilly on Potter soils. The effects of climate and vegetation are modified by relief through exposure to sun and wind, the rate of erosion, and the kind and amount of vegetation.

If other factors of soil formation are equal, the formation of a soil profile depends on the amount of moisture in the soil. Steep soils have greater runoff and absorb less moisture, and thus have a more weakly developed profile than level or depressional soils. The shallow Kimbrough soils take in a limited amount of water because they are gently sloping and have medium runoff. In contrast, the shallow Potter soils, which have thinner, indistinct horizons, lack soil moisture because they have stronger slopes and more rapid runoff. The soils in flat swales and playa lakes, such as the Stegall and Lea soils, are good examples of the effect of relief in the development of deep soils and distinct horizons.

Natural drainage is influenced by relief and parent material. In well-drained soils, such as Amarillo soils, water is removed readily, but not rapidly. In excessively drained soils, water is removed so rapidly that crops may wither and die from lack of water. Most soils in Lea County are well drained. The Kermit, Tonuco, and Tivoli soils are excessively drained and droughty.

Relief has been greatly influenced by the loss of vegetative cover in the sandy areas of Lea County. Soil blowing has accelerated the movement and shifting of coarse-textured soils into dunes and left barren, exposed finer textured soil materials at the surface. Runoff in such areas is variable and soil drainage complex.

Parent material

Most of the soils in the High Plains of Lea County formed in windblown and water-laid material that was deposited in Quaternary and late Tertiary periods. The source of the windblown material is thought to be soils of the Pecos Valley to the southwest. Wind has reworked most of the sediments since the alluvium was originally deposited. The parent material is largely calcareous, unconsolidated sandy and silty material. In some places the lime content has been increased by a high water table. Some shallow enclosed basins have received lime from surrounding areas (*6*).

Many of the soils in the Southern Desertic Basins, Plains, and Mountains Area also formed in windblown and water-laid material that was deposited in Quaternary and late Tertiary periods. Some of the soils formed in valley-fill sediments of mixed mineralogy. These sediments were derived from materials deposited in Quaternary, Tertiary, Permian, Triassic, and Recent periods. The Quaternary sediments are a combination of sandy alluvium, caliche, and eolian deposits. Silty alluvial deposits from the Triassic age are weathering into reddish calcareous soils that have moderately fine textured control sections. The sandy alluvial deposits derived from the Tertiary-age Ogallala Formation are the parent materials of the Mobeetie and Wink soils. The sandy eolian deposits are the parent materials of the Berino and Maljamar soils.

Time

Soil formation requires time. Many soil characteristics are determined by the length of time that the soil-forming factors have been acting. The kind of parent material, climate, relief, as well as biological activity, are interdependent with time in the formation of soils. If soil-forming factors have not been active long enough for a soil to be in balance with its environment, the soil may show little evidence of soil formation, for example, the Tivoli, Kermit, and Tonuco soils. Soils that have been in place a long time and are in balance with their environment have distinct horizon formation, for example, the Amarillo, Arvana, and Brownfield soils.

Steep soils are immature, because geologic erosion has displaced the soil material about as fast as it forms. Potter soils are representative of this type of slow soil development. Stony rolling land is an example of soil material in which there is little or no development because of slope.

Representative Soil Horizons

The action of the soil-forming factors is reflected in the soil profile, which is a succession of horizons, or layers, from the surface down to unalterable material. The horizons differ in one or more properties, such as color, texture, thickness, structure, consistence, porosity, and reaction.

Mollic and ochric epipedons and cambic, argillic, and calcic horizons are the major horizons in the soils of Lea County. Lea, Kimbrough, Mansker, and Portales soils have a mollic epipedon.

Argillic and cambic horizons are typically subsoil horizons, but after erosion or land leveling, they may occur at the surface. Arvana, Amarillo, Berino, Maljamar, Stegall, and Palomas soils, for example, have an argillic (B2t) horizon. This horizon has a significant accumulation of silicate clays. The clay films on the surface of

peds indicate a downward movement of clay from the epipedon (A horizon).

Lea, Gomez, Midessa, and Pajarito soils have a cambic (B) horizon. In this horizon, soil-forming processes have altered the earthy parent material enough to form structure and to form silicate clays.

The calcic horizon is one of secondary carbonate enrichment and is 6 inches or more thick. The calcium carbonate equivalent content is 15 percent or more. It is at least 5 percent more in this horizon than in the C horizon. The letter designation *ca* is used to indicate accumulations of calcium carbonate or calcium magnesium carbonates. The accumulations may be in the C horizon, in mollic epipedons, and in argillic or other horizons. Sometimes it is difficult or even impossible to distinguish calcic horizons from horizons naturally high in calcareous material. Examples of soils that have a calcic horizon are the Mansker, Portales, Gomez, and Wink soils.

Some soils lack cambic or argillic horizons. The letter *C* is used to designate a horizon below the epipedon in these soils. Tivoli and Kermit soils, for example, do not have a diagnostic horizon, but they do have an ochric epipedon over sand parent material that is only slightly altered.

Classification of the Soils

The purpose of soil classification is to help us remember the significant characteristics of soils, assemble our knowledge about soils, see their relationships to one another and to the whole environment, and develop principles relating to their behavior and their response to manipulation. First through classification and then through the use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The current system of soil classification (*1*, *8*) was adopted by the Cooperative Soil Survey in 1965. It is a comprehensive system, designed to accommodate all soils. In this system classes of soils are defined in terms of observable or measurable properties. The properties chosen are primarily those that result in the grouping of soils of similar genesis, or mode of origin. Genesis does not, however, appear in the definitions of the classes.

The current system of classification has six categories. Beginning with the most inclusive, the categories are the order, the suborder, the great group, the subgroup, the family, and the series. Table 9 shows the classification of the soils of Lea County according to this system. Brief descriptions of the six categories follow.

Order.—Ten soil orders are recognized: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate orders are those that tend to give broad climatic groupings of soils. Two exceptions to this generalization are the Entisols and the Histosols, both of which occur in many different climates. Five of the 10 orders are represented in Lea County: Alfisols, Inceptisols, Mollisols, Aridisols, and Entisols.

Suborder.—Each order is divided into suborders, mainly on the basis of soil characteristics that result in grouping soils according to genetic similarity. The climatic range is narrower than that of the order. The properties used are mainly those that reflect either the presence or absence of waterlogging or differences in climate or vegetation.

Great group.—Each suborder is divided into great groups on the basis of similarity in the kind and sequence of the major horizons and in major soil properties. The horizons considered are those in which clay, iron, or humus have accumulated and those in which pans that interfere with the growth of roots and the movement of water have formed. The properties are soil temperature, chemical composition (mainly content of calcium, magnesium, sodium, and potassium), and the like.

Subgroup.—Each great group is divided into subgroups, one that represents the central (typic) concept of the group, and others, called intergrades, that have one or more properties of another great group, suborder, or order.

Family.—Families are established within each subgroup, primarily on the basis of properties important to the growth of plants or properties significant in engineering. Texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence are among the properties considered.

Series.—A series is a group of soils that has horizons similar in all important characteristics, except for texture of the surface layer, and similar in arrangement in the profile. (See the section "How This Survey Was Made.")

General Nature of the County

Lea County was organized in 1917 from parts of Chaves and Eddy Counties. Since then the county has been used mostly for grazing livestock. Many farmers settled in New Mexico between 1916 and 1920 to homestead 160-acre tracts of land. The farm population is centered around Lovington and Hobbs and extends north and northeast to Tatum and Bronco. Areas in the rough sandy lands along the Texas border, in the southern part of the county, and near the western and northwestern margins of the county are less populated.

Oil was discovered near Hobbs and Jal in 1928, and the oil industry has expanded rapidly. Prior to 1928, ranching and farming were the principal occupations. In 1931, the boundaries of a large area of shallow ground water were established to form the Lea County Shallow Water Basin. The basin, the center of which is slightly east of Lovington, is about 25 miles wide and 50 miles long. Within a year of its establishment, 5,000 acres were under irrigation. With increasing development and interest, more than 125,000 acres were under irrigation by 1957.

Physiography and Drainage

The northern half of Lea County is in the southwestern part of the Llano Estacado, or Staked Plains, which is a remnant of the southern extension of the Southern High Plains. The Southern High Plains are remnants of a vast debris apron spread along the eastern front of the mountains of Central New Mexico by streams flowing eastward and southeastward during the Tertiary period. This southeastward movement of debris is reflected in the present-day soil pattern. With the exception of the sandy undulating areas along the eastern and northern edges,

TABLE 9.—*Classification of soils series by higher categories*

[Placement of some series in this classification system, especially in the family category, may be changed as more precise information becomes available; placement is current through November 1970]

Series	Family	Subgroup	Order
Amarillo	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Arch	Fine-loamy, mixed, thermic	Ustochreptic Calciorthids	Aridisols.
Arvana	Fine-loamy, mixed, thermic	Petrocalcic Paleustalfs	Alfisols.
Berino	Fine-loamy, mixed, thermic	Typic Haplargids	Aridisols.
Brownfield	Loamy, mixed, thermic	Arenic Aridic Paleustalfs	Alfisols.
Cacique	Fine-loamy, mixed, thermic	Petrocalcic Paleargids	Aridisols.
Cottonwood	Loamy, mixed (calcareous), thermic, shallow	Ustic Torriorthents	Entisols.
Drake	Fine-loamy, mixed (calcareous), thermic	Typic Ustorthents	Entisols.
Drake, low rainfall variant.	Fine-loamy, mixed (calcareous), thermic	Ustic Torriorthents	Entisols.
Gomez	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Jal	Fine-loamy, carbonatic, thermic	Typic Calciorthids	Aridisols.
Kermit	Siliceous, thermic	Typic Torripsamments	Entisols.
Kimbrough	Loamy, mixed, thermic, shallow	Petrocalcic Calciustolls	Mollisols.
Largo	Fine-silty, mixed (calcareous), thermic	Typic Torriorthents	Entisols.
Lea	Fine-loamy, mixed, thermic	Petrocalcic Paleustolls	Mollisols.
Maljamar [1]	Fine-loamy, mixed, thermic	Arenic Haplargids	Aridisols.
Mansker	Fine-loamy, mixed, thermic	Aridic Calciustolls	Mollisols.
Midessa	Fine-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Mobeetie	Coarse-loamy, mixed, thermic	Aridic Ustochrepts	Inceptisols.
Pajarito	Coarse-loamy, mixed, thermic	Typic Camborthids	Aridisols.
Palomas	Fine-loamy, mixed, thermic	Typic Haplargids	Aridisols.
Patricia	Fine-loamy, mixed, thermic	Aridic Paleustalfs	Alfisols.
Portales	Fine-loamy, mixed, thermic	Aridic Calciustolls	Mollisols.
Potter	Loamy, carbonatic, thermic, shallow	Ustollic Calciorthids	Aridisols.
Pyote	Loamy, mixed, thermic	Arenic Ustalfic Haplargids	Aridisols.
Reeves	Fine-loamy, gypsic, thermic	Calcic Gypsiorthids	Aridisols.
Sharvana	Loamy, mixed, thermic, shallow	Petrocalcic Ustalfic Paleargids	Aridisols.
Simona	Loamy, mixed, thermic, shallow	Typic Paleorthids	Aridisols.
Slaughter	Clayey, mixed, thermic, shallow	Petrocalcic Paleustolls	Mollisols.
Springer	Coarse-loamy, mixed, thermic	Udic Paleustalfs	Alfisols.
Stegall	Fine, mixed, thermic	Petrocalcic Paleustolls	Mollisols.
Tivoli	Mixed, thermic	Typic Ustipsamments	Entisols.
Tonuco	Sandy, mixed, thermic, shallow	Typic Paleorthids	Aridisols.
Upton	Loamy, carbonatic, thermic, shallow	Typic Paleorthids	Aridisols.
Wink	Coarse-loamy, mixed, thermic	Typic Calciorthids	Aridisols.
Zita	Fine-loamy, mixed, thermic	Aridic Haplustolls	Mollisols.

[1] The Maljamar series was proposed after the soil survey of the Eddy Area, N. Mex. was published. Consequently, some Maljamar mapping units in Lea County adjoin areas mapped as Berino soils in the Eddy Area.

this part of the county has a nearly flat surface. It has a gradient to the east and southeast of about 10 to 15 feet to the mile. Elevations on the Southern High Plains are 4,000 to 4,400 feet along the west side to 3,600 to 3,900 feet along the Texas line.

There are no perennial streams on the Southern High Plains. Rainfall is disposed of by seepage, evaporation, or incipient stream channels that fade out within a few miles or terminate in closed depressions, locally known as playas. Other common features of the Southern High Plains are undrained depressions called "buffalo wallows." These depressions are believed to have formed by leaching of the caliche cap and the calcareous cement of the underlying sandstone in the Ogallala Formation and subsequent removal of the loosened material by winds (*4*).

Water in the shallow water basin is found in the sands and gravels of the Ogallala Formation. The thickness of the saturated sediments at Lovington is 125 feet, which is slightly less than the average for a major part of the basin. They thin to less than 25 feet on the north, west, and south. Recharge from rainfall into this basin is very small. However, there is a large volume of water contained in ground storage in these sediments. Fairly reliable information indicates that some 25,000,000 acre-feet of water is stored in the Ogallala Formation in Lea County. Under present controls, a minimum of 40 years of development appears assured (*7*).

The southern half of Lea County consists of gently sloping sandy plains. Maximum relief is 100 feet. The slope is gradual to the south and southeast. This part of the county lies in the Southern Desertic Basins, Plains, and Mountains Land Resource Area. Elevations are 4,200 feet in the northwestern part to 3,000 feet in the southeastern part near the Texas line.

The natural drainage is south to southeast. Monument Draw, which heads in the lower portions of the Southern High Plains, north of Monument Community, and drains southward into Texas near the southeast corner of Lea County, is the only extensive drainageway. It is intermittent because of the low rainfall and the deposition of sediments along its course. Surface drainage is into numerous undrained depressions.

Climate [5]

Lea County has a semiarid, continental climate—warm summers, cool, dry winters, and plenty of sunshine. Moisture from the Gulf of Mexico moving from the southeast in the general circulation is the primary source of rainfall.

The northern part of Lea County receives greater amounts of rain because the moist air moves upslope. Strong surface heating in the summer contributes to the brief and heavy thunderstorms which are responsible for most of the yearly rainfall. Blizzards are rare, and snow generally melts soon after falling.

Table 10 summarizes temperature and precipitation data for Lovington, which is generally representative for all of Lea County. Temperatures are a little warmer in the southern and western parts of the county and a little cooler in the northern part, The county is one of the warmer parts of the State. Summer temperatures of 90 degrees or more occur about 66 percent of the time. Winter temperatures reach the freezing point on about 66 of the days. Temperatures seldom go below zero, and generally they go above the freezing point during the day. Extreme temperatures recorded in the county are a high of 113° F. at Maljamar in June 1944 and a low of −32° at Tatum in February 1933.

Figures 13 and 14 show the probabilities of specified temperatures occurring on indicated calendar dates in spring and fall. Because these charts are based on data recorded at Lovington, a few days difference will be likely in the cooler northern areas of the county and the warmer southern and western areas.

To use figure 13, select the temperature you are interested in (32° for example), select the calendar date you want (April 30), and note the point where these lines intersect. Follow this point to the left to find the probability (about 10 percent). This means that there is about a 10 percent chance that the temperature will be 32° or lower on April 30th of any given year. Figure 14 is used in the same manner but the probabilities for a given temperature are on or before the specified dates.

Average annual precipitation in Lea County ranges from about 16 inches in the northern part to about 12 inches in the southern part. Approximately 80 percent of the annual rainfall occurs in the six-month period of May through October, much of it in brief but heavy thundershowers. Record rainfalls of 36.49 inches for the month of May 1941 and 7 inches on July 30, 1925, have been recorded at Tatum. The lowest recorded rainfall occurred at Ochoa, where only 2.46 inches fell in 1956.

Average annual snowfall ranges from about 4 inches in the southern part of the county to about 10 inches in the northern part. The record for any one month was 18.5 inches at Lovington, in February 1961, and for one day, 18 inches on February 20, 1961. Nearly half the winter months, on the average, have no measurable snowfall.

From November through April surface winds in Lea County are mostly from the southwest, and from May through October they are from the southeast. The direction of the currents is determined by the general circulation around the Bermuda high pressure area and is modified by the low pressure over Arizona in summer. The

[5] By FRANK E. HOUGHTON, State climatologist for the State of New Mexico.

TABLE 10.—*Temperature and precipitation data*

[All data from Lovington, Lea County, N. Mex.]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Average number of days with precipitation	
			Maximum temperature equal to or higher than	Minimum temperature equal to or lower than		Less than—	More than—	0.10 inch or more	0.25 inch or more
	°F.	°F.	°F.	°F.	In.	In.	In.		
January	57	26	71	12	0.52	(1)	1.3	2	1
February	62	28	76	14	0.56	(1)	1.4	2	1
March	69	33	82	20	0.51	(1)	1.5	1	1
April	78	42	90	29	0.63	0.1	1.5	1	1
May	85	51	94	40	2.18	0.5	3.1	4	3
June	92	60	102	53	1.50	0.1	3.1	3	2
July	92	63	100	58	2.52	1.0	4.2	5	3
August	92	62	99	56	2.15	0.3	4.5	4	2
September	86	55	95	44	2.27	0.2	4.9	4	2
October	77	45	88	35	1.60	0.2	2.9	3	2
November	65	32	78	20	0.44	(1)	1.1	2	1
December	58	27	72	16	0.56	(1)	1.4	2	1
Year	76	44	[2] 103	[3] 3	15.44	9.4	23.1	33	20

[1] Less than 0.05 inch.
[2] Average annual maximum.
[3] Average annual minimum.

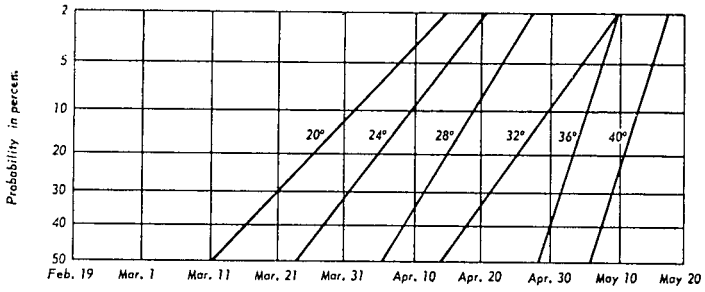

***Figure 13.*—Probability of temperatures as low as or lower than those specified, on or after indicated dates in spring.**

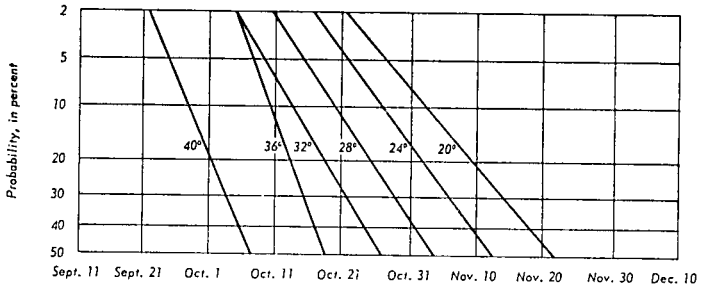

***Figure 14.*—Probability of temperatures as low as or lower than those specified, on or before indicated dates in fall.**

average annual wind velocity is 12.2 miles per hour, with monthly averages ranging from 10.0 miles per hour in October to 15.0 miles per hour in March. In spring, winds generally have the higher velocities and in fall, the lower velocities. Winds in excess of 46 miles per hour are mostly from the west. On the average they occur twice a year.

A tabulation of windstorms and duststorms at Hobbs Airport during the early 1940's showed that blowing dust was most common in the month of March, when winds were more than 25 miles per hour. Blowing duststorms that significantly reduced visibility averaged only 5 hours per year.

Tornados or funnel clouds occur about once or twice a year in Lea County. The record for annual occurrences is five in 1957, but none were reported in 1955 and 1958. Many reported tornados were over open land and caused no damage. Occasionally tornados have been accompanied by heavy hail that in places caused extensive damage to crops. Tornados have occurred mainly between 2 and 5 p.m., but have been as early as 3 a.m. The greatest number occur in April and May, but they have occurred as late as mid-September.

Evaporation from a Class A measuring pan ranges from 105 to 110 inches a year on the average, and from a lake surface, from 45 to 49 inches. Sixty-seven percent of the evaporation takes place during the six-month period May through October. Less than 10 inches of variation from the average annual evaporation occurs in 2 years out of 3.

The average annual relative humidity of the county is 45 to 50 percent. Average monthly humidities are slightly lower during the spring months than for the rest of the year.

An average of about 75 percent of the possible sunshine may be expected during the year. The percentage is higher in June and during the fall season and a bit lower in winter. Similarly, the average cloud cover is four-tenths and is less in June and during the fall season and more in winter.

Farms and Ranches

The economy of Lea County depends primarily on agriculture. Cotton, grain sorghum, and alfalfa are the major cash crops. Grasses support cattle, sheep, swine, and horses. In 1965, a total of 117,570 acres was farmed. Cropland harvested amounted to nearly 75,570 acres. Cotton was grown on about 25,000 acres, grain sorghum on about 24,000 acres, and alfalfa and other hay crops on about 11,000 acres. Small grain, vegetables, and broomcorn were also important crops.

Beef cattle is the most important kind of livestock, and cattle ranches are located throughout the county. Most farmers raise cattle to supplement their crop income. In the past few years, large acreages of shallow gravelly soils and rolling sandy soils have been cleared of brush by ranchers and farmers and seeded to grass.

A few of the large ranch owners have purebred herds, but most ranchers use purebred bulls and have high-grade cows. The crossing of more hardy breeds of cattle and culling of inferior animals is gradually improving the quality of the herds. Most of the cattle are kept on the range throughout the year. In winter the cattle are usually fed cottonseed cake, minerals, and bundle feeds to supplement range forage. In summer sudangrass, bermudagrass, and stubble are used for temporary grazing while native grasses rest during part of the growing season and produce seed for regrowth.

In 1965, dairy cattle numbered approximately 2,300, and sheep about 54,000. Horses are less common and are used mainly for ranching and recreation. Hog production is low. About 4,000 hogs and pigs were marketed locally in 1965.

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Glossary

Alluvial fan. A fan-shaped deposit of sand, gravel, and fine material dropped by a stream where its gradient lessens abruptly.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water holding 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.

Blowout. An excavation produced by wind action in loose soil, usually sand.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A thin coating of clay on the surface of a soil aggregate. Synonyms: Clay coat, clay skin.

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.

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 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.

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 have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and in Podzolic soils commonly have mottlings below a depth of 6 to 16 inches, in the lower A horizon and in the B and C horizons.

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.

Verly 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.

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.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors, such as light, moisture, temperature, and the physical condition of the soil are favorable.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has been allowed to drain away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity.*

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gypsum. Calcium sulphate.

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 the soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

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.

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.

Permeability. The quality of a soil horizon that enables water or air to move through it. Terms used to describe permeability are as follows: *Very slow, slow, moderately slow, moderate, moderately rapid, rapid,* and *very rapid.*

Phase, soil. A subdivision of a soil, series, or other unit in the soil classification system made because of differences in the soil that affect its management but do not affect its classification in the natural landscape. A soil type, for example, may be divided into phases because of differences in slope, stoniness, thickness, or some other characteristic that affects its management but not its behavior in the natural landscape.

pH value. A numerical means for designating relatively weak acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

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.

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. In words, the degrees of acidity and 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

Red beds (*Geol.*). Sedimentary strata, largely of Permian and Triassic age, that are predominantly red in color. Red beds contain few fossils.

Relief. The elevations or inequalities of a land surface, considered collectively.

Sand. Individual rock or mineral fragments that have diameters ranging 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.

Silt. Individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

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 a period 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).

Soil variant. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in a mature soil includes the A and B horizons. Generally the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

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 (1) *single grain* (each grain by itself, as in dune sand) or (2) *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surplus 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.

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."

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