Series 1959, No. 7 Issued March 1962

SOIL SURVEY

Lamb County Texas

OUR SOIL ★ OUR STRENGTH

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
TEXAS AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS SURVEY will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, buildings, ponds, and other structures; serve as a reference for students and teachers; and add to the knowledge of soil scientists.

In making this survey, soil scientists checked the fields and native grasslands in all parts of the county. They dug holes and examined surface soils and subsoils; measured slopes with a hand level; noted differences in growth of crops, weeds, and grasses; and recorded observations about the soils that they believed might affect their suitability for farming, engineering, and other uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then, cartographers prepared from the photographs the detailed soil map in the back of this report. Fields, roads, and many other landmarks can be seen on the map.

Locating the Soils

Use the index for the map sheets to locate areas on the large map. The index is a small map of the county on which numbered rectangles have been drawn to show where each sheet of the large map is located. The boundaries of the soils are outlined on each sheet of the soil map, and there is a symbol for each kind of soil. All areas marked with the same symbol are the same kind of soil, wherever they appear on the map. The symbol will be inside the area if there is enough space; otherwise, it will be outside the area and a pointer will show where it belongs.

Suppose, for example, an area located on the map has the symbol AfA. The legend for the detailed map shows that this symbol identifies Amarillo fine sandy loam, 0 to 1 percent slopes. This soil and all others mapped in the county are described in the section "Descriptions of the Soils."

Finding Information

The soil survey report has special sections for different groups of readers, as well as sections that may be of value to all.

Farmers and ranchers can learn about the soils in the section "Descriptions of the Soils" and then identify them on their land. They can learn how these soils can be managed by reading the section "Use and Management of the Soils."

The soils are placed in capability units; that is, groups of soils that need similar management and respond in about the same way. For example, in the section "Descriptions of the Soils," Amarillo fine sandy loam, 0 to 1 percent slopes, is shown to be in capability unit IIIe-2 (dryland farming) and capability unit IIe-2 (irrigation). These capability units are discussed in the section "Use and Management of the Soils."

The soils are placed in range sites, which are kinds of rangeland. Each range site has its own potential for production of grasses and other vegetation. For example, Amarillo fine sandy loam, 0 to 1 percent slopes, is placed in the Mixed Land range site. A description of each range site is given in the section "Range Management."

The guide to mapping units, capability units, and range sites at the back of the report will simplify the use of the map and the report. The guide gives the name and map symbol for each soil and the page on which the soil is described, and the capability units and range site in which the soil has been placed and the pages on which these are described.

Help in making plans for farms or ranches can be obtained through a local representative of the Soil Conservation Service or the county agricultural agent. Members of the staff of the Texas Agricultural Experiment Station and others familiar with farming in Lamb County will also be glad to help.

Engineers will want to refer to the section "Engineering Applications." Tables in that section show characteristics of the soils that affect engineering.

Soil scientists and others interested in the scientific aspect of the soils will find information about how the soils were formed and how they are classified in the section "Formation, Classification, and Morphology of the Soils."

Students, teachers, and other users will find information about the soils and their management in various parts of the report, depending on their particular interest.

Newcomers in Lamb County will be especially interested in the section "General Soil Areas," which describes the broad pattern of the soils. They may also wish to read the section "Additional Facts About the County."

* * * *

This cooperative soil survey was made by the United States Department of Agriculture and the Texas Agricultural Experiment Station to provide a basis for determining the best agricultural uses of the soils. The Soil Conservation Service completed the fieldwork in 1959, and unless otherwise specified, all statements in this report refer to conditions at that time. The soil survey is part of the technical assistance furnished to the Lamb County Soil Conservation District.

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SOIL SURVEY OF LAMB COUNTY, TEXAS

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

General Nature of the County

Lamb County is in the southwestern part of the Panhandle of Texas. It is in the High Plains section of the Southern Great Plains province. The total area is 657,280 acres, or 1,027 square miles. The county is rectangular and extends 30 miles from east to west, and 34 miles from north to south. The location of Lamb County in Texas is shown in figure 1.

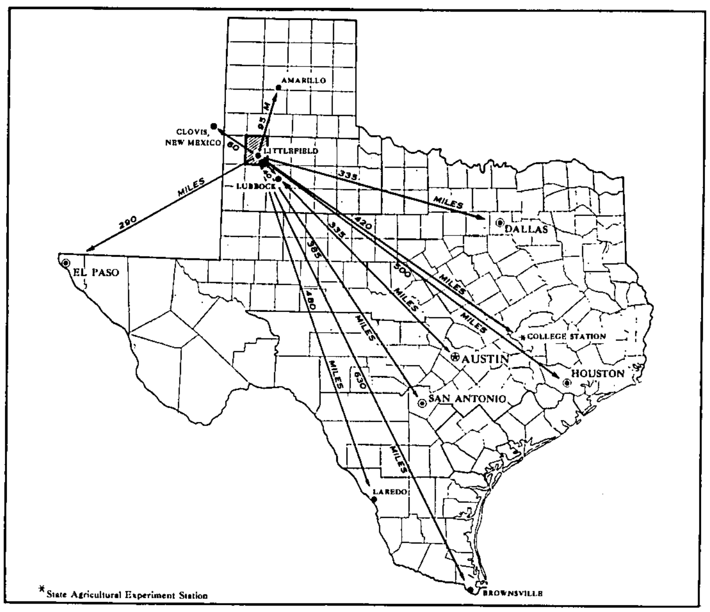

***Figure 1.*—Location of Lamb County in Texas.**

Most of the area is a nearly level to gently undulating plain that slopes upward from the southeast to the northwest. The elevation rises from about 3,400 to 3,800 feet. In the county are four saline lakes; they are Bull, Illusion, Soda, and Yellow Lakes.

Agriculture is the main industry; almost all of the county is in farms. About 350,000 acres are irrigated and 150,000 acres are dry-farmed. Much of the acreage in the southwestern part is dry-farmed.

Cotton and grain sorghum are the main crops. Other crops grown are alfalfa, corn, sesame, small grains, soybeans, vegetables, castorbeans, and some grasses for seed production.

General Soil Areas

In mapping a county or other large tract, it is easy to see differences as one travels from place to place. Some of these differences are in shape, length, and steepness of slope, in kinds of native plants, and in the kinds of agriculture. With the more obvious differences, there are others less obvious in the patterns of soils. The soils differ along with the other parts of the environment.

The soils of Lamb County occur in definite patterns. By drawing lines around the different patterns of soils on a small map, one may obtain a map of the general soil areas, or, as they are sometimes called, soil associations. Such a map is useful to those who want a general idea of the soils, who want to compare different parts of the county, or who want to locate large areas suitable for some particular crop, kind of agriculture, or other broad land use.

The eight general soil areas in Lamb County are shown in figure 2. The areas are named for the major soil series in them, but soils of other series may be present in any of the areas. Also, the major soil series of one area may occur in other areas. A brief description of each general soil area follows. More detailed information about individual soils in each general soil area can be obtained from the detailed soil map and by reading the section "Descriptions of the Soils."

Area 1

Amarillo fine sandy loams area: Level to gently sloping, deep, moderately coarse textured, moderately permeable soils

The soils of this general soil area occupy a nearly level to gently sloping plain having a gradual slope to the southeast. This general soil area contains about 331,000 acres; it is dotted with intermittent lakes of 10 to 30 acres.

Amarillo fine sandy loams are the most extensive soils in the area (fig. 3). Portales, Zita, Drake, Mansker, and Randall soils occur within the lake basins.

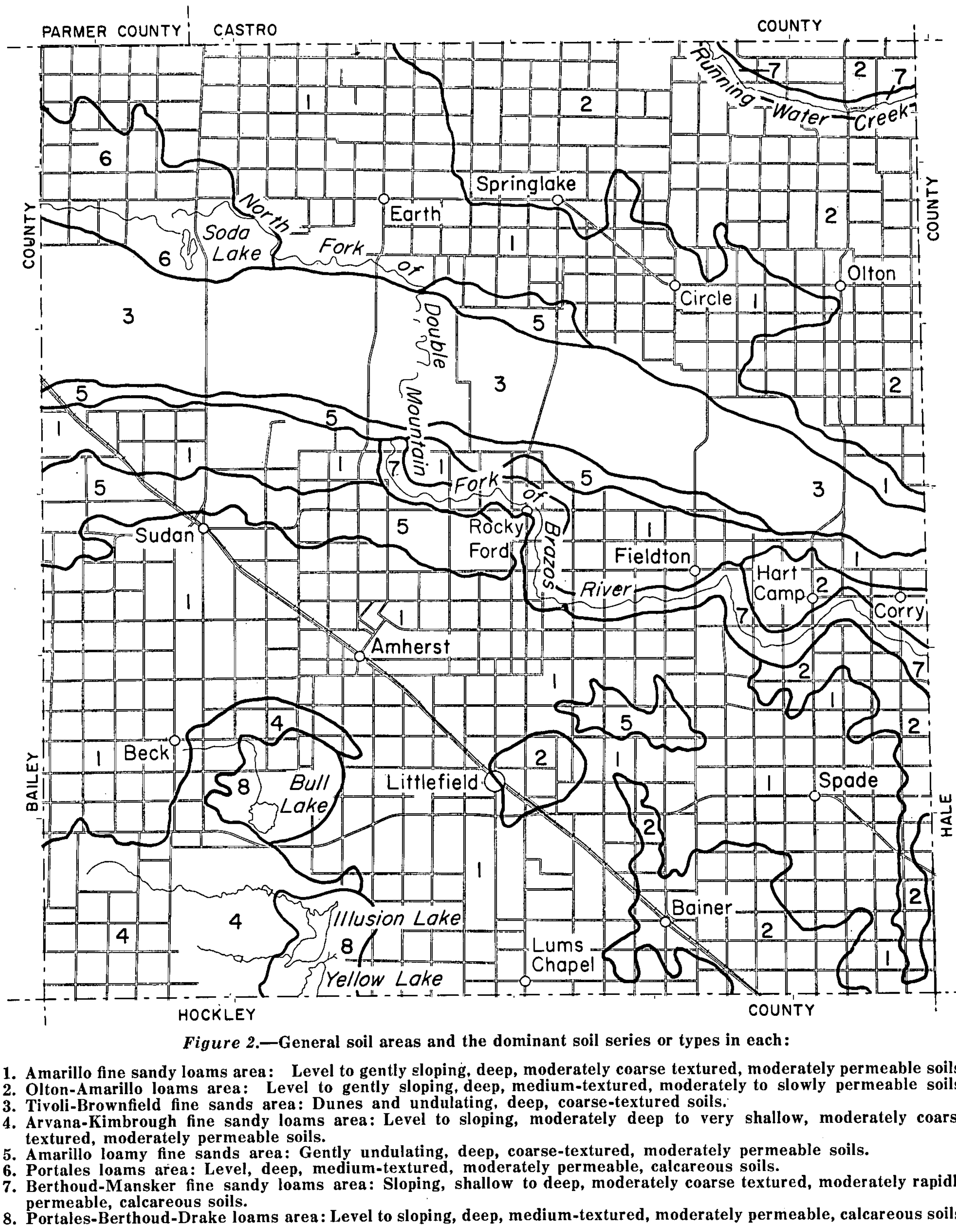

Figure 2.—General soil areas and the dominant soil series or types in each:

1. Amarillo fine sandy loams area: Level to gently sloping, deep, moderately coarse textured, moderately permeable soils.
2. Olton-Amarillo loams area: Level to gently sloping, deep, medium-textured, moderately to slowly permeable soils.
3. Tivoli-Brownfield fine sands area: Dunes and undulating, deep, coarse-textured soils.
4. Arvana-Kimbrough fine sandy loams area: Level to sloping, moderately deep to very shallow, moderately coarse textured, moderately permeable soils.
5. Amarillo loamy fine sands area: Gently undulating, deep, coarse-textured, moderately permeable soils.
6. Portales loams area: Level, deep, medium-textured, moderately permeable, calcareous soils.
7. Berthoud-Mansker fine sandy loams area: Sloping, shallow to deep, moderately coarse textured, moderately rapidly permeable, calcareous soils.
8. Portales-Berthoud-Drake loams area: Level to sloping, deep, medium-textured, moderately permeable, calcareous soils.

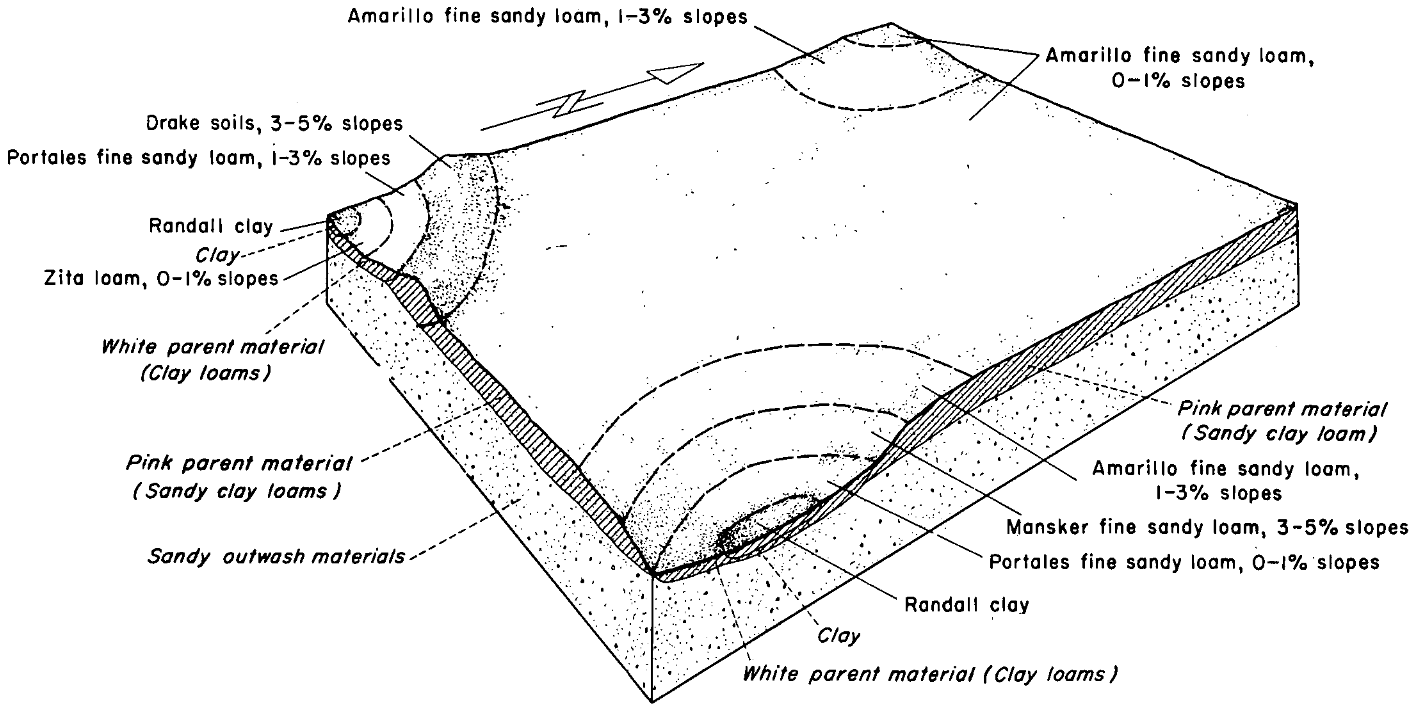

***Figure* 3.—Some soils of general soil area 1.**

Most of this area is used for production of crops. Two-thirds of the area is irrigated. Cotton and grain sorghum are the main irrigated crops. About 5 percent of the irrigated acreage is in alfalfa, corn, sesame, vegetables, and grasses for seed. Cotton and grain sorghum are the main crops grown on dryland.

These soils are productive, but they must be protected to prevent damage from wind erosion.

Area 2

Olton-Amarillo loams area: Level to gently sloping, deep, medium-textured, moderately to slowly permeable soils

The soils of this general soil area occupy a nearly level to gently sloping plain with a gradual slope to the southeast. This general soil area contains about 113,000 acres; it is dotted with intermittent lakes of 10 to 50 acres.

Olton loam and Amarillo loam are the main soils on this plain (fig. 4). Lofton, Mansker, and Randall soils occur within the lake basins.

Most of this area is in irrigated cropland. Cotton and grain sorghum are the main crops. Small grains, castorbeans, alfalfa, and vegetables are grown on about 10 percent of the irrigated acreage.

These soils are among the most productive in the county. They produce high yields if they are properly irrigated and fertilized.

Area 3

Tivoli-Brownfield fine sands area: Dunes and undulating, deep, coarse-textured soils

The soils of this general soil area occupy a duned to gently undulating topography. The dunes are Tivoli fine sand; the undulating areas are Brownfield fine sand (fig. 5). This general soil area contains about 87,000 acres.

Most of the area is rangeland. If properly managed, it produces good yields of tall grasses. A small acreage is irrigated cropland. The high hazard of wind erosion makes these soils poorly suited to cultivation.

Area 4

Arvana-Kimbrough fine sandy loams area: Level to sloping, moderately deep to very shallow, moderately coarse textured, moderately permeable soils

The soils of this general soil area occupy a nearly level to gently sloping plain with a gradual slope to the southeast. Most of this soil area has rocklike caliche 4 to 36 inches below the surface and some rock outcrops. This general soil area contains about 35,000 acres.

The main soils in this area are the Arvana and the Kimbrough. The Arvana soils are moderately deep. The Kimbrough soils are very shallow. Other soils in this area are the Portales, Mansker, and Amarillo fine sandy loams.

About 75 percent of the acreage of this area is used for dryland farming, but 15 percent of this is poorly suited to cultivation. Cotton and grain sorghum are grown. Most of the range is on shallow or steeply sloping soils. The native vegetation is mid grasses and short grasses.

The deeper soils in this area are moderately productive but need protection from wind erosion. The shallow soils have a low moisture-holding capacity that limits crop production, and the rock outcrops damage tillage implements. These shallow soils are better suited to range than to cultivation.

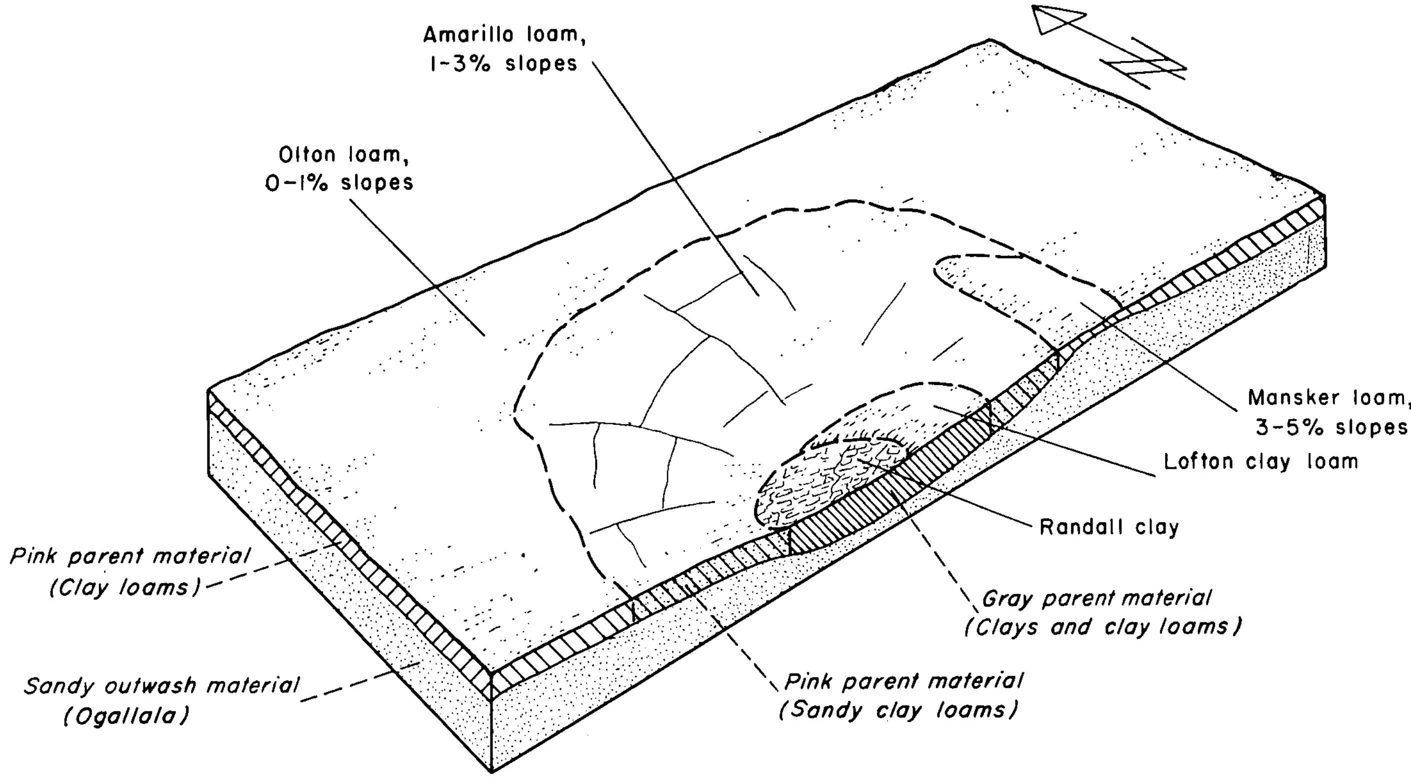

Figure 4.—Some soils of general soil area 2.

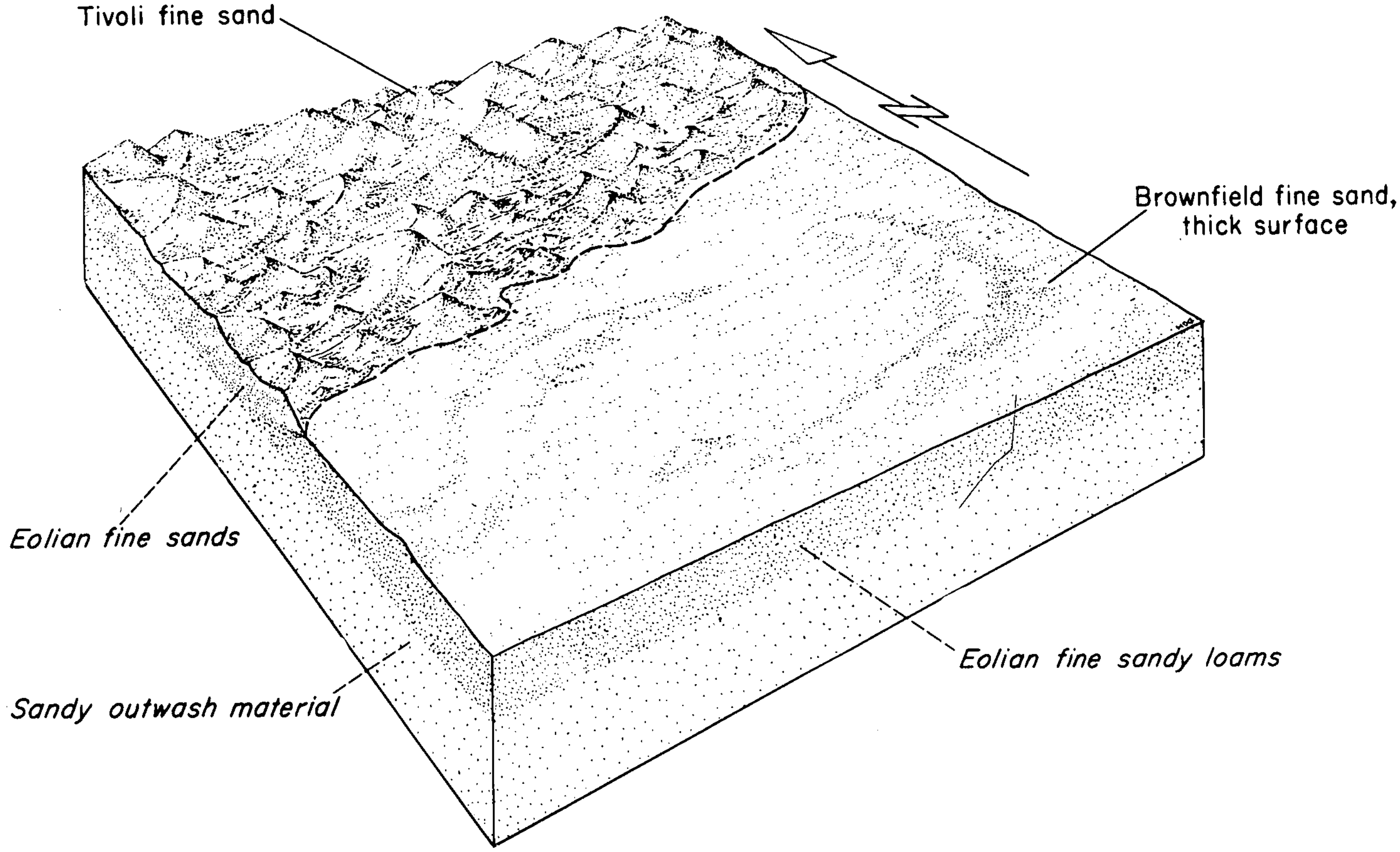

Figure 5.—Some soils of general soil area 3.

Area 5

Amarillo loamy fine sands area: Gently undulating, deep, coarse-textured, moderately permeable soils

The soils of this general soil area are sandy. The area contains about 34,000 acres. About half of this acreage is irrigated cropland.

Most of the soils of this area are Amarillo soils, but some Brownfield, Springer, and Portales soils occur. Cotton and grain sorghum are the crops grown. Intensive farming practices are needed to protect these soils from wind erosion.

Area 6

Portales loams area: Level, deep, medium-textured, moderately permeable, calcareous soils

The soils of this general soil area are in a level, broad, shallow valley with a slight slope to the southeast. The area contains about 26,000 acres.

Portales loams are the main soils, but some Zita, Arch, Church, and Drake soils occur around the edge of the area.

Most of this area is irrigated farmland. It is one of the largest producers of alfalfa hay on the High Plains. Other crops are vegetables, corn, cotton, and grain sorghum.

These calcareous soils produce good yields because of good farming practices and abundant irrigation water.

Area 7

Berthoud-Mansker fine sandy loams area: Sloping, shallow to deep, moderately coarse textured, moderately rapidly permeable, calcareous soils

This general soil area occupies the slopes along Running Water Creek and the North Fork of the Double Mountain Fork of the Brazos River. It covers about 17,000 acres.

The deeper soils along these slopes are the Berthoud. The shallow soils are the Mansker (fig. 6). Both are calcareous and have moderate to moderately rapid permeability. The dark, nearly level areas along the bottoms of the draws are Spur soils.

About 60 percent of the area is cultivated, but only about 35 percent of this is well suited to cultivation. Most of the cultivated land is irrigated. Crops grown are cotton, grain sorghum, and alfalfa. Most of the native vegetation is mid grasses.

Water erosion is the greatest hazard on these sloping soils.

Area 8

Portales-Berthoud-Drake loams area: Level to sloping, deep, medium-textured, moderately permeable, calcareous soils

This general soil area comprises the soils surrounding the saline lakes. It contains about 14,000 acres.

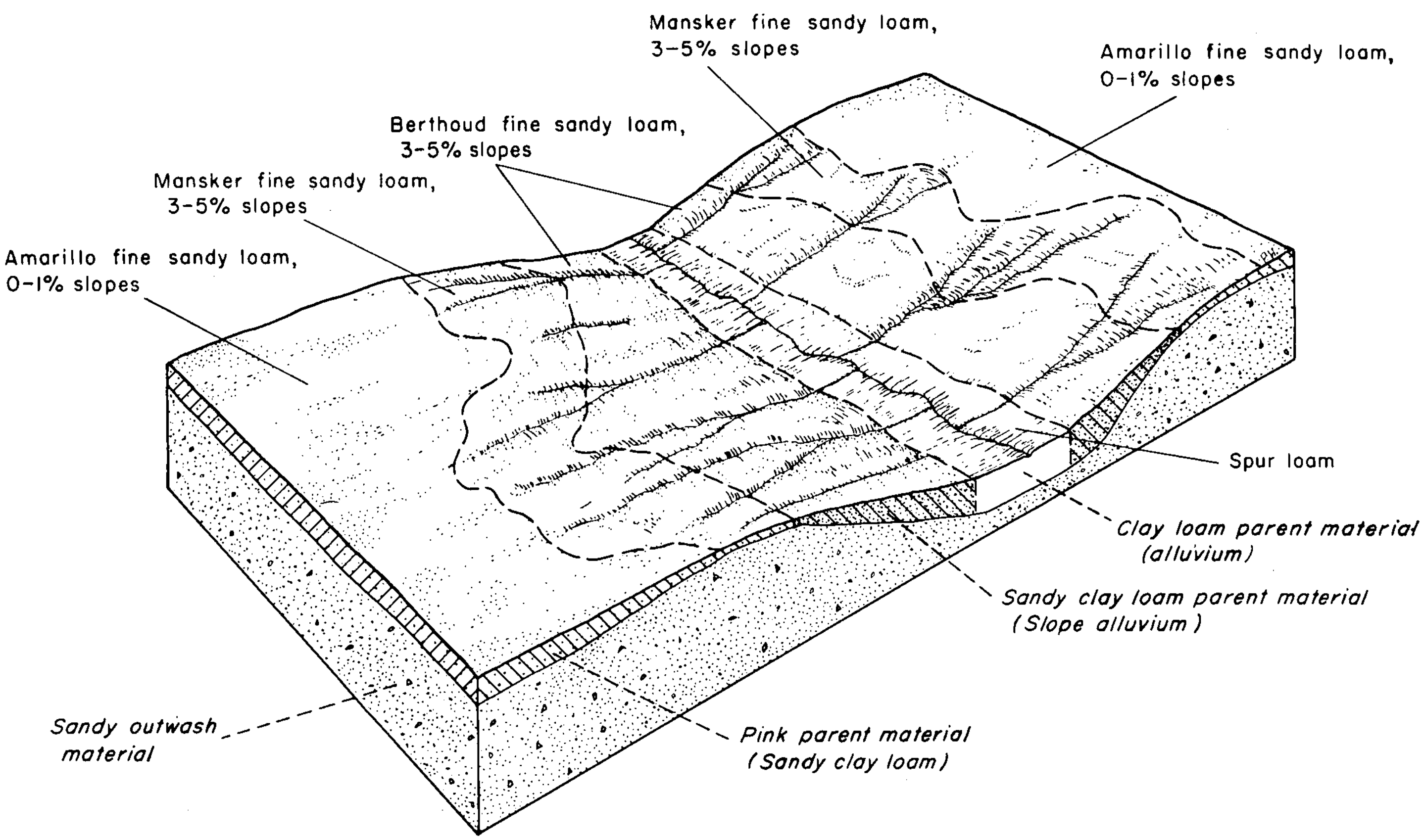

Figure 6.—Some soils of general soil area 7.

Berthoud loam occupies the moderately sloping land west of Bull and Illusion Lakes. The high dunes east of these lakes are the Drake soils. Portales loam occupies the broad, level areas east of these dunes.

About 60 percent of the area is cultivated. The crops grown are cotton and grain sorghum.

The Portales soils are cultivated. The Berthoud and Drake soils are in rangeland. The native vegetation is mostly short grasses.

Descriptions of the Soils

The soil scientists who prepared this survey went over the area at appropriate intervals and dug holes with a spade, auger, or power soil sampler. They examined the different layers, or horizons, in each boring, and they compared the different borings. By such comparison, they determined the different kinds of soils in the area.

Then, they described the various soils and drew boundaries on aerial photographs to separate them. The soils are described in the following pages. Their acreage and proportionate extent are shown in table 1, and their location can be seen on the detailed map at the back of this report.

In this report, the soil series are described in alphabetic order. After each series, the soils of that series that were mapped in the county are described. An important part of each soil description is the soil profile, a record of what the soil scientist saw and learned when he dug into the ground. Since all the soils in one series have essentially the same profile, except for possible differences in texture of the surface layer, it is not necessary to describe the profile of every soil. The profile is therefore described for the first soil in each type. The reader can assume that all the other soils of one type have essentially the same kind of profile. To illustrate, a detailed profile is described for Amarillo fine sandy loam, 0 to 1 percent slopes, and the reader is to conclude that all the Amarillo fine sandy loams mapped have essentially this kind of profile. The differences, if any, are indicated in the soil name, or mentioned in describing the particular soil.

The profile description is in smaller type than the rest of the description of the soil. Those who want to have only a working knowledge of the soil and its management need read only the part set in larger type.

In describing the soils, the scientist frequently assigns a letter symbol, for example, "A_1," to the various layers. These letter symbols have special meanings that concern scientists and others who desire to make a special study of soils. Most readers need to remember only that all letter symbols beginning with "A" are surface soil and subsurface soil; those beginning with "B" are subsoil; and those beginning with "C" are substratum, or parent material. It may also be helpful to remember that the small letter "p" indicates a plowed layer and that the small letters "ca" indicate an accumulation of calcium carbonate.

Layers, or horizons, in soils are measured from the top of the mineral soil material downward. The distance from the top to the bottom of each layer is indicated in inches. In soils, one layer is seldom followed immediately by another layer in such a way that they can be divided by a straight line. Boundaries between horizons have thickness and shape. The terms for thickness are (1) *abrupt*, if less than 1 inch thick; (2) *clear*, if about 1 to 2½ inches thick; (3) *gradual*, if 2½ to 5 inches thick; and (4) *diffuse*, if more than 5 inches thick. The shape of the boundary is described as *smooth*, *wavy*, *irregular*, or *broken*.

Soil scientists use Munsell notations to indicate the color of a soil precisely, and they provide the equivalent in words for those not familiar with the system. They compare a sample of the soil with a standard color chart. The Munsell notation, and its less exact approximation in words, are read from the chart; for example, "light gray (10YR 7/2; 5/2)." In the example given, "10YR" is the hue, and "7/2" and "5/2" each express, respectively, value and chroma in hue 10YR. The notation "10YR 7/2" is equivalent to the words "light gray;" it is the hue, value, and chroma of the soil when dry. The notation "10YR 5/2" indicates the hue, value, and chroma of the soil when moist. To save space, the notation for the dry soil always comes first, and it is not followed by the word "dry."

The texture of the soil refers to the content of sand, silt, and clay. It is determined by the way the soil feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural name, such as "fine sandy loam." This refers to the texture of the surface layer.

Structure is indicated by the way the individual soil particles are arranged in larger grains, or aggregates, and the amount of pore space between the grains. The structure of the soil is determined by the strength or grade, the size, and the shape of the aggregates. For example, a horizon may have "weak, fine, blocky structure."

Consistence refers to the feel of the soil when wet, moist, or dry. Other features, such as pores, clay skins, and insect activity are also described.

Calcareousness refers to the presence of free lime in each horizon.

Other technical terms are explained in the Glossary in the back of this report and in the "Soil Survey Manual" (*8*).[1]

Active Dunes

Active dunes (Ad).—This miscellaneous land type consists of unstabilized areas in the sandhills. These areas are subject to continuous wind action. Active dunes have no profile development.

Areas of this miscellaneous land type range from 5 to 60 acres in size. About 60 to 80 percent of a mapped area consists of active dunes of fine sand. These dunes are 10 to 50 feet high and usually slope from 10 to 20 percent on the west side and 15 to 40 percent on the east side. In places the surface soil is slightly calcareous. The remaining 20 to 40 percent of the mapped area consists of blownout places that are usually on the west side of the dune. In these blownout areas, erosion has removed all of the soil down to the parent material. This parent material is pink to pale-brown, or reddish-yellow, calcareous sandy clay loam, 10 to 20 percent of which is hard concretions of calcium carbonate. In places the parent material is white calcareous sand that contains abundant remains of small snail shells.

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[1] Italic numbers in parentheses refer to Literature Cited, p. 67.

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

Soil	Cropland		Range	Other	Total	Extent
	Irrigated	Dryland				
	Acres	*Acres*	*Acres*	*Acres*	*Acres*	*Percent*
Active dunes				858	858	0. 1
Amarillo fine sandy loam, 0 to 1 percent slopes	85, 754	47, 290	2, 045	3, 718	138, 807	21. 1
Amarillo fine sandy loam, 1 to 3 percent slopes	46, 914	28, 550	2, 168	2, 142	79, 774	12. 1
Amarillo fine sandy loam, 3 to 5 percent slopes	2, 204	1, 488	461	115	4, 268	. 7
Amarillo loam, 0 to 1 percent slopes	34, 320	1, 383	913	1, 047	37, 663	5. 7
Amarillo loam, 1 to 3 percent slopes	9, 849	253	798	303	11, 203	1. 7
Amarillo loamy fine sand, 0 to 3 percent slopes	12, 407	12, 300	2, 981	769	28, 457	4. 3
Arch fine sandy loam	1, 014	85	2, 440	98	3, 637	. 6
Arch loam	375	44	1, 072	42	1, 533	. 2
Arch loamy fine sand, overblown	298	264	2, 537	87	3, 186	. 5
Arvana fine sandy loam, 0 to 1 percent slopes	3, 307	7, 439	384	309	11, 439	1. 7
Arvana fine sandy loam, 1 to 3 percent slopes	1, 115	3, 267	806	144	5, 332	. 8
Arvana fine sandy loam, shallow, 0 to 1 percent slopes	318	380	373	29	1, 100	. 2
Arvana fine sandy loam, shallow, 1 to 3 percent slopes	159	878	503	43	1, 583	. 2
Berthoud fine sandy loam, 1 to 3 percent slopes	349	452	720	27	1, 548	. 2
Berthoud fine sandy loam, 3 to 5 percent slopes	825	1, 607	3, 020	164	5, 616	. 9
Berthoud fine sandy loam, 5 to 8 percent slopes	29	307	1, 136	41	1, 513	. 2
Berthoud loam, 1 to 3 percent slopes			1, 560	27	1, 587	. 2
Berthoud loam, 3 to 5 percent slopes	55		840	17	912	. 1
Brownfield fine sand, thick surface	2, 173	1, 936	36, 353	1, 122	41, 584	6. 3
Church clay loam	897	44	1, 387	64	2, 392	. 4
Drake soils, 1 to 3 percent slopes	916	428	928	63	2, 335	. 4
Drake soils, 3 to 5 percent slopes	586	876	1, 227	76	2, 765	. 4
Drake soils, 5 to 20 percent slopes	60	77	2, 441	71	2, 649	. 4
Kimbrough soils	74	629	4, 936	110	5, 749	. 9
Lea clay loam	249		62	9	320	[1]
Likes loamy fine sand, undulating	168	214	40	13	435	. 1
Lofton clay loam	1, 337	104	179	45	1, 665	. 3
Lubbock fine sandy loam	2, 757	1, 727	36	125	4, 645	. 7
Mansker fine sandy loam, 0 to 1 percent slopes	683	978	187	51	1, 899	. 3
Mansker fine sandy loam, 1 to 3 percent slopes	2, 735	1, 632	794	143	5, 304	. 8
Mansker fine sandy loam, 3 to 5 percent slopes	587	699	597	52	1, 935	. 3
Mansker fine sandy loam, 5 to 8 percent slopes	168	360	1, 488	56	2, 072	. 3
Mansker loam, 0 to 1 percent slopes	931	261	33	34	1, 259	. 2
Mansker loam, 1 to 3 percent slopes	1, 925	120	452	69	2, 566	. 4
Mansker loam, 3 to 5 percent slopes	422	25	361	29	837	. 1
Mansker loam, 5 to 8 percent slopes	23	7	273	9	312	[1]
Olton loam, 0 to 1 percent slopes	67, 444	5, 299	897	2, 035	75, 675	11. 5
Olton loam, 1 to 2 percent slopes	4, 821	214	223	145	5, 403	. 8
Portales fine sandy loam, 0 to 1 percent slopes	6, 679	6, 090	939	375	14, 083	2. 1
Portales fine sandy loam, 1 to 3 percent slopes	8, 569	8, 400	3, 573	584	21, 126	3. 2
Portales loam, 0 to 1 percent slopes	17, 100	2, 715	1, 602	598	22, 015	3. 4
Portales loam, 1 to 3 percent slopes	6, 441	389	670	230	7, 730	1. 2
Portales loamy fine sand, overblown	300	275	508	30	1, 113	. 2
Potter soils, 1 to 8 percent slopes			858	23	881	. 1
Potter soils, 8 to 30 percent slopes	8	157	2, 405	72	2, 642	. 4
Randall clay	2, 254	1, 751	8, 843	356	13, 204	2. 0
Randall fine sandy loam	281	440	71	21	813	. 1
Springer fine sandy loam, undulating	386	849	282	42	1, 559	. 2
Springer fine sandy loam, hummocky	163	439	437	28	1, 067	. 2
Springer loamy fine sand, hummocky	127	490	422	29	1, 068	. 2
Spur fine sandy loam	88	370	169	17	644	. 1
Spur loam	1, 020	538	735	64	2, 357	. 4
Tivoli fine sand		30	38, 909	1, 079	40, 018	6. 1
Zita fine sandy loam, 0 to 1 percent slopes	4, 698	4, 225	1, 038	276	10, 237	1. 6
Zita fine sandy loam, 1 to 3 percent slopes	2, 305	1, 581	237	114	4, 237	. 6
Zita loam, 0 to 1 percent slopes	5, 615	432	609	185	6, 841	1. 0
Zita loam, 1 to 2 percent slopes	803	122	175	31	1, 131	. 2
Zita loamy fine sand, overblown	590	380	15	25	1, 010	. 2
Saline lakes				1, 687	1, 687	. 3
Total (acres)	345, 675	151, 290	140, 148	20, 167	657, 280	100. 0
Total (percent)	52. 7	23. 1	21. 4	2. 8	100. 0	

[1] Less than 0.1 percent.

This land type is suitable for wildlife cover or for recreation areas. (Capability unit VIIIe-1.)

Amarillo Series

The Amarillo series consists of deep, reddish-brown, moderately sandy soils. Soft caliche generally occurs at depths of about 30 to 60 inches.

These soils occur on broad, nearly level to gently sloping uplands. They are the most extensive soils in the county.

Amarillo fine sandy loam, 0 to 1 percent slopes (AfA).—This soil is moderately sandy. The surface layer is brown to reddish-brown fine sandy loam, 6 to 12 inches thick. The subsoil is reddish-brown sandy clay loam, 18 to 50 inches thick. It is underlain by pink to yellowish-red caliche at an average depth of about 42 inches. This soil occupies broad, smooth, nearly level areas.

Amarillo fine sandy loam is associated with Arvana soils, which have indurated caliche within a depth of 36 inches; Olton soils, which have a more clayey subsoil; and Springer soils, which have a sandier subsoil.

Profile of Amarillo fine sandy loam, 0 to 1 percent slopes (about 2 miles northwest of Sudan):

A_1 0 to 11 inches, brown (7.5YR 4/4; 3/4, moist) fine sandy loam; weak, granular structure; hard when dry, very friable when moist; many fine and medium pores and wormcasts; noncalcareous; clear boundary.

B_2 11 to 27 inches, reddish-brown (5YR 4/4; 3/4, moist) sandy clay loam; moderate, coarse, prismatic and weak, subangular blocky structure; very hard when dry, friable when moist; many fine and medium pores; common wormcasts; noncalcareous; gradual boundary.

B_3 27 to 38 inches, yellowish-red (5YR 4/6; 3/6, moist) sandy clay loam; weak, subangular blocky structure; hard when dry, friable when moist; common to many films and threads of calcium carbonate, mostly on ped surfaces; weakly calcareous; clear boundary.

C_{ca} 38 to 56 inches, pink (5YR 7/3; 6/3, moist), very strongly calcareous sandy clay loam or fine earth materials; an estimated 60 percent of the volume is mostly hard concretions of calcium carbonate, less than 1 inch in diameter; gradual boundary.

C 56 to 66 inches +, yellowish-red (5YR 5/6; 4/6, moist), very strongly calcareous sandy clay loam; few, mostly soft concretions of calcium carbonate, less than 1 inch in diameter.

The color of the surface soil ranges from reddish brown to brown, hue 5YR to 7.5YR.

The structure of the B_2 horizon ranges from moderate, coarse, prismatic to weak or moderate, fine to medium, subangular blocky. In places the color varies slightly from reddish brown (5YR 4/4, dry). The thickness ranges from 10 to 20 inches.

The structure of the B_3 horizon ranges from weak, coarse, prismatic to fine, subangular blocky. The color ranges from reddish brown to reddish yellow, hue 5YR to 7.5YR, value 4 to 6, and chroma 4 to 6. The thickness ranges from 10 to 30 inches.

The texture of the C_{ca} horizon is usually sandy clay loam but is clay loam in places. The color ranges from reddish yellow to pinkish white but is generally pink. Hard and soft concretions of calcium carbonate make up 30 to 60 percent of this horizon. The thickness is generally about 18 inches but ranges from 6 to 36 inches. Depth to the C_{ca} horizon ranges from 30 to 60 inches or more.

The sandy clay loam C horizon ranges in color from yellowish red to reddish yellow.

Included with this soil, as mapped, are small areas of Portales, Arvana, and Lubbock soils. Also included are small areas that have moderately severe wind erosion.

This soil is productive, but wind erosion is a moderate hazard. It is one of the better dryland soils. Under irrigation, it responds well to applications of nitrogen and phosphate. (Capability unit IIIe-2 (dryland farming); capability unit IIe-2 (irrigation); Mixed Land range site.)

Amarillo fine sandy loam, 1 to 3 percent slopes (AfB).—This soil is very similar to Amarillo fine sandy loam, 0 to 1 percent slopes. It occupies smaller areas generally adjacent to large, nearly level areas of Amarillo fine sandy loam, 0 to 1 percent slopes. Slopes are mostly plane, or single. They range from about 1 to 3 percent but are mainly about 2 percent.

This is a productive soil; the hazards of wind and water erosion are moderate. (Capability unit IIIe-1 (dryland farming or irrigation); Mixed Land range site.)

Amarillo fine sandy loam, 3 to 5 percent slopes (AfC).—Except for slope, this soil is very similar to Amarillo fine sandy loam, 0 to 1 percent slopes. Most areas of this soil range from 5 to 30 acres in size. They occur on northwest slopes bordering playas and within areas of Amarillo fine sandy loam, 1 to 3 percent slopes. The hazard of water erosion is much greater than on the less sloping Amarillo fine sandy loams. (Capability unit IVe-3 (dryland farming or irrigation); Mixed Land range site.)

Amarillo loamy fine sand, 0 to 3 percent slopes (AmB).—This soil has a surface layer of brown loamy fine sand, 8 to 16 inches thick. The subsoil is reddish-brown sandy clay loam, 24 to 42 inches thick. It is underlain by pink to yellowish-red caliche at depths of about 40 to 60 inches. This soil occupies broad, gently undulating areas generally adjacent to the sandhills.

Amarillo loamy fine sand is associated with Brownfield soils, which have thicker surface layers of sand and a redder subsoil; with Springer soils, which have a sandy subsoil; and with Amarillo fine sandy loam, which is less sandy.

Profile of Amarillo loamy fine sand, 0 to 3 percent slopes (about 3.8 miles east and 2.8 miles north of Littlefield):

A_p 0 to 14 inches, brown (7.5YR 5/4; 4/4, moist) loamy fine sand; structureless; loose when dry, very friable when moist; many fine pores; few wormcasts; noncalcareous; abrupt boundary.

B_2 14 to 30 inches, reddish-brown (5YR 4/4; 3/4, moist) sandy clay loam; compound, moderate, coarse, prismatic and weak, subangular blocky structure; hard when dry, firm when moist; many fine pores; few wormcasts; noncalcareous; gradual boundary.

B_3 30 to 45 inches, reddish-yellow (5YR 6/6; 5/6, moist) sandy clay loam; weak, coarse, prismatic structure; hard when dry, friable when moist; many very fine pores; noncalcareous to 40 inches, weakly calcareous below; clear boundary.

C_{ca} 45 to 58 inches, pinkish-white (5YR 8/2; 7/2, moist) clay loam; hard when dry, friable when moist; an estimated 30 to 50 percent of the volume is soft calcium carbonate equivalent; very strongly calcareous; diffuse boundary.

C 58 to 72 inches +, reddish-yellow (5YR 6/6; 5/6, moist), very strongly calcareous sandy clay loam.

The color of the A_p horizon ranges from light brown to brown, hue 7.5YR to 10YR.

The structure of the B_2 horizon ranges from moderate, coarse, prismatic to moderate, medium, subangular blocky. In places the color varies slightly from reddish brown (5YR 4/4, dry). Thickness ranges from 10 to 20 inches.

The structure of the B_3 horizon ranges from weak to moderate, coarse, prismatic to subangular blocky. The color ranges from reddish brown to reddish yellow, hue 5YR to 7.5YR, value 4 to 6, and chroma 4 to 6. The thickness ranges from 12 to 30 inches. The B_3 horizon is weakly calcareous in places.

The C_{ca} horizon ranges in color from reddish yellow to pinkish white but is generally pink. Hard and soft calcium carbonate concretions may make up 20 to 50 percent of this horizon. The horizon is usually 12 to 18 inches thick, but the total range is 6 to 36 inches.

The sandy clay loam C horizon ranges in color from yellowish red to reddish yellow, hue 5YR to 7.5YR.

Included with this soil, as mapped, are small areas of Brownfield and Springer soils. Also included are small areas that have moderately severe wind erosion. Some small areas of this soil have slopes greater than 3 percent.

The hazard of wind erosion is high. The soil can be plowed deeply to help control erosion. The sandy surface layer is low in fertility and in water-holding capacity. (Capability unit IVe-4 (dryland farming); capability unit IIIe-4 (irrigation); Sandy Land range site.)

Amarillo loam, 0 to 1 percent slopes (AlA).—This soil has a surface layer of brown to reddish-brown loam, 6 to 12 inches thick. The subsoil is reddish-brown sandy clay loam, 18 to 40 inches thick. It is underlain by pink caliche at depths of about 30 to 60 inches. This soil is generally in the northern and eastern parts of the county. It occupies broad, smooth, nearly level areas.

Amarillo loam is associated with Olton loam, which is more clayey in the subsoil, and with Amarillo fine sandy loam, which is more sandy.

Profile of Amarillo loam, 0 to 1 percent slopes (about 2 miles north and 1.2 miles west of Olton):

A_p 0 to 10 inches, reddish-brown (5YR 4/4; 3/4, moist) loam; weak, granular structure; hard when dry, friable when moist; noncalcareous; abrupt boundary.

B_{21} 10 to 21 inches, reddish-brown (5YR 4/3; 3/3, moist) sandy clay loam; weak to moderate, fine and medium, subangular blocky and weak, medium, prismatic structure; very hard when dry, firm when moist; many fine and medium pores; many wormcasts; discontinuous clay films; noncalcareous; gradual boundary.

B_{22} 21 to 32 inches, reddish-brown (5YR 5/4; 4/4, moist) sandy clay loam; structure similar to that of B_{21} horizon; hard when dry, friable when moist; many fine and medium pores; many wormcasts; noncalcareous; gradual boundary.

B_3 32 to 56 inches, reddish-yellow (5YR 6/6; 5/6, moist) sandy clay loam; weak, medium, prismatic, and subangular blocky structure; slightly hard when dry, friable when moist; many fine pores; weakly calcareous; many films and threads of calcium carbonate, mostly on vertical ped surfaces; clear boundary.

C_{ca} 56 to 74 inches, pink (5YR 7/4; 6/4, moist) clay loam; very strongly calcareous; about 40 percent of the volume is calcium carbonate equivalent; diffuse boundary.

C 74 to 80 inches +, reddish-yellow (5YR 6/6; 5/6, moist), very strongly calcareous sandy clay loam; a few, mostly soft, calcium carbonate concretions less than 1 inch in diameter.

In most areas the texture of the surface soil is loam, but in some areas it is sandy clay loam. The color ranges from reddish brown to brown, hue 5YR to 7.5YR.

The structure of the B_{21} and B_{22} horizons ranges from weak or moderate, coarse, prismatic to weak, fine, or moderate, medium, subangular blocky. The color varies slightly from reddish brown (5YR 4/3 or 5/4, dry).

The color of the B_3 horizon ranges from reddish brown to reddish yellow, hue 5YR to 7.5YR, value 4 to 6, and chroma 4 to 6.

The texture of the C_{ca} horizon is usually heavy sandy clay loam or clay loam. Depth to the C_{ca} horizon ranges from 30 to 60 inches, or more. The color ranges from pinkish white to reddish yellow but is generally pink. Small concretions of calcium carbonate may make up 20 to 60 percent of this horizon. The thickness of the horizon is generally about 18 inches but ranges from 12 to 40 inches.

The sandy clay loam C horizon ranges in color from yellowish red to reddish yellow, hue 5YR to 7.5YR.

Included with this soil, as mapped, are small areas of Olton loam, Portales loam, and Amarillo fine sandy loam.

This is one of the better soils in Lamb County. It is productive, but wind erosion is a slight hazard. Irrigated areas respond well to proper fertilization. The soil is droughty under dryland farming. (Capability unit IIIce-1 (dryland farming); capability unit IIe-1 (irrigation); Deep Hardland range site.)

Amarillo loam, 1 to 3 percent slopes (AlB).—This soil is very similar to Amarillo loam, 0 to 1 percent slopes. Most areas are on the slopes around playas.

Included with this soil, as mapped, are small areas that have slopes greater than 3 percent.

This is a productive soil, but water erosion is a moderate hazard. (Capability unit IIIe-3 (dryland farming or irrigation); Deep Hardland range site.)

Arch Series

The Arch series consists of light-gray to grayish-brown, strongly calcareous, moderately deep soils. These soils show little profile development. The parent materials are chalky earths that appear to have been modified by deposits of calcium carbonate from ground water. The areas where these soils developed were probably shallow lakes.

Associated soils are the Church soils, which are more clayey; the Portales soils, which are darker and deeper; the Drake soils, which are duned; and the Tivoli soils, which are noncalcareous sand.

The high lime content in Arch soils makes them more susceptible to wind erosion and limits the number of suitable crops.

Arch loam (Ao).—This soil occurs on very gradual slopes in the northwestern part of the county. It is slightly higher than the associated Church clay loam.

Profile of Arch loam (9 miles west and 1 mile south of Earth):

A_p 0 to 7 inches, light-gray (10YR 7/2; 5/2, moist) loam; structureless; very hard when dry, firm when moist; very strongly calcareous; abrupt boundary.

AC 7 to 24 inches, very pale brown (10YR 7/3; 6/3, moist) clay loam; weak, granular structure; very hard when dry, firm when moist; very strongly calcareous; clear boundary.

C_{ca} 24 to 48 inches +, very pale brown (10YR 8/3; 7/3, moist), very strongly calcareous clay loam.

In most areas the texture of the surface soil is loam, but in some it is sandy clay loam. The color throughout the profile ranges from pale brown to white, hue 10YR, value 6 to 8, and chroma 1 to 3. Structure ranges from weak, granular to weak, subangular blocky. Hard, medium to fine concretions of calcium carbonate occur throughout the profile in places.

A few areas of this soil are cultivated under irrigation, but most are in native pasture. The present vegetation is mainly alkali sacaton, inland saltgrass, and blue grama.

Because of the high content of lime, lime-tolerant crops should be grown on irrigated areas.

In some areas Arch loam may be slightly saline. (Capability unit IVe-1 (dryland farming); Capability unit IIIe-6 (irrigation); High Lime range site.)

Arch fine sandy loam (An).—Areas of this soil associated with Tivoli fine sand are slightly depressed. Areas associated with Church clay loam are slightly higher and more sloping than the Church soil.

Profile of Arch fine sandy loam (8 miles west and 1 mile south of Earth):

A_{1p} 0 to 8 inches, light brownish-gray (10YR 6/2; 4/2, moist) fine sandy loam; weak, subangular blocky structure; slightly hard when dry, very friable when moist; very strongly calcareous; abrupt boundary.

A_{12} 8 to 14 inches, very pale brown (10YR 7/3; 6/3, moist) fine sandy loam; weak, subangular blocky and granular structure; slightly hard when dry, very friable when moist; many very fine pores; few worm-casts; very strongly calcareous; gradual boundary.

AC 14 to 21 inches, light-gray (10YR 7/2; 6/2, moist) sandy clay loam; weak, subangular blocky and granular structure; very hard when dry, friable when moist; many fine pores; very strongly calcareous.

C_{ca} 21 to 48 inches +, white (10YR 8/2, 7/2, moist), very strongly calcareous sandy clay loam.

In most areas the texture of the surface soil is fine sandy loam, but in some small areas it is loamy fine sand or loam. The color ranges from brown to light gray, hue 10YR, value 5 to 7, and chroma 1 to 3. The texture of the subsoil ranges from sandy clay loam to clay loam. The color of the subsoil ranges from gray to white, hue 10YR, value 6 to 8, and chroma 1 to 2.

This soil is better suited to range than to cultivation. If the soil is cultivated, it should be planted to lime-tolerant crops.

The present vegetation includes alkali sacaton, inland saltgrass, and blue grama. (Capability unit IVe-1 (dryland farming); capability unit IIIe-6 (irrigation); High Lime range site.)

Arch loamy fine sand, overblown (As).—This soil occurs as slightly depressed areas. It is usually associated with sandy soils, such as Brownfield and Tivoli fine sands. Its sandy soil is apparently wind-deposited material removed from these sandier soils.

Profile of Arch loamy fine sand, overblown (4 miles west and 3 miles south of Earth):

A_1 0 to 14 inches, grayish-brown (10YR 5/2; 4/2, moist) loamy fine sand; weak, granular structure; soft when dry, very friable when moist; weakly calcareous; gradual boundary.

AC 14 to 22 inches, gray (10YR 5/1; 4/1, moist) fine sandy loam; weak, granular and subangular blocky structure; slightly hard when dry, friable when moist; many medium pores; few, hard, medium to fine concretions of calcium carbonate; strongly calcareous; gradual boundary.

C_{ca} 22 to 48 inches +, light-gray (2.5Y 7/2; 6/2, moist), very strongly calcareous sandy clay loam; becomes white (10YR 8/2) with depth.

In most areas the texture of the surface soil is loamy fine sand, but in some it is fine sand. The color of the surface layer ranges from brown (10YR 5/3) to light gray (10YR 7/2). The color of the subsoil ranges from grayish brown to white. In places small areas of indurated caliche occur at depths of 24 to 36 inches.

Even under irrigation, this soil is poorly suited to cultivation. The hazard of wind erosion is high, and the soil is high in lime.

This soil is much better suited to range than to cultivation. The present vegetation includes side-oats grama and blue grama. (Capability unit VIe-2 (without irrigation); Capability unit IVe-7 (irrigation); Sandy Land range site.)

Arvana Series

The Arvana series consists of reddish-brown, moderately sandy soils. These soils are underlain by hard, platy caliche at depths of 10 to 36 inches. They have developed in a thin mantle of wind-deposited material that overlies rocklike caliche.

Arvana soils occur mainly in the southwestern part of the county on broad, nearly level to gently sloping areas. They are associated with the Amarillo soils, which are not on indurated caliche; the Kimbrough soils, which are less than 10 inches deep over indurated caliche; and the Mansker soils, which are grayer and are calcareous.

Arvana fine sandy loam, 0 to 1 percent slopes (AvA).—This soil has 6 to 10 inches of brown to reddish-brown fine sandy loam surface soil. The subsoil is 10 to 30 inches of reddish-brown sandy clay loam, which rests on hard, platy caliche. This soil occupies broad, smooth, nearly level areas.

Profile of Arvana fine sandy loam, 0 to 1 percent slopes (about 8.7 miles west and 2 miles north of Littlefield):

A_p 0 to 6 inches, reddish-brown (5YR 4/4; 3/4, moist) fine sandy loam; structureless; slightly hard when dry, friable when moist; noncalcareous; abrupt boundary.

B_{21} 6 to 14 inches, reddish-brown (5YR 4/4; 3/4, moist) sandy clay loam; moderate, coarse, prismatic structure; very hard when dry, friable when moist; many fine pores; few wormcasts; noncalcareous; gradual boundary.

B_{22} 14 to 26 inches, reddish-brown (5YR 5/4; 4/4, moist) sandy clay loam; weak, coarse, prismatic structure; hard when dry, friable when moist; few, fine pores and wormcasts; noncalcareous; gradual boundary.

B_3 26 to 30 inches, yellowish-red (5YR 5/6; 4/6, moist) sandy clay loam; weak, coarse, prismatic structure; hard when dry, friable when moist; few, fine pores and wormcasts; weakly calcareous; abrupt boundary.

D_r 30 inches +, indurated platy caliche.

In most areas, the texture of the surface soil is fine sandy loam, but in some it is loam. Color ranges from reddish brown to brown, hue 5YR to 7.5YR.

The B_{21} horizon is slightly heavier in texture than the B_{22}. The thickness of the B_{21} horizon ranges from 6 to 10 inches. The structure ranges from moderate, coarse, prismatic to compound, weak, prismatic and subangular blocky. In most areas the color is reddish brown, hue 5YR.

The structure of the B_{22} horizon is slightly weaker than the B_{21}. The thickness ranges from 6 to 12 inches. The color ranges from reddish brown to yellowish red, hue 2.5YR to 5YR, value 4 to 5, and chroma 3 to 6.

The B_3 horizon ranges in thickness from 3 to 5 inches. In places it is noncalcareous. The color ranges from red to yellowish red, hue 2.5YR to 5YR, value 4 to 5, and chroma 6 to 8.

The depth to the indurated caliche ranges from 20 to 36 inches. The caliche rock is platy, and the fragments range from 10 to 20 inches in diameter and are 1 to 3 inches thick. The flat fragments of hard caliche overlap from 20 to 50 percent. They form a bed 6 to 30 inches thick that is underlain by softer caliche.

Included with this soil, as mapped, are small areas of Amarillo and Portales fine sandy loams and Arvana fine sandy loam, shallow. Also included are small areas that have moderately severe wind erosion.

This soil is productive but has a somewhat limited water-holding capacity because of the depth to indurated caliche. The hazard of wind erosion is moderate. Irrigated soils respond well to the proper use of fertilizers. (Capability unit IIIe-2 (dryland farming); capability unit IIe-2 (irrigation); Mixed Land range site.)

Arvana fine sandy loam, 1 to 3 percent slopes (AvB).—This soil is associated with Arvana fine sandy loam, 0 to 1 percent slopes. It is similar to the associated soil but usually occurs in smaller and more sloping areas. The hazards of wind and water erosion are moderate. (Capability unit IIIe-1 (dryland farming or irrigation); Mixed Land range site.)

Arvana fine sandy loam, shallow, 1 to 3 percent slopes (AxB).—This soil is 10 to 20 inches deep over indurated caliche. Most areas occur west of Bull and Illusion Lakes.

Profile of Arvana fine sandy loam, shallow, 1 to 3 percent slopes (about 13 miles west and 3 miles south of Littlefield):

A_1 0 to 5 inches, brown (7.5YR 5/4; 4/4, moist) fine sandy loam; weak, granular structure; slightly hard when dry, very friable when moist; noncalcareous; clear boundary.

B_2 5 to 18 inches, reddish-brown (5YR 4/4; 3/4, moist) sandy clay loam; moderate, coarse, prismatic structure; hard when dry, friable when moist; common fine pores and wormcasts; noncalcareous; abrupt boundary.

D_r 18 inches +, indurated platy caliche.

The surface layer is usually fine sandy loam but is loam in some places. The color and structure of this soil are fairly uniform. A thin B_3 horizon occurs in places. Rock outcrops occur locally.

The shallowness of this soil restricts its water-holding capacity. This is the main problem on cultivated areas. Irrigation is more costly because of the need for smaller and more frequent waterings. The hazard of wind erosion is moderate. (Capability unit IVe–5 (dryland farming); capability unit IIIe–5 (irrigation); Mixed Land range site.)

Arvana fine sandy loam, shallow, 0 to 1 percent slopes (AxA).—This soil is very similar to Arvana fine sandy loam, shallow, 1 to 3 percent slopes, but is less sloping. It is easier to irrigate; otherwise, its management is the same. (Capability unit IVe–5 (dryland farming); capability unit IIIe–5 (irrigation); Mixed Land range site.)

Berthoud Series

The Berthoud series consists of brown to grayish-brown, deep, calcareous soils. These soils have developed from material that washed from higher lying soils. They make up alluvial fans and foot slopes along the draws and escarpments.

These soils are in long, narrow areas that follow the slope contours of the draws throughout the county, or escarpments west of Bull and Illusion Lakes. Associated soils are the Mansker soils, which are less deep; the Spur soils, which are darker; and the Potter soils, which are very shallow.

Berthoud loam, 3 to 5 percent slopes (BhC).—This soil has 10 to 24 inches of loam surface layer over 10 to 30 inches of clay loam subsoil. It is moderately permeable.

Most of this soil occurs west of Bull and Illusion Lakes. The buried material below this soil appears to be Cretaceous in origin. Marine fossils and round, smooth pieces of gravel, less than 4 inches in diameter, are common.

Profile of Berthoud loam, 3 to 5 percent slopes (6 miles west and 3 miles south of Littlefield, and west of Illusion Lake):

A_{11} 0 to 3 inches, grayish-brown (10YR 5/2; 4/2, moist) loam; weak, fine, subangular blocky structure; slightly hard when dry, very friable when moist; fine pores and wormcasts common; gravel and marine fossils less than 4 inches in diameter also common; weakly calcareous; gradual boundary.

A_{12} 3 to 12 inches, grayish-brown (10YR 5/2; 4/2, moist) loam; weak, medium to fine, subangular blocky structure; hard when dry, friable when moist; common, fine pores and wormcasts; gravel and marine fossils less than 4 inches in diameter are common; strongly calcareous; gradual boundary.

AC 12 to 28 inches, pale-brown (10YR 6/3, 5/3, moist) clay loam; weak, fine, subangular blocky structure; very hard when dry, friable when moist; pores, wormcasts, gravel, and fossils as in layer above; very strongly calcareous; clear boundary.

C 28 to 40 inches, very pale brown (10YR 7/3; 6/3, moist) clay loam; very strongly calcareous; clear boundary.

D 40 to 72 inches +, pale-olive (5Y 6/3; 5/3, moist) clay; extremely hard when dry, firm when moist; very thinly stratified horizon that ranges in color from olive (5Y 4/4) to pale yellow (5Y 8/4); many gypsum crystals are below 60 inches; very strongly calcareous.

In most areas the texture of the surface soil is loam, but in some it is sandy clay loam. The color of the surface soil ranges from light brown to brown, hue 7.5YR to 10YR, value 4 to 6, and chroma 2 to 4. The structure is weak, granular, or subangular blocky. The thickness of the surface soil ranges from 10 to 15 inches.

The texture of the AC and C horizons is usually clay loam. The color ranges from light brownish gray to very pale brown, hue 10YR, value 6 to 8, and chroma 2 to 4. The thickness of the AC horizon ranges from 12 to 30 inches.

Fossils and water-transported gravel are common in this soil west of the large saline lakes. They do not occur in the soils along the draws.

The D horizon is usually clay and ranges in color from yellow to olive, hue 2.5Y to 5Y, value 4 to 8, and chroma 2 to 6.

Included with this soil, as mapped, are small areas of Mansker loam. Also included are small areas that are not calcareous in the upper 12 inches.

Most of this soil is used as rangeland. The hazard of water erosion is high. Under cultivation, intensive practices are needed to protect the soil. (Capability unit IVe–2 (dryland farming or irrigation); Deep Hardland range site.)

Berthoud loam, 1 to 3 percent slopes (BhB).—This soil is very similar to Berthoud loam, 3 to 5 percent slopes, but it is less sloping.

All of this soil is now in rangeland. The hazard of wind and water erosion is slight to moderate. (Capability unit IIIe–3 (dryland farming or irrigation); Deep Hardland range site.)

Berthoud fine sandy loam, 5 to 8 percent slopes (BeD).—This soil has 6 to 10 inches of fine sandy loam surface soil over 20 to 40 inches of sandy clay loam subsoil. It is deep and porous.

Most of this soil occurs along the draws. In places it has gullies up to 6 feet deep.

Profile of Berthoud fine sandy loam, 5 to 8 percent slopes (8.5 miles north and 0.5 mile east of Littlefield):

A_{1p} 0 to 6 inches, brown (7.5YR 5/4; 4/4, moist) fine sandy loam; weak, granular structure; soft when dry, very friable when moist; weakly calcareous; abrupt boundary.

A_{12} 6 to 12 inches, brown (10YR 5/3; 4/3, moist), heavy fine sandy loam; weak, coarse, prismatic, and medium to fine, subangular blocky structure; hard when dry, friable when moist; common, fine pores and wormcasts; many fine, hard concretions of calcium carbonate; weakly calcareous; clear boundary.

AC 12 to 32 inches, pale-brown (10YR 6/3; 5/3, moist) sandy clay loam; weak, fine, subangular blocky structure; hard when dry, friable when moist; few, hard, fine concretions of calcium carbonate; strongly calcareous; clear boundary.

C 32 to 52 inches +, pale-brown (10YR 6/3; 5/3, moist) sandy clay loam; very strongly calcareous.

This soil is porous and usually has many wormholes. The structure is weak and ranges from prismatic to subangular blocky or granular. Small concretions may occur throughout the profile.

In most areas the texture of the surface soil is fine sandy loam, but in some small areas it is loam and sandy clay loam.

The color of the surface soil ranges from brown to grayish brown, hue 7.5YR to 10YR, value 4 to 6, and chroma 2 to 4. The thickness of the surface soil ranges from 6 to 14 inches.

The texture of the subsoil is usually sandy clay loam. The color of the AC horizon varies slightly from pale brown, hue 10YR, value 6 to 7, and chroma 2 to 4. The thickness of the AC horizon ranges from 16 to 36 inches.

The characteristics of the C horizon are about the same as those of the AC horizon, except that the color may be slightly higher in value.

Included with this soil, as mapped, are small areas of Mansker fine sandy loam. Also included are small areas that have moderately severe water erosion.

Because of steep slopes, this soil cannot be cultivated. The hazard of water erosion is high; that of wind erosion is moderate. (Capability unit VIe–3; Mixed Land range site.)

Berthoud fine sandy loam, 3 to 5 percent slopes (BeC).—This soil has a profile very similar to that of Berthoud fine sandy loam, 5 to 8 percent slopes. The size of the areas is usually larger.

The soil is highly susceptible to water erosion. The hazard of wind erosion is moderate. Intensive farming practices are needed to protect this soil. (Capability unit IVe–3 (dryland farming or irrigation); Mixed Land range site.)

Berthoud fine sandy loam, 1 to 3 percent slopes (BeB).—The profile of this soil is very similar to that of Berthoud fine sandy loam, 5 to 8 percent slopes, but the areas are much less sloping. Wind and water erosion are moderate hazards. (Capability unit IIIe–1 (dryland farming or irrigation); Mixed Land range site.)

Brownfield Series

Soils of the Brownfield series have a brown, loose, fine sand surface layer, 14 to 30 inches thick, over 2 to 4 feet of red sandy clay loam subsoil. The parent materials are sandy and were apparently wind deposited.

These soils occur in large, gently undulating areas. They are mostly in the Sand Hills. Associated soils are the Springer soils, which are sandier in the subsoil; the Amarillo soils, which are less sandy and darker; and the Tivoli soils, which are sand dunes.

Brownfield fine sand, thick surface (Br).—Profile of Brownfield fine sand, thick surface (4 miles south and 3 miles west of Springlake):

A_{11} 0 to 6 inches, brown (7.5YR 4/4; 3/4, moist) fine sand; single grain; loose when dry or moist; noncalcareous; gradual boundary.

A_{12} 6 to 28 inches, light-brown (7.5YR 6/4; 5/4, moist) fine sand; single grain; loose when dry or moist; noncalcareous; clear boundary.

B_2 28 to 55 inches, red (2.5YR 4/6; 3/6, moist) sandy clay loam; moderate, course, prismatic and weak, subangular blocky structure; very hard when dry, firm when moist; few, very fine to fine pores; distinct clay films; noncalcareous; gradual boundary.

B_3 55 to 64 inches, yellowish-red (5YR 5/8; 4/8, moist) sandy clay loam; structure similar but weaker than in B_2 horizon; very hard when dry, friable when moist; few, fine to very fine pores; noncalcareous; gradual boundary.

C 64 to 72 inches +, yellowish-red (5YR 5/6; 4/6, moist), light sandy clay loam; few, medium, soft accumulations of calcium carbonate in 64- to 66-inch layer that may be a weak C_{ca} horizon.

The color of the surface soil ranges from reddish yellow to light brown or brown, hue 5YR to 7.5YR.

The texture of the B_2 horizon is usually a sandy clay loam. The structure ranges from moderate, coarse, prismatic to subangular blocky. The color ranges from red to reddish brown, hue 2.5YR to 5YR, value 4 to 5, and chroma 3 to 6.

The texture of the B_3 horizon ranges from sandy clay loam to fine sandy loam. The structure ranges from weak, prismatic to subangular blocky. The color ranges from yellowish red to reddish yellow, hue 5YR.

The texture of the C horizon ranges from sandy clay loam to loamy fine sand. The color is usually yellowish red.

In places a C_{ca} horizon occurs at 60 inches or more.

Included with this soil are small areas of Tivoli, Amarillo, and Springer soils.

This soil is well suited to range. It produces good vegetation during dry periods and is moderately productive. The hazard of wind erosion is high. Close-spaced crops that produce much residue can be grown under irrigation. (Capability unit VIe–2 (without irrigation); capability unit IVe–7 (irrigation); Sandy Land range site.)

Church Series

The Church series consists of slowly drained, gray, calcareous soils. The parent materials are grayish, strongly calcareous clays that apparently were formed by weathering under very wet conditions. Remains of small snail shells are generally abundant.

These soils occur in association with the saline lakes. Associated soils are the Arch soils, which have a less clayey subsoil and are less dark; the Portales soils, which are deeper and less clayey; and the Berthoud soils, which are browner and deeper.

Most areas of these soils receive runoff from adjacent slopes. Surface drainage is fairly poor. In some areas these soils are slightly saline.

Church clay loam (Ch).—Profile of Church clay loam (7 miles west and 1 mile south of Earth):

A_{1p} 0 to 5 inches, dark, grayish-brown (2.5Y 4/2; 3/2, moist) clay loam; structureless; hard when dry, firm when moist; strongly calcareous; abrupt boundary.

A_{12} 5 to 8 inches, grayish-brown (10YR 5/2; 5/2, moist) clay loam; moderate, medium to fine, subangular blocky structure; hard when dry, firm when moist; many fine pores; strongly calcareous; clear boundary.

AC 8 to 15 inches, grayish-brown (10YR 5/2; 5/2, moist) clay; moderate, medium, blocky structure; very hard when dry, very firm when moist; few, fine pores; strongly calcareous; clear boundary.

C_{ca} 15 to 24 inches, light-gray (10YR 7/2; 7/2, moist) clay; moderate, fine, subangular blocky structure; very hard when dry, very firm when moist; contains remains of small snail shells; very strongly calcareous; gradual boundary.

C 24 to 48 inches +, light-gray (10YR 7/1; 7/1, moist) clay; very hard when dry, very firm when moist; contains remains of small snail shells; very strongly calcareous.

In most areas the texture of the surface soil is clay loam, but in some it is clay. The color of the surface soil ranges from gray to very dark brown, hue 10YR to 2.5Y.

The color of the subsoil ranges from light brownish-gray to white, hue 10YR to 2.5Y. The structure ranges from very fine, subangular blocky to medium, blocky.

Salinity ranges from none to strong. This soil usually contains snail shells. Gypsum crystals occur below 6 feet in places. In some places the water table is within 2 feet of the surface.

Included with this soil, as mapped, are small areas with slopes of 1 to 1½ percent.

This soil is poorly suited to cultivation. It is very droughty under dryland farming. Frequent yellowing of sorghum plants indicates a high content of lime that makes some of the plant food unavailable, even under irrigation.

This soil is better suited to range. The present vegetation includes blue grama, alkali sacaton, and inland saltgrass. (Capability unit IVe-1 (dryland farming); capability unit IIIe-6 (irrigation); High Lime range site.)

Drake Series

The Drake series consists of gray, strongly calcareous, fine sandy loams and loams. These soils have developed in low dunes to the leeward (east and southeast) of playas, ancient watercourses, and saline lakes. The dunes have formed from wind-deposited material that has blown from saline lakes and playas, or from areas of Arch and Church soils. When these dunes were forming, the prevailing winds were from the west and northwest.

Drake soils occur in all parts of the county in crescents or oblong areas. Most areas range from 10 to 40 acres in size; those to the east of Bull and Illusion Lakes, however, cover several hundred acres.

Associated soils are the Portales soils, which are deeper and darker; the Zita soils, which are darker and noncalcareous; and the Church and Arch soils, which were developed in depressions.

Drake soils, 5 to 20 percent slopes (DrE).—Most of these soils are to the leeward of the saline lakes or larger playa basins. The dunes are usually more than 50 feet thick and more than a mile in length.

Profile of Drake soils, 5 to 20 percent slopes (5.5 miles west and 5 miles south of Littlefield):

A_1 0 to 5 inches, light brownish-gray (2.5Y 6/2; 5/2, moist) loam; weak, granular structure; soft when dry, very friable when moist; fine pores are common; very strongly calcareous; clear boundary.

AC 5 to 24 inches, light brownish-gray (2.5Y 6/2; 5/2, moist) loam; weak, granular structure; slightly hard when dry, friable when moist; fine pores and fine, white, soft masses of calcium carbonate are common; very strongly calcareous; clear boundary.

C 24 to 48 inches +, light brownish-gray (2.5Y 6/2; 6/2, moist) loam; very strongly calcareous; contains particles of snail shells.

Some areas of Drake soils are of loam texture; others are fine sandy loam. The structure is weak throughout the profile. The color ranges from grayish brown to white, hue 10YR to 2.5Y, value 5 to 8, and chroma 1 and 2.

Areas with slopes of more than 20 percent are included.

Steep slopes and the high risk of wind and water erosion make these soils unsuitable for cultivation. Proper range management is needed to prevent erosion. (Capability unit VIe-5; High Lime range site.)

Drake soils, 1 to 3 percent slopes (DrB).—These soils have a profile very similar to that of Drake soils, 5 to 20 percent slopes, but the A_1 horizon is slightly darker and thicker. The soil areas are generally less than 20 acres in size.

These soils are highly susceptible to wind erosion. The hazard of water erosion is moderate. The high content of lime makes some of the plant food unavailable, as is shown by the yellowing of sorghum. (Capability unit IVe-1 (dryland farming); capability unit IIIe-6 (irrigation) High Lime range site.)

Drake soils, 3 to 5 percent slopes (DrC).—These soils have a profile very similar to that of Drake soils, 5 to 20 percent slopes. Areas are less than 50 acres in size. The dunes are less than 50 feet thick.

These soils are highly susceptible to wind and water erosion. They are better suited to range than to cultivation, but under irrigation, a close-spaced crop that produces much residue can be grown. (Capability unit VIe-1 (without irrigation); capability unit IVe-6 (irrigation); High Lime range site.)

Kimbrough Series

The Kimbrough series consists of very shallow, neutral to calcareous soils that have developed over thick beds of stonelike caliche. These soils have 2 to 10 inches of brown fine sandy loam over the caliche. They occur mostly west of Bull and Illusion Lakes.

Kimbrough soils have slopes of less than 5 percent. Rock outcrops occur on slopes greater than 2 percent. However, in local areas rock outcrops occur on slopes of less than 2 percent.

Kimbrough soils are associated with the Arvana soils, which are deeper and redder, and the Potter soils, which are underlain by soft caliche.

Most of the acreage of Kimbrough soils is rangeland.

Kimbrough soils (Km).—Profile of Kimbrough soils (11.9 miles west and 3 miles south of Littlefield):

A_1 0 to 4 inches, brown (7.5YR 5/4; 4/4, moist) fine sandy loam; weak, granular structure; slightly hard when dry, very friable when moist; noncalcareous; abrupt boundary.

D_r 4 inches +, indurated, platelike caliche; the plates overlap 20 to 40 percent and have a 1- to 5-millimeter coating of soft, white calcium carbonate that is pisolitic underneath.

In most areas the texture of the surface soil is fine sandy loam, but in some it is loam and sandy clay loam. Depth ranges from 2 to 10 inches. This soil is calcareous in places. The range in color is 7.5YR to 10YR in hue, 4 to 5 in value, and 2 to 4 in chroma.

Included are small areas of Arvana, Mansker, and Potter soils.

Because of the very shallow depth, this soil is not suited to cultivation. (Capability unit VIIs-1; Shallow Land range site.)

Lea Series

The Lea series consists of dark, grayish-brown, fine-textured soils that have a compact clay loam subsoil. These soils have developed on thick beds of stonelike caliche.

Only one Lea soil is in Lamb County. This level soil has a dark, grayish-brown clay loam surface soil, 4 to 6 inches thick. The subsoil is a dark-brown clay loam, 12 to 20 inches thick, underlain by hard, platy caliche.

The Lea soils are associated with the Kimbrough soils, which are shallower; the Mansker soils, which are shallower and calcareous; the Portales soils, which are grayer and calcareous; and the Zita soils, which are less clayey and have no indurated caliche.

Lea clay loam (Le).—Profile of Lea clay loam (6 miles west of Earth, near the intersection of U.S. Highway 70 and Farm Road 303):

A_{1p} 0 to 4 inches, dark grayish-brown (10YR 4/2; 3/2, moist) clay loam; moderate, medium, subangular blocky structure; very hard when dry, firm when moist; few, very fine pores; noncalcareous; abrupt boundary.

A_{12} 4 to 17 inches, very dark grayish-brown (10YR 3/2; 2/2, moist) clay loam; moderate, fine, blocky structure; extremely hard when dry, very firm when moist; few, very fine pores; noncalcareous; clear boundary.

AC 17 to 24 inches, dark-brown (10YR 3/3; 2/3, moist) clay loam; moderate, fine, blocky structure; very hard when dry, firm when moist; few, fine pores; strongly calcareous; abrupt boundary.

D_r 24 inches, indurated caliche.

The texture of the surface soil is usually clay loam. The structure of the subsoil ranges from moderate, medium, subangular blocky to strong, fine, blocky. The depth to caliche ranges from 18 to 30 inches.

This soil is productive under irrigation. The hazards of wind and water erosion are slight. The application of nitrogen and phosphate to irrigated crops gives good results. (Capability unit IIIce-1 (dryland farming); capability unit IIe-1 (irrigation); Deep Hardland range site.)

Likes Series

The soils of the Likes series are light-colored, sandy, and deep. They consist of 6 or more feet of yellowish-brown to grayish-brown loamy fine sands. They are billowy or undulating.

The Likes soils are associated with the Portales soils, which are less sandy; the Zita soils, which are darker and noncalcareous; and the Amarillo soils, which are redder and more clayey.

Likes soils are highly susceptible to wind erosion.

Likes loamy fine sand, undulating (Lk).—Profile of Likes loamy fine sand, undulating (3 miles north and 1.5 miles east of Littlefield):

A_p 0 to 8 inches, yellowish-brown (10YR 5/4; 4/4, moist) loamy fine sand; single grain; loose when dry or moist; weakly calcareous; abrupt boundary.

AC 8 to 14 inches, brown (10YR 5/3; 4/3, moist), light fine sandy loam; weak, very coarse, prismatic and granular structure; soft when dry, very friable when moist; weakly calcareous; clear boundary.

C 14 to 60 inches +, yellowish-brown (10YR 5/4; 4/4, moist) loamy fine sand; single grain; soft when dry, loose when moist; weakly calcareous.

In most areas the texture of the surface soil is loamy fine sand, but in some it is fine sand. In places the thin horizon of fine sandy loam is missing. The color ranges from yellowish brown to grayish brown, hue 10YR, value 5 to 7, and chroma 2 to 4. Structure ranges from single grain to weak, very coarse, prismatic. In places the upper 30 inches is noncalcareous. The lower horizons are strongly calcareous in most places.

This soil is best suited to range. The risk of wind erosion is high, and the soil has a low capacity to hold plant nutrients. Under irrigation the soil should be used for close-spaced crops that produce much residue. (Capability unit VIe-2 (without irrigation); capability unit IVe-7 (irrigation); Sandy Land range site.)

Lofton Series

The Lofton series consists of deep, compact, dark-gray, or grayish-brown soils developed in fine-textured, calcareous material. These soils consist of 4 to 18 inches of dark-gray clay loam over 30 to 40 inches of dark-gray to black, compact clay.

Lofton soils occur in the northeastern part of the county in association with Randall clay. Randall clay is grayer and occupies the lake floors. Lofton soils occur on the first benches southeast of the lakebeds. These benches are slightly higher than the lakebeds, but they may be flooded for short periods.

Areas of Lofton soils usually cover less than 25 acres but range from 5 to 50 acres in size. Slope is generally less than 1 percent. In most areas Lofton soils receive runoff from slopes above, and surface drainage is fairly poor.

Lofton soils are used mainly as irrigated cropland.

Lofton clay loam (Lo).—Profile of Lofton clay loam (1 mile east and 0.5 mile south of Olton):

A_1 0 to 5 inches, very dark gray (10YR 3/1; 2/1, moist) clay loam; weak, subangular blocky structure; hard when dry, friable when moist; sticky and slightly plastic when wet; few very fine pores; noncalcareous; clear boundary.

B_2 5 to 22 inches, very dark gray (10YR 3/1; 2/1, moist) clay; strong, fine, blocky structure; extremely hard when dry, firm when moist; sticky and plastic when wet; peds have a few, very fine pores and distinct, continuous, clay films; peds overlap 25 to 50 percent; noncalcareous; gradual boundary.

B_3 22 to 40 inches, dark-gray (10YR 4/1; 3/1, moist) clay; moderate, medium, blocky structure; extremely hard when dry, firm when moist; sticky and plastic when wet; continuous clay films on peds; weakly calcareous; gradual boundary.

C_{ca} 40 to 54 inches, gray (10YR 5/1; 4/1, moist) clay; very hard when dry, friable when moist; sticky and plastic when wet; few, faint, light-gray mottles; soft masses of calcium carbonate; strongly calcareous.

In most areas the texture of the surface soil is clay loam, but in some it is clay and silty clay loam. The dry color of the surface soil ranges from dark grayish brown (10YR 4/2) to very dark gray (10YR 3/1). The thickness of the A_1 horizon ranges from 4 to 18 inches. The color of the B_2 horizon ranges from very dark grayish brown (10YR 3/2) to black (10YR 2/1). The structure of the B_2 horizon ranges from moderate to strong, fine subangular blocky to strong, medium, blocky. The thickness of the B_2 horizon ranges from 10 to 30 inches.

The dry color of the B_3 horizon ranges from brown (10YR 5/3) to gray (10YR 5/1). The thickness ranges from 10 to 40 inches. In places the B_3 horizon is not calcareous. The structure of the B_3 horizon ranges from moderate, coarse, subangular blocky to strong, medium, blocky. The C_{ca} horizon ranges from silty clay loam to clay in texture and from gray (10YR 5/1) to pale brown (10YR 6/3) in color.

Included with this soil, as mapped, are small areas that have slopes of 1 to 1½ percent.

This soil is very productive under irrigation. The hazard of wind and water erosion is slight. Irrigated crops respond well to applications of nitrogen and phosphate. (Capability unit IIIce-1 (dryland farming); capability unit IIe-1 (irrigation); Deep Hardland range site.)

Lubbock Series

The soils of the Lubbock series occupy slight depressions and have a moderately sandy surface soil over a compact subsoil. The surface soil is fine sandy loam, about 8 to 15 inches thick. It overlies 12 to 24 inches of compact, brown to grayish-brown clay.

Lubbock fine sandy loam is the only soil of this series in Lamb County. The depressed areas in which these soils occur are 5 to 30 acres in size and are nearly level.

Associated soils are the Amarillo soils, which are redder and less clayey; the Zita soils, which are more porous; and the Randall soils, which occupy the playa floor.

Lubbock fine sandy loam (Lu).—Profile of Lubbock fine sandy loam (4.2 miles north and 1.8 miles west of Littlefield):

A_{1p} 0 to 4 inches, brown (7.5YR 5/4; 4/4, moist) fine sandy loam; structureless; slightly hard when dry, friable when moist; noncalcarous; abrupt boundary.

A_{12} 4 to 10 inches, dark-brown (7.5YR 4/2; 3/2, moist) fine sandy loam; moderate, coarse prismatic structure; hard when dry, friable when moist; fine pores and wormcasts are common; noncalcareous; gradual boundary.

B_1 10 to 17 inches, dark-brown (7.5YR 4/2; 3/2, moist) clay loam; compound, moderate, medium, prismatic, and subangular blocky structure; hard when dry, friable when moist; few to common, fine pores and wormcasts that decrease with depth; noncalcareous; gradual boundary.

B_2 17 to 25 inches, brown (7.5YR 5/2; 4/2, moist), light clay; moderate, medium to fine, blocky structure; extremely hard when dry, firm when moist; few pores; distinct clay films; noncalcareous; clear boundary.

B_3 25 to 32 inches, light-gray (10YR 7/2; 4/2, moist), light clay; moderate, fine, blocky structure; few, fine, soft masses of calcium carbonate that increase with depth; strongly calcareous; gradual boundary.

C_{ca} 32 to 42 inches +, pink (7.5YR 7/4; 6/4, moist) clay loam; 50 percent of the volume is soft and hard concretions of calcium carbonate; very strongly calcareous.

In areas associated with an Amarillo soil, the color of the A_{1p} and A_{12} horizons ranges from reddish brown to brown, hue 5YR to 7.5YR, value 4 to 5, and chroma 2 to 4. In areas associated with a Zita soil, the color of the A_{1p} and A_{12} horizons ranges from brown to grayish brown, hue 7.5YR to 10YR, value 4 to 5, and chroma 2 to 4.

The texture of the B_1 horizon ranges from sandy clay loam to clay loam. The structure ranges from prismatic to subangular blocky. The color range in the B_1 horizon is the same as that of the A horizon. As in that horizon, it varies according to the associated soils.

The texture of the B_2 horizon ranges from heavy clay loam to clay. The color ranges from brown to dark grayish brown, hue 7.5YR to 10YR, value 3 to 5, and chroma 2 to 4. The thickness ranges from 6 to 12 inches. The depth to the B_2 horizon ranges from 15 to 24 inches.

The texture of the B_3 horizon ranges from clay loam to light clay. The color ranges from brown to light gray, hue 7.5YR to 10YR, value 5 to 7, and chroma 2 to 4.

The C_{ca} horizon is usually pink or pinkish-white in color and clay loam or silty clay loam in texture.

Where Lubbock fine sandy loam is associated with Randall soils, small areas with slopes of 1 to 1½ percent are included in places.

This soil is productive, but it is moderately susceptible to wind erosion. Because of its slightly depressed position, it receives some runoff from surrounding soils that helps to increase yields on dryland.

This soil is rated as slowly permeable because of the compact layer 15 to 24 inches below the surface soil. The material above the compact layer, however, acts more like a moderately permeable material. (Capability unit IIIe–2 (dryland farming); capability unit IIe–2 (irrigation); Mixed Land range site.)

Mansker Series

The Mansker series consists of shallow, grayish-brown to brown, calcareous soils. Caliche occurs at depths of 10 to 20 inches.

These soils occur on slopes above playas with Portales soils, which are deeper, and with Amarillo soils, which are redder and noncalcareous. They also occur along the slopes of draws with Berthoud soils, which are deeper, and with Potter soils, which are shallower.

Mansker loam, 1 to 3 percent slopes (MkB).—This soil has 10 to 20 inches of brown or grayish-brown calcareous loam over pink caliche. Most of this soil is in the northern part of the county.

Profile of Mansker loam, 1 to 3 percent slopes (about 1 mile north and 1 mile east of Springlake):

A_p 0 to 10 inches, brown (10YR 5/3; 4/3, moist) loam; weak, subangular blocky structure; hard when dry, friable when moist; common, medium and fine, hard concretions of calcium carbonate; many fine pores and wormcasts; strongly calcareous; abrupt boundary.

AC 10 to 18 inches, pale-brown (10YR 6/3; 5/3, moist) clay loam; weak, subangular blocky and granular structure; hard when dry, firm when moist; concretions, pores, and wormcasts same as in layer above; strongly calcareous; clear boundary.

C_{ca} 18 to 42 inches, pink (7.5YR 7/4; 6/4, moist) clay loam; many soft and hard, medium to fine concretions of calcium carbonate; very strongly calcareous; diffuse boundary.

C 42 to 60 inches +, reddish-yellow (7.5YR 7/6; 6/6, moist), very strongly calcareous clay loam.

In most areas the texture of the surface layer is loam, but in some it is clay loam and sandy clay loam. The thickness ranges from 4 to 10 inches. The color ranges from brown to grayish brown, hue 7.5YR to 10YR.

The structure of the AC horizon is usually weak granular and subangular blocky. The thickness ranges from 6 to 12 inches. The range in color is about the same as that of the surface layer.

The C_{ca} horizon ranges from 6 to 24 inches in thickness. The color ranges from pale brown to white but is generally pink, hue 7.5YR to 10YR. In a few places this horizon is weakly to strongly indurated.

The C horizon has about the same color range as the C_{ca} horizon but contains less calcium carbonate.

This soil is porous and generally has many wormholes. Concretions of calcium carbonate are common.

Included with this soil, as mapped, are small areas of Portales and Potter soils.

This soil tends to be droughty under dryland farming. The lime content increases the hazard of wind erosion. The shallow depth restricts the moisture-holding capacity and root development. (Capability unit IVe–5 (dryland farming); capability unit IIIe–5 (irrigation); Shallow Land range site.)

Mansker loam, 0 to 1 percent slopes (MkA).—This soil is very similar to Mansker loam, 1 to 3 percent slopes, but it is less sloping. Areas are small. (Capability unit IVe–5 (dryland farming); capability unit IIIe–5 (irrigation); Shallow Land range site.)

Mansker loam, 3 to 5 percent slopes (MkC).—This soil is very similar to Mansker loam, 1 to 3 percent slopes. However, it is more sloping, its solum is usually 2 to 4 inches thinner, and the C_{ca} horizon is less distinct. Most of it occurs along the slopes of draws.

Included with this soil, as mapped, are small areas of Berthoud and Potter soils. (Capability unit VIe–1 (without irrigation); capability unit IVe–6 (irrigation); Shallow Land range site.)

Mansker loam, 5 to 8 percent slopes (MkD).—This soil is very similar to Mansker loam, 3 to 5 percent slopes, but it is much more sloping. This soil occurs in long, narrow areas along draws. (Capability unit VIe–3; Shallow Land range site.)

Mansker fine sandy loam, 0 to 1 percent slopes (MfA).—This soil consists of 4 to 10 inches of fine sandy loam surface soil and 6 to 12 inches of brown to grayish-brown sandy clay loam subsoil over white or pink caliche. Most of this soil is in the southern part of the county.

Profile of Mansker fine sandy loam, 0 to 1 percent slopes (about 2 miles north and 1 mile west of Spade):

A_p 0 to 8 inches, brown (7.5YR 5/4; 4/4, moist) fine sandy loam; weak, granular structure; slightly hard when dry, very friable when moist; few, hard, medium to fine concretions of calcium carbonate; strongly calcareous; abrupt boundary.

AC 8 to 18 inches, pale-brown (10YR 6/3; 5/3, moist) sandy clay loam; weak, coarse, prismatic, and granular structure; hard when dry, friable when moist; many fine pores and wormcasts; concretions as in layer above; very strongly calcareous; gradual boundary.

C_{ca} 18 to 24 inches, very pale brown (10YR 8/4; 7/4, moist) sandy clay loam; hard when dry, friable when moist; many fine pores and wormcasts; 30 percent of the volume is calcium carbonate; very strongly calcareous; diffuse boundary.

C 24 to 42 inches +, white (10YR 8/2; 7/2, moist), very strongly calcareous sandy clay loam.

In most areas the texture of the surface soil is fine sandy loam, but in some small areas it is loam. The color range is the same as for Mansker loam.

Except for a sandy clay loam texture, the subsoil and parent material have about the same range in characteristics as corresponding parts of Mansker loam.

Included with this soil, as mapped, are small areas of Portales and Potter soils. Also included are small areas that show moderately severe wind erosion.

The hazard of wind erosion on this soil is moderate. The shallow depth restricts moisture-holding capacity and root development. (Capability unit IVe-5 (dryland farming); capability unit IIIe-5 (irrigation); Mixed Land range site.)

Mansker fine sandy loam, 1 to 3 percent slopes (MfB).—Except for slope, this soil is very similar to Mansker fine sandy loam, 0 to 1 percent slopes. (Capability unit IVe-5 (dryland farming); capability unit IIIe-5 (irrigation); Mixed Land range site.)

Mansker fine sandy loam, 3 to 5 percent slopes (MfC).—This soil is very similar to Mansker fine sandy loam, 0 to 1 percent slopes, except that it is much more sloping, the solum is 2 to 4 inches thinner in places, and the C_{ca} horizon is less distinct. Most of this soil occurs along the slopes of draws.

Small areas that have moderately severe water erosion are included with this soil as mapped. (Capability unit VIe-1 (without irrigation); IVe-6 (irrigation); Mixed Land range site.)

Mansker fine sandy loam, 5 to 8 percent slopes (MfD).—This soil is very similar to Mansker fine sandy loam, 3 to 5 percent slopes, but it is much more sloping. The long, narrow areas occur along the slopes of draws.

Small areas that have moderately severe water erosion are included with this soil. (Capability unit VIe-3; Mixed Land range site.)

Olton Series

The Olton series consists of reddish-brown, deep, slowly permeable soils that have developed in fine-textured, calcareous material. These soils have 6 to 12 inches of brown to reddish-brown loam surface layer and 30 to 50 inches of reddish-brown clay loam subsoil over pink caliche.

Olton soils are more extensive in the northern and eastern areas of the county. They are among the best soils for irrigation farming.

Associated soils are the Amarillo soils, which are sandier and less clayey; and the Portales soils, which are grayer and calcareous.

Olton loam, 0 to 1 percent slopes (OtA).—This soil occurs in broad, level areas.

Profile of Olton loam, 0 to 1 percent slopes (1 mile east and 3 miles north of Olton):

A_p 0 to 8 inches, brown (7.5YR 4/3; 3/3, moist) loam; weak subangular blocky and granular structure; slightly hard when dry, friable when moist; noncalcareous; abrupt boundary.

B_{21} 8 to 13 inches, reddish-brown (5YR 4/3; 3/3, moist) clay loam; moderate, fine, subangular blocky structure; hard when dry, firm when moist; distinct clay films; common, fine and medium pores; noncalcareous; clear boundary.

B_{22} 13 to 26 inches, reddish-brown (5YR 4/3; 3/3, moist), heavy clay loam; contains more clay than B_{21} horizon; moderate, fine, blocky structure; hard to very hard when dry, firm when moist; distinct clay films; common, fine pores; noncalcareous; clear boundary.

B_3 26 to 47 inches, reddish-brown (5YR 5/4; 4/4, moist) clay loam; weak, subangular blocky structure; upper part of horizon is weakly calcareous and grades to strongly calcareous in lower part; few, fine concretions of calcium carbonate in lower part; clear boundary.

C_{ca} 47 to 60 inches, pink (5YR 8/4; 6/4, moist), very strongly calcareous clay loam; volume is an estimated 40 to 50 percent calcium carbonate equivalent; diffuse boundary.

C 60 to 72 inches +, light reddish-brown (5YR 6/4; 5/4, moist), light clay loam; very strongly calcareous; few, soft masses of calcium carbonate.

In most areas the texture of the surface soil is loam, but in some areas it is clay loam and sandy clay loam. The color of the surface soil is brown in most places, but is reddish brown in some; hue 5YR to 7.5YR, value of 3 and 4, and chroma 2 to 4.

The structure of the B_{21} horizon ranges from moderate, fine, subangular blocky to blocky. The color of this horizon is usually reddish brown but is brown in places. Hue, value, and chroma are the same as for the surface soil. The thickness ranges from 4 to 10 inches.

The B_{22} horizon has about the same range in structure and color as the B_{21} horizon, but as it is a heavy clay loam, it has a higher content of clay. The thickness ranges from 8 to 18 inches.

The structure of the B_3 horizon ranges from weak subangular blocky to blocky. In places it is not calcareous. The dry color is usually reddish brown (5YR 5/4) or yellowish red (5YR 5/6 or 4/6). The thickness ranges from 10 to 30 inches.

The color of the C_{ca} horizon is usually pink but is white or reddish yellow in places. The thickness ranges from 12 to 36 inches but is usually 18 to 24 inches. It may contain as much as 60 percent soft and hard concretions of calcium carbonate. The depth to the C_{ca} horizon ranges from 30 to 60 inches.

The C horizon is usually pink or reddish-yellow calcareous clay loam, hue 5YR to 7.5YR, value 6 to 8, and chroma 4 to 6.

Included with this soil, as mapped, are small areas of Amarillo loam or Portales loam.

Under irrigation this is a very productive soil that responds well to applications of nitrogen and phosphate. The hazard of wind and water erosion is slight.

This soil has a low rate of water intake. The rate can be increased somewhat by maintaining a high content of organic matter, especially in the subsoil. Cropping systems should include such crops as alfalfa or sweetclovers to keep the amount of organic matter high. (Capability unit IIIce-1 (dryland farming); capability unit IIe-1 (irrigation); Deep Hardland range site.)

Olton loam, 1 to 2 percent slopes (OtB).—This soil is very similar to Olton loam, 0 to 1 percent slopes. Most of it occurs in the northern part of the county on slopes around playas. The areas are circular to semicircular in shape and less than 100 acres in size.

Because of the slope, water erosion is a moderate hazard. This soil needs more intensive practices to preserve it and maintain its fertility than the less sloping soils. (Capability unit IIIe–3 (dryland farming or irrigation); Deep Hardland range site.)

Portales Series

The Portales series consists of grayish-brown, moderately deep calcareous soils. These soils occur in all parts of the county, but the largest areas are in the northwestern part of the county and east of the saline lakes.

Closely related are the Zita soils, which are darker and noncalcareous; the Mansker soils, which are shallower; the Church soils, which are more clayey and limey; the Arch soils, which are less deep and more limey; and the Drake soils, which are dunes made up of materials that are very high in lime.

Associated soils are the Amarillo soils, which are redder and noncalcareous; and the Arvana soils, which are redder, are noncalcareous, and are underlain by indurated caliche.

Portales loam, 0 to 1 percent slopes (PmA).—This soil has 8 to 20 inches of loam surface soil over 10 to 20 inches of moderately permeable clay loam. A distinct C_{ca} horizon begins at depths of 26 to 40 inches.

Large areas of this soil are in the northwestern part of the county and east of the large saline lakes. Smaller areas are associated with Amarillo loam amd Olton loam. This soil also occurs around playas.

Profile of Portales loam, 0 to 1 percent slopes (9 miles west and 1 mile north of Earth):

A_{1p} 0 to 7 inches, grayish-brown (10YR 5/2; 4/2, moist) loam; weak, granular structure; slightly hard when dry, friable when moist; wormcasts and pores are common; weakly calcareous; abrupt boundary.

A_{12} 7 to 20 inches, grayish-brown (10YR 5/2; 4/2, moist) clay loam; weak, coarse, prismatic and moderate, very fine, subangular blocky structure; hard when dry, friable when moist; many fine pores and wormcasts; few very fine, hard concretions of calcium carbonate; strongly calcareous; gradual boundary.

AC 20 to 40 inches, light-brown (7.5YR 6/4; 5/4, moist) clay loam; 10 to 30 percent is light-gray or white (10YR 7/2 or 8/2) clay loam; weak, coarse, prismatic and very fine, subangular blocky structure; slightly hard when dry, friable when moist; many fine pores and wormcasts; very strongly calcareous; gradual boundary.

C_{ca} 40 to 56 inches, pale-brown (10YR 6/3; 4/3, moist), very strongly calcareous clay loam; 30 to 50 percent of the volume is calcium carbonate; diffuse boundary.

C 56 to 98 inches +, light-gray (10YR 7/2; 6/2, moist), very strongly calcareous clay loam.

In most areas the texture of the surface soil is loam, but in some it is sandy clay loam. The color of the surface soil ranges from grayish brown to brown, hue 7.5YR to 10YR.

The subsoil is clay loam in texture but otherwise has about the same range in characteristics as the surface soil.

The color of the C_{ca} and C horizons ranges from white or pink to pale brown, hue 7.5YR to 10YR. The texture of the parent material ranges from clay loam to silty clay loam.

This soil is porous and usually contains many wormholes. Small concretions of calcium carbonate occur throughout the profile in places.

Included with this soil, as mapped, are small areas of Arch and Mansker loams.

Under dryland farming, this soil tends to be droughty. The lime content increases the hazard of wind erosion. Because of this lime, deep plowing is not suitable.

When properly fertilized and irrigated, Portales loam produces good yields. (Capability unit IIIce–1 (dryland farming); capability unit IIe–1 (irrigation); Deep Hardland range site.)

Portales loam, 1 to 3 percent slopes (PmB).—This soil has a profile very similar to that of Portales loam, 0 to 1 percent slopes. Most areas are less than 50 acres in size. They are generally associated with playas.

The hazard of wind and water erosion is slight to moderate. Under dryland farming, this soil tends to be droughty. When properly fertilized and irrigated, it produces good yields. (Capability unit IIIe–3 (dryland farming or irrigation); Deep Hardland range site.)

Portales fine sandy loam, 0 to 1 percent slopes (PfA).—This soil has 6 to 15 inches of fine sandy loam surface soil over 10 to 20 inches of sandy clay loam subsoil. The subsoil has moderately rapid permeability. A distinct C_{ca} horizon occurs at depths of 24 to 40 inches. Most areas of this soil are less than 50 acres in size.

This soil is associated with Amarillo and Arvana fine sandy loams. It also occurs around playas in association with Zita fine sandy loam.

Profile of Portales fine sandy loam, 0 to 1 percent slopes (1 mile south and 0.7 mile west of Bainer):

A_{1p} 0 to 5 inches, brown (10YR 5/3; 4/3, moist) fine sandy loam; weak, granular structure; soft when dry, very friable when moist; strongly calcareous; abrupt boundary.

A_{12} 5 to 12 inches, dark-brown (10YR 4/3; 3/3, moist), heavy fine sandy loam; weak, subangular blocky and granular structure; slightly hard when dry, friable when moist; many fine to medium pores and wormcasts; strongly calcareous; gradual boundary.

AC 12 to 36 inches, pale-brown (10YR 6/3; 5/3, moist) sandy clay loam; weak, subangular blocky and granular structure; soft when dry, friable when moist; many fine pores; wormcasts are common; few, hard, fine to medium concretions of calcium carbonate that increase with depth; very strongly calcareous; gradual boundary.

C_{ca} 36 to 72 inches +, very pale brown (10YR 7/3; 6/3, moist), very strongly calcareous sandy clay loam; about 30 percent of the volume is calcium carbonate; both hard and soft concretions of calcium carbonate are less than 20 millimeters in size.

This soil is porous and usually has many wormholes. The structure is weak and ranges from prismatic to subangular blocky or granular. Small concretions occur throughout the profile in places.

In most areas the texture of the surface soil is fine sandy loam, but in some small areas it is loam or sandy clay loam. The color ranges from grayish brown to brown, hue 7.5YR to 10YR.

The texture of the subsoil is usually sandy clay loam. The color ranges from grayish brown to pale brown. The thickness ranges from 12 to 24 inches.

The color of the C_{ca} horizon ranges from white or pink to pale brown, hue 7.5YR to 10YR. The texture of the C_{ca} horizon ranges from sandy clay loam to clay loam.

Included with this soil, as mapped, are small areas of Arch and Mansker fine sandy loams. Also included are small areas that have had moderately severe wind erosion.

This soil is moderate in fertility and in moisture-holding capacity. The hazard of wind erosion is moderate. Deep plowing is not suitable because it increases the lime content of the surface layer. When properly irrigated and fertilized, this soil produces good yields. (Capability unit

IIIe–2 (dryland farming); capability unit IIe–2 (irrigation); Mixed Land range site.)

Portales fine sandy loam, 1 to 3 percent slopes (PfB).—The profile of this soil is very similar to that of Portales fine sandy loam, 0 to 1 percent slopes. The areas are smaller and more sloping. They are usually associated with playa basins.

The hazard of wind and water erosion is moderate. This soil is moderate in fertility and in moisture-holding capacity. (Capability unit IIIe–1 (dryland farming or irrigation); Mixed Land range site.)

Portales loamy fine sand, overblown (Pn).—This soil is very similar to Portales fine sandy loam, except that it is covered by a deposit of loamy fine sand. The surface layer consists mainly of accumulations of sandy material deposited by wind. These materials were blown from the sandier associated Brownfield, Amarillo, and Tivoli soils.

This soil has an 8- to 20-inch layer of pale-brown loamy fine sand over 6 to 20 inches of brown to grayish-brown sandy clay loam subsoil. Most areas of this soil are small and slightly depressed. They occur in the vicinity of the Sand Hills.

Profile of Portales loamy fine sand, overblown (3 miles north and 2 miles east of Littlefield):

A_p 0 to 16 inches, pale-brown (10YR 6/3; 5/3, moist) loamy fine sand; single grain; loose when dry or moist; weakly calcareous; abrupt boundary.

AC 16 to 26 inches, brown (10YR 5/3; 4/3, moist) sandy clay loam; weak, coarse, prismatic structure; hard when dry, friable when moist; many fine pores and wormcasts; strongly calcareous; clear boundary.

C_{ca} 26 to 44 inches, pink (7.5YR 8/4; 7/4, moist) sandy clay loam; very hard when dry, friable when moist; a few, hard, medium to fine concretions of calcium carbonate; very strongly calcareous; clear boundary.

C 44 to 60 inches +, light reddish-brown (5YR 6/4; 5/4, moist), strongly calcareous sandy clay loam.

In most areas the texture of the surface soil is loamy fine sand, but in some small areas it is fine sand. This soil is porous and has a weak structure. The structure ranges from weak, prismatic to subangular blocky, or granular. The color ranges from brown to pale brown, hue 7.5YR to 10YR.

The texture of the subsoil is usually sandy clay loam. The color ranges are the same as in the surface layer. Depth to the C_{ca} horizon ranges from 20 to 40 inches.

The color of the C_{ca} horizon ranges from white or pink to pale brown, hue 7.5YR to 10YR.

The hazard of wind erosion on this soil is high. The water-holding capacity and the capacity to hold plant nutrients are low. Deep plowing is not suitable, as it increases the lime content of the surface layer. This soil is not suitable for dryland farming. (Capability unit VIe–2 (without irrigation); capability unit IVe–7 (irrigation); Sandy Land range site.)

Potter Series

The Potter series consists of pale-brown to grayish-brown, very shallow soils. They have a 2- to 10-inch, strongly calcareous surface layer. This overlies thick beds of soft or semi-indurated caliche or highly calcareous earths that generally are more than 50 percent free lime.

Potter soils, 8 to 30 percent slopes (PsE).—These soils occur as steep slopes above the stream channels in association with Mansker soils, which are deeper, and with Berthoud soils, which are darker and much deeper. They are also common along the escarpments west of Bull and Illusion Lakes. In these areas they are associated with Kimbrough soils, which are less steep and are underlain by indurated caliche.

Most slopes range from 8 to 30 percent. Some slopes, however, range from as little as 5 percent along the draws to as much as 40 percent along the escarpments.

Profile of Potter soils, 8 to 30 percent slopes (about 6 miles north and 1.5 miles west of Olton):

A_1 0 to 5 inches, pale-brown (10YR 6/3; 5/3, moist) loam; weak, granular structure; hard when dry, friable when moist; many wormcasts; many fine pores; 20 to 30 percent hard caliche gravel, 5 to 30 millimeters in diameter; very strongly calcareous; gradual boundary.

C 5 to 30 inches +, pink (7.5YR 7/4; 6/4, moist) clay loam; a few, soft and hard concretions of calcium carbonate; very strongly calcareous.

In most areas the texture of the surface soil is loam, but in some it is clay loam. Caliche gravel is common on the surface of all Potter soils, but rocks more than a foot in diameter are numerous along the escarpments.

Small areas of Mansker soils are included.

Because of the very shallow depth and steep slopes, this soil is not suited to cultivation. (Capability unit VIIs–1; Shallow Land range site.)

Potter soils, 1 to 8 percent slopes (PsC).—These soils occupy large areas that are 200 to 500 acres in size. Associated soils are the Arch soils, which are deeper and whiter; Brownfield soils, which are darker and deeper, and Tivoli soils, which consist of dunes of fine sand. Most slopes are less than 2 percent, but some range from 0 to 8 percent.

Profile of Potter soils, 1 to 8 percent slopes (about 6.8 miles west and 2.8 miles south of Earth):

A_1 0 to 5 inches, grayish-brown (10YR 5/2; 4/2, moist) loam; weak, granular structure; soft when dry, very friable when moist; strongly calcareous; clear boundary.

C 5 to 40 inches +, white (10YR 8/2; 7/2, moist), soft, very strongly calcareous caliche that contains many medium to very coarse, soft and hard concretions.

In most areas the texture of the surface soil is loam, but in some it is sandy clay loam. Its color ranges from brown (10YR 5/3) to gray (10YR 7/2). The parent material ranges from white (10YR 8/2) to pink (7.5YR 8/4). Small gravel or rock outcrops are common.

Small areas of Arch soils are included with this soil as mapped.

Because of the very shallow depth, this soil is not suited to cultivation. (Capability unit VIIs–1; Shallow Land range site.)

Randall Series

Randall soils occur only in the intermittent lakebeds. They receive runoff from the surrounding soils and are covered by a few inches to several feet of water for long periods.

Areas of Randall soils range from 5 to 60 acres in size. They are from 3 to 50 feet below the level of the surrounding plain.

Associated soils are the Lofton, which are less clayey and are on the first benches above and to the southeast of the lakebeds; the Lubbock soils, which are less dark and less clayey; and the Zita soils, which are sandier and much less clayey.

Randall clay (Ra).—Profile of Randall clay (½ mile south of Olton):

A_{11} 0 to 10 inches, dark-gray (10YR 4/1; 3/1, moist) clay; moderate, fine, blocky, and irregular blocky structure; very hard when dry, very firm when moist, very sticky and plastic when wet; weakly calcareous; diffuse boundary.

A_{12} 10 to 23 inches, gray (10YR 5/1; 4/1, moist) clay; weak to moderate, medium and coarse, blocky structure; extremely hard when dry, very firm when moist, very sticky and plastic when wet; common, very fine, hard concretions of calcium carbonate; strongly calcareous; diffuse boundary.

AC 23 to 66 inches, grayish-brown (10YR 5/2; 4/2, moist) clay; weak, medium and coarse, blocky structure; extremely hard when dry, very firm when moist, very sticky and plastic when wet; common to many, fine and very fine, hard concretions of calcium carbonate; very strongly calcareous; gradual boundary.

C 66 to 72 inches +, grayish-brown (2.5Y; 5/2; 4/2, moist) clay; weak, medium and coarse, blocky structure; extremely hard when dry, firm when moist, very sticky and plastic when wet; less clayey than layer above; few, faint yellowish-brown (10YR 5/6, dry) mottles; very strongly calcareous.

The texture of the surface soil is usually clay, but a few inches of overwash material of other textures is common. The structure of the subsoil ranges from weak, blocky to massive. The profile ranges from neutral to very strongly calcareous. The colors of the subsoil and surface soil range from grayish brown to black, hue 10YR to 2.5Y, value 2 to 5, and chroma 1 and 2.

In some places the soil is less calcareous than the one described, and the subsoil does not contain concretions of lime.

This soil can be cultivated at times during dry years, or if water from higher areas is diverted from it. However, it is difficult to cultivate and is either too dry or too wet. (Capability unit VIw–1.)

Randall fine sandy loam (Rf).—This soil has a much sandier surface soil and usually a much sandier subsoil than Randall clay. It occupies shallow, partly filled depressions that are not as deep as those occupied by Randall clay. These areas are generally less than 20 acres in size and are surrounded by Amarillo loamy fine sand.

Profile of Randall fine sandy loam (11.5 miles north and 0.5 mile west of Littlefield):

A_{11} 0 to 18 inches, dark-brown (10YR 4/3; 3/3, moist) fine sandy loam; weak, fine, subangular blocky and granular structure; hard when dry, friable when moist; noncalcareous; gradual boundary.

A_{12} 18 to 35 inches, dark-gray (10YR 4/1; 3/1, moist) sandy clay loam; weak, medium, blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; few, fine to very fine pores; roots between ped surfaces; noncalcareous; diffuse boundary.

AC 35 to 60 inches, gray (10YR 5/1; 4/1, moist) clay; weak, medium, blocky structure; very hard when dry, firm when moist, sticky and plastic when wet; fine, faint to distinct, grayish-brown (10YR 5/2, dry) and reddish-yellow (5YR 7/7 dry) mottles are common; noncalcareous; diffuse boundary.

C 60 to 73 inches +, gray (10YR 6/1; 5/1, moist) clay; less clay than in layer above; noncalcareous.

In most areas the texture of the surface soil is fine sandy loam, but in some it is loamy fine sand and loam. Depth to the clayey substrata ranges from 14 to 30 inches. This soil is usually noncalcareous.

The color of the surface soil ranges from dark brown (10YR 4/3) to grayish brown (10YR 5/2). The color of the subsoil is about the same as that of Randall clay.

Because this soil is sandier, it is not covered by water as long as Randall clay. In addition, runoff into the playas is less because the surrounding soils are sandy. This soil is seldom completely covered by water and is normally dry within a week after heavy rains.

Unless rainfall is very high, this soil can be cultivated. Most of the acreage is used for cotton and grain sorghum. Generally, these crops produce high yields. (Capability unit IVw–1.)

Springer Series

The Springer series consists of deep, red, sandy soils. These soils are usually hummocky or undulating. They generally occur along the edge of the sandhills as long, narrow ridges or round hills or knolls.

Associated soils are the Amarillo soils, which have less sandy subsoils, and the Brownfield soils, which have a sandier surface soil and a more clayey subsoil.

Springer fine sandy loam, hummocky (Sg).—This soil occurs on low knolls and ridges that alternate with shallow valleys or nearly level areas. The knolls range from about 200 to 600 feet in diameter and from 5 to 10 feet in height. The ridges are mainly less than 300 feet wide but are 5 to 10 feet high and range in length from about 600 feet to one-half mile or more. The intervening lower areas, valleys, or level regions usually are much less extensive than the ridges and knolls. Slopes range within short distances from about 3 to 8 percent.

Profile of Springer fine sandy loam, hummocky (11 miles north and 2.7 miles east of Littlefield):

A_1 0 to 7 inches, brown (7.5YR 5/4; 4/4, moist) fine sandy loam; granular structure and single grain; slightly hard when dry, very friable when moist; noncalcareous; clear boundary.

B_2 7 to 18 inches, red (2.5YR 5/8; 4/8, moist) fine sandy loam; weak, coarse, prismatic structure; slightly hard when dry, very friable when moist; many pores; few wormcasts; noncalcareous; gradual boundary.

B_3 18 to 28 inches, reddish-yellow (5YR 6/8; 5/8, moist) fine sandy loam grading to loamy fine sand; weak, coarse, prismatic structure; soft when dry, loose when moist; noncalcareous; diffuse boundary.

C 28 to 90 inches +, yellowish-red (5YR 5/8; 4/8, moist), noncalcareous loamy fine sand.

In most areas the texture of the surface soil is fine sandy loam, but in some small areas it is loamy fine sand. The thickness of the surface soil ranges from 4 to 12 inches. The color ranges from reddish yellow to brown, hue 5YR to 7.5YR, value 5 and 6, and chroma 4 to 6.

The thickness of the B_2 horizon ranges from 6 to 20 inches. The structure and texture are usually consistent. The color ranges from red to yellowish red, hue 2.5YR to 5YR, value 4 and 5, and chroma 6 to 8.

The colors of the B_3 and C horizons have the same range as those of the B_2 horizon. The texture ranges from loamy fine sand to fine sandy loam.

A buried soil occurs below 6 feet in places. A weak C_{ca} horizon also occurs in places.

This soil is very susceptible to wind erosion. Because there is no clayey horizon, erosion cannot be controlled by deep plowing. The best way to control erosion is by keeping a vegetative cover on the soil. If the soil is cultivated, the cover should consist of continuous, close-spaced crops that produce much residue.

This soil is better suited to range than to cultivation. Because of the hummocky topography, a sprinkler irrigation system is suitable if the soil is farmed. (Capability unit IVe–3 (dryland farming or irrigation); Mixed Land range site.)

Springer fine sandy loam, undulating (Sf).—The slopes of this soil range from 1 to 3 percent. It occurs on smaller knolls and ridges than Springer loamy fine sand, hummocky. The soil profile is very similar to the hummocky Springer soil, except that a weak C_{ca} horizon occurs at depths of 48 to 60 inches in places.

This soil is highly susceptible to wind erosion. As there is no clayey horizon, erosion cannot be controlled by deep plowing. Vegetative cover is the best way to control erosion.

Because of the undulating topography, a sprinkler irrigation system is more suitable for this soil if it is cultivated. (Capability unit IIIe-1 (dryland farming or irrigation); Mixed Land range site.)

Springer loamy fine sand, hummocky (Sh).—This soil consists of 8 to 24 inches of loamy fine sand over a fine sandy loam subsoil. The slopes range from 1 to 5 percent within short distances. This soil generally occurs in long, narrow ridges on either side of the sandhills. Small, shallow basins occur between these ridges.

Profile of Springer loamy fine sand, hummocky (6 miles north of Fieldton):

A_1 0 to 16 inches, reddish-brown (5YR 5/4; 4/4, moist) loamy fine sand; single grain; loose when dry or moist; noncalcareous; clear boundary.

B_2 16 to 34 inches, red (2.5YR 4/6; 3/6, moist) fine sandy loam; weak, coarse, prismatic structure; slightly hard when dry, friable when moist; many fine pores; noncalcareous; gradual boundary.

B_3 34 to 42 inches, yellowish-red (5YR 5/6; 4/6 moist) loamy fine sand; weak, coarse, prismatic structure and single grain; soft when dry, very friable when moist; noncalcareous; diffuse boundary.

C 42 to 60 inches +, reddish-yellow (5YR 6/6; 5/6, moist), noncalcareous loamy fine sand.

In most areas the texture of the surface soil is loamy fine sand, but in some small areas it is fine sand.

The structure and texture of the B_2 horizon are fairly uniform. The range in color throughout the profile is very similar to that of Springer fine sandy loam. A weak C_{ca} horizon occurs in places. Included with this soil are small areas with more than 5 percent slope.

Because of the high hazard of wind erosion, this soil is better suited to range than to cultivation. If the soil is farmed, a sprinkler irrigation system is suitable. (Capability unit VIe-2 (without irrigation); capability unit IVe-7 (irrigation); Sandy Land range site.)

Spur Series

The Spur series consists of deep, dark, bottom-land soils. These soils occur as the first benches on either side of the stream channels. They are subject to occasional flooding. Spur soils have developed from alluvial materials washed from higher lying, adjacent soils. Most areas of these soils are less than 400 feet wide.

Associated soils are the Berthoud and Mansker soils, which occur on the slopes on either side of the draw.

Spur loam (Sr).—Profile of Spur loam (6 miles north and 1 mile east of Olton):

A_{1p} 0 to 8 inches, dark grayish-brown (10YR 4/2; 3/2, moist) loam; weak, subangular blocky structure; hard when dry, friable when moist; weakly calcareous; abrupt boundary.

A_{12} 8 to 24 inches, very dark grayish-brown (10YR 3/2; 2/2, moist) clay loam; moderate, medium to fine, subangular blocky structure; very hard when dry, firm when moist; few fine pores and wormcasts; weakly calcareous; diffuse boundary.

AC 24 to 52 inches, brown (10YR 5/3; 4/3, moist) clay loam; weak, subangular blocky structure; hard when dry, friable when moist; few, fine pores: films of calcium carbonate are common on ped surfaces; strongly calcareous; abrupt boundary.

D 52 to 72 inches +, white (10YR 8/2; 7/2, moist), very strongly calcareous sandy clay loam.

In most areas the texture of the surface soil is loam, but in some areas it is sandy clay loam. The texture of the subsoil ranges from clay loam to clay. The structure ranges from weak, granular to very fine, subangular blocky, and blocky. The depth to the substrata ranges from 36 to more than 70 inches. The stratified substrata ranges from clay to sand and has a white or grayish color. The upper 12 to 24 inches of this soil is not calcareous in places.

Although this soil is subject to occasional flooding, it is very productive. Irrigated crops respond well to additions of nitrogen and phosphate. (Capability unit IIIce-1 (dryland farming); capability unit IIe-1 (irrigation); Bottom Land range site.)

Spur fine sandy loam (Sp).—Spur fine sandy loam is generally lighter in color, coarser in texture, and less well developed than Spur loam.

Profile of Spur fine sandy loam (6 miles north and 1 mile east of Littlefield):

A_{1p} 0 to 12 inches, brown (10YR 4/3; 3/3, moist) fine sandy loam; weak, subangular blocky structure; slightly hard when dry, friable when moist; fine pores and wormcasts are common; weakly calcareous; abrupt boundary.

A_{12} 12 to 26 inches, dark grayish-brown (10YR 4/2; 3/2, moist) sandy clay loam; weak, subangular blocky structure; hard when dry, friable when moist; many fine pores and wormcasts; weakly calcareous; gradual boundary.

AC 26 to 52 inches, brown (7.5YR 5/4; 4/4, moist) clay loam; weak, subangular blocky structure; hard when dry, friable when moist; common, fine pores; strongly calcareous; gradual boundary.

C 52 to 72 inches +, light brownish-gray (10YR 6/2; 5/2, moist), very strongly calcareous clay loam.

The color of the surface soil ranges from brown (7.5YR 4/4) to very dark grayish brown (10YR 3/2). The structure of the subsoil ranges from weak, granular to moderate, medium, subangular blocky. The depth to the substratum ranges from 36 to more than 60 inches. The stratified substratum ranges from clay to sand and has a white to grayish color. Spur fine sandy loam is usually calcareous to the surface.

This soil is subject to moderate wind erosion and to occasional flooding. It has a moderate capacity to hold plant nutrients but responds well to nitrogen and phosphate under irrigation. (Capability unit IIIe-2 (dryland farming); capability unit IIe-2 (irrigation); Bottom Land range site.)

Tivoli Series

The soils of the Tivoli series are deep, loose sands. They comprise most of the sandhills, which are 2 to 6 miles wide and bisect the central part of the county from west to east. Tivoli soils occur as vegetated dunes, 6 to 75 feet high. The dunes have a rather sharp crest with a side slope of 5 to 35 percent. Slopes on the east side are usually 5 percent steeper than those on the west side.

Tivoli fine sand is the only Tivoli soil that occurs in Lamb County. Associated soils are the Brownfield soils, which have a redder, less sandy subsoil; and the Arch soils, which are grayer and less sandy. Brownfield and Arch soils occur in the more nearly level areas adjacent to the dunes.

Tivoli fine sand (Tv).—Profile of Tivoli fine sand (along Highway 303, 7 miles north of Sudan):

A_1 0 to 8 inches, pale-brown (10YR 6/3; 5/3, moist) fine sand; single grain; loose when dry or moist; noncalcareous; diffuse boundary.

C 8 to 96 inches +, yellow (10YR 7/6; 6/6, moist) fine sand; single grain; loose when dry or moist; noncalcareous.

The color of the surface soil ranges from brown (10YR 5/3) to yellow (10YR 7/6). The darker color is usually the result of organic matter staining. The color of the subsoil ranges from pale brown (10YR 6/3) to reddish yellow (7.5YR 7/6). Small areas are weakly calcareous in places.

Because the hazard of wind erosion is very high, this soil is not suitable for cultivation. It is well suited to range. Vegetation includes Indiangrass, sand bluestem, little bluestem, and side-oats grama. (Capability unit VIIe-1; Sandy Land range site.)

Zita Series

The Zita series consists of brown to grayish-brown, moderately deep soils. These soils are noncalcareous in the upper 15 to 24 inches. They are underlain by a chalky carbonate zone.

Zita soils occur in all parts of the county. They are usually associated with playas, but they also occur in a few, broad, level areas.

Closely related soils are the Portales soils, which are less dark and calcareous; the Mansker soils, which are shallow and calcareous; and the Arch soils, which are much grayer and are strongly calcareous.

Associated soils are the Amarillo soils, which are redder; the Lubbock soils, which have clayey subsoils; and the Olton soils, which are redder and have more clayey subsoils.

Zita fine sandy loam, 0 to 1 percent slopes (ZfA).—This soil has 6 to 10 inches of fine sandy loam surface soil over 10 to 18 inches of sandy clay loam subsoil. A pale-brown to white, chalky layer of caliche occurs at 18 to 30 inches.

Profile of Zita fine sandy loam, 0 to 1 percent slopes (8 miles west and 2 miles north of Earth):

A_{1p} 0 to 8 inches, dark grayish-brown (10YR 4/2; 3/2, moist) fine sandy loam; weak, subangular blocky structure; hard when dry, friable when moist; noncalcareous; abrupt boundary.

A_{12} 8 to 21 inches, dark grayish-brown (10YR 4/2; 3/2, moist) sandy clay loam; weak, coarse, prismatic and moderate, fine, subangular blocky structure; hard when dry, friable when moist; many fine pores and wormcasts; noncalcareous; clear boundary.

AC 21 to 25 inches, grayish-brown (10YR 5/2; 4/2, moist) sandy clay loam; weak, subangular blocky and granular structure; hard when dry, friable when moist; many medium to fine pores and wormcasts; strongly calcareous; abrupt boundary.

C_{ca} 25 to 38 inches, very pale brown (10YR 7/3; 5/3, moist) clay loam; 50 percent of soil mass is soft, white (10YR 8/2, 7/2, moist) calcium carbonate; many medium to fine pores; very strongly calcareous; diffuse boundary.

C 38 to 66 inches +, very pale brown (10YR 7/3; 6/3, moist), very strongly calcareous clay loam.

This soil is porous and in most places contains many wormholes. The structure is weak to moderate and ranges from prismatic to subangular blocky and granular.

In most areas the texture of the surface soil is fine sandy loam, but in some small areas it is loam. The color ranges from brown to very dark grayish brown, hue 7.5YR to 10YR.

In most areas the texture of the subsoil is sandy clay loam, but in some it is clay loam. The color range is the same as that of the surface soil.

The C_{ca} horizon ranges in color from pale brown to white and is pink in places, hue 7.5YR to 10YR. The texture ranges from sandy clay loam to clay loam. The percentage by volume of calcium carbonate ranges from 30 to 60.

The C horizon has the same ranges in characteristics as the C_{ca} horizon, except that there is much less calcium carbonate.

Included with this soil, as mapped, are small areas of Portales fine sandy loam and Lubbock fine sandy loam. Also included are small areas that have had moderately severe wind erosion.

This soil has moderate to high fertility and moisture-holding capacity. It produces good yields when properly irrigated and fertilized. The hazard of wind erosion is moderate. (Capability unit IIIe-2 (dryland farming); capability unit IIe-2 (irrigation); Mixed Land range site.)

Zita fine sandy loam, 1 to 3 percent slopes (ZfB).—The profile of this soil is very similar to that of Zita fine sandy loam, 0 to 1 percent slopes. The soil areas are small and usually are associated with playas. The slopes are mainly less than 2 percent.

This is a productive soil, but the hazard of wind and water erosion is moderate. (Capability unit IIIe-1 (dryland farming or irrigation); Mixed Land range site.)

Zita loam, 0 to 1 percent slopes (ZmA).—This soil consists of 6 to 10 inches of loam surface soil over 10 to 18 inches of clay loam subsoil. A layer of pale-brown to white, chalky caliche occurs at 18 to 30 inches.

Profile of Zita loam, 0 to 1 percent slopes (1 mile east of Bainer):

A_{1p} 0 to 10 inches, dark grayish-brown (10YR 4/2; 2/2, moist) loam; weak, granular structure; slightly hard when dry, friable when moist; noncalcareous; abrupt boundary.

A_{12} 10 to 18 inches, dark grayish-brown (10YR 4/2; 3/2, moist) clay loam; weak, coarse, prismatic and moderate, fine and very fine subangular blocky structure; hard when dry, friable when moist; many fine to very fine pores and wormcasts; noncalcareous; clear boundary.

AC 18 to 26 inches, grayish-brown (10YR 5/2; 4/2, moist) clay loam; weak, subangular blocky structure; hard when dry, friable when moist; many fine pores and wormcasts; strongly calcareous; clear boundary.

C_{ca} 26 to 38 inches, white (10YR 8/2; 7/2, moist) clay loam; 50 to 60 percent of soil mass is soft, chalky calcium carbonate; very strongly calcareous; diffuse boundary.

C 38 to 60 inches +, light-gray (10YR 7/2; 6/2, moist), very strongly calcareous clay loam; contains 10 to 15 percent soft and hard, fine concretions of calcium carbonate.

In most areas the texture of the surface soil is loam, but in some it is sandy clay loam. The color ranges from brown to very dark grayish brown, hue 7.5YR to 10YR, value 3 to 5, and chroma 2 to 4.

The subsoil is clay loam in texture but otherwise has about the same range in characteristics as the surface soil.

This soil is porous and usually has many wormholes. The structure is weak to moderate and ranges from prismatic to subangular blocky and granular.

The C_{ca} horizon ranges in color from pale brown to white and, in places, is pink, hue 7.5YR to 10YR. The volume of calcium carbonate ranges from 30 to 60 percent.

The C horizon has the same range in characteristics as the C_{ca}, except that there is much less calcium carbonate.

Included with this soil, as mapped, are small areas of Portales loam.

This is a very productive soil. The hazard of wind erosion is slight. (Capability unit IIIce-1 (dryland farming); capability unit IIe-1 (irrigation); Deep Hardland range site.)

Zita loam, 1 to 2 percent slopes (ZmB).—This soil is very similar to Zita loam, 0 to 1 percent slopes. The areas of this soil are small and are usually associated with playa basins.

This is a productive soil, but wind erosion is a slight hazard and water erosion a slight to moderate hazard. If properly irrigated and fertilized, this soil produces good yields. (Capability unit IIIe-3 (dryland farming or irrigation); Deep Hardland range site.)

Zita loamy fine sand, overblown (Zo).—This soil has 8 to 20 inches of brown loamy fine sand over 8 to 18 inches of dark grayish-brown sandy clay loam subsoil. The surface soil consists mostly of accumulations of sandy material deposited by wind. These sandy materials were blown from Amarillo loamy fine sand. The original surface soil was probably about 8 to 14 inches of light fine sandy loam.

Areas of this soil are generally slightly depressed and are surrounded by Amarillo loamy fine sand. Most areas have been deep plowed to a depth of 14 to 18 inches.

Profile of Zita loamy fine sand, overblown (4.2 miles north and 3 miles west of Sudan):

A_{1p} 0 to 18 inches, brown (10YR 5/3; 4/3, moist) loamy fine sand; single grain; loose when dry or moist; some fine sandy loam has been mixed from below by plowing; noncalcareous; abrupt boundary.

A_{12} 18 to 26 inches, dark grayish-brown (10YR 4/2; 3/2, moist) sandy clay loam; moderate, medium, subangular blocky structure; hard when dry, friable when moist; common, very fine pores and worm-casts; noncalcareous; clear boundary.

AC 26 to 34 inches, grayish-brown (10YR 5/2; 4/2, moist) sandy clay loam; weak, subangular blocky structure; hard when dry, friable when moist; many fine pores; strongly calcareous; gradual boundary.

C_{ca} 34 to 48 inches, light-gray (10YR 7/2; 6/2, moist) clay loam; hard when dry, friable when moist; few, soft masses of calcium carbonate; very strongly calcareous; diffuse boundary.

C 48 to 72 inches, light brownish-gray (10YR 6/2; 5/2, moist), very strongly calcareous clay loam.

In most areas the texture of the surface soil is loamy fine sand, but in a few small areas it is fine sand. The color ranges from brown to pale brown, hue 7.5YR to 10YR.

In most areas the texture of the subsoil is sandy clay loam, but in some it is clay loam. The structure ranges from moderate, coarse, prismatic to fine, subangular blocky. The color ranges from brown to very dark grayish-brown, hue 7.5YR to 10YR.

The color of the clay loam C_{ca} horizon ranges from gray to white. The C_{ca} horizon ranges in thickness from 6 to 20 inches. The depth to the C_{ca} horizon ranges from 22 to 40 inches but is usually 26 to 30 inches.

The hazard of wind erosion is high. The sandy surface soil has a low water-holding capacity and a low capacity to hold plant nutrients. This soil can be plowed deeply to increase the clay content in the surface soil to help control wind erosion. (Capability unit IVe-4 (dryland farming); capability unit IIIe-4 (irrigation); Sandy Land range site.)

Wind Erosion and Its Control

No farm in Lamb County is safe from the damage caused by high winds. Wind erosion, therefore, has a major influence on soil management. Effective control of erosion requires the cooperation of all farmers in an area, because soil blown from unprotected fields will damage the soils on adjoining farms.

Effects of Wind Erosion

The effects of wind erosion are serious and extensive (*9*). Many crops are lost, and soil fertility is greatly reduced. Railways and highways are sometimes buried under drifted soil. Traffic accidents are common during duststorms. Insects and weed seeds are blown far and wide with drifting soil. Fences, hedges, and shelterbelts are sometimes buried or ruined. At times, farm buildings are ruined by drifts and sand blasting. Duststorms are disagreeable or unbearable both to farm families and to town and city people. The most serious effects of wind erosion are the loss of fine soil fractions (silt, clay, and organic matter) that are gradually sorted and moved to distant places.

The wind acts like a sieve on some soils. It removes the fine fractions and retains the coarse ones. The coarse fractions are not fertile and are little more than the soil skeleton. The plants get their food from the finer soil particles.

Each shift of soil by the wind removes more plant nutrients (*5*). After the soil has been moved a number of times, the remaining soil that forms the hummocks and fence-row dunes is mainly sand, regardless of the original texture.

The finer textured soils (loams and clay loams) are least affected by wind erosion, because tillage usually roughens and clods them so that they can resist blowing. However, wind winnowing has removed enough of the organic matter, silts, and clays from the surface soils in most areas to make them coarser textured than when first cultivated. Thus, soils become more susceptible to erosion, have less capacity to hold water and plant nutrients, and are more likely to form plowpans.

The same effects also occur on most cultivated areas mapped as fine sandy loams. The wind erosion removes most of the organic matter, silts, and clays from the plow layer of these soils. The remaining sandy layer lacks plant food and is highly susceptible to wind erosion. To offset these effects, farmers have plowed deeper to bring more clayey material from below. This process has been repeated so often that in many areas the surface layer, to a depth of 10 to 12 inches, probably has changed from a fine sandy loam to a loamy fine sand.

Wind erosion has had the most drastic effects on loamy fine sand and fine sand. In cultivated areas fence-row dunes up to 10 feet high are common. In places abandoned fields have lost all of the thick, sandy surface. The blowing of sterile sand from these areas to adjoining areas of more productive soils is especially damaging.

Rangeland also shows the effects of wind erosion. Some of the soil is shifted or removed. Generally, however, the soil is blown on the rangeland from cultivated areas. In some places several acres are covered with 6 inches to 3 feet of sand. On such areas the good grasses are smothered and weeds and brush grow.

One of the least noticeable yet most damaging effects of wind erosion is the blowing of clay and silt from cultivated land to rangeland. These materials are carried many miles and deposited as a thin mantle on the rangeland. Though this mantle is only ⅛ to ½ inch thick, it is almost impervious to water. It increases runoff and water erosion and thus takes greatly needed moisture from the good grasses.

Evidence of the removal of plant nutrients by wind erosion is shown by the following comparisons. Samples of dust deposited on snow and ice in Iowa by a duststorm originating in the Texas-Oklahoma Panhandle early in 1937 were compared with samples from a small dune formed by the same wind at Dalhart, Tex. (*2*). The dust contained about 10 times as much organic matter, 9 times as much nitrogen, 19 times as much phosphoric acid, and about 1½ times as much potash as the dune sand. Compared to a virgin soil near Dalhart, the dust contained more than 3 times as much nitrogen and organic matter, about 5 times as much phosphoric acid, and 1¼ times as much potash.

Samples of dust deposited at Hays, Kans., and Clarinda, Iowa, from the 1937 Panhandle storm were compared with samples of soil of unplowed grassland and with dune sand collected near Dalhart, Tex. The results of the analysis of the samples are shown in table 2.

The removal of plant nutrients by wind erosion reduces yields far more than is generally realized. The use of improved varieties of seed and efficient mechanical farming offsets the depletion of the soil. Yields, however, would be much more if erosion were controlled.

TABLE 2.—*Organic matter and partial chemical content of soil of unplowed grassland, dune sand, and dust*

Element	Unplowed grassland, near Dalhart, Tex.	Dune sand, Dalhart, Tex.	Dust	
			Hays, Kans.	Clarinda, Iowa
	Percent	*Percent*	*Percent*	*Percent*
CaO	0.34	0.31	3.15	1.98
K_2O	2.05	1.77	2.46	2.58
P_2O_5	.04	(1)	.14	.19
Nitrogen	.06	.02	.20	.19
Organic matter	1.06	.33	3.34	3.35

1 Trace.

Types of Wind Erosion

There are three main types of soil movement by wind. They are (1) floating, (2) bouncing, and (3) creeping. During a duststorm, soil may float or move in the air. This is the type of movement that is usually noticed. The bouncing of particles causes the other two types of movement. The particles that move in a series of short bounces are the size of very fine to medium sand and are moved directly by the wind. These particles, in turn, may cause larger particles to creep along the surface as they strike them, or they may detach, lift, and suspend in the air particles the size of clay and silt. The material that moves by bouncing or creeping stays near its place of origin (*3*). After the dust is suspended in air, it may be blown hundreds of miles.

Factors in Wind Erosion

Soil cloddiness, surface roughness, and amounts of crop residues on the surface are the three main factors that influence the susceptibility of soil to wind erosion. These factors are closely interrelated.

A clod the size of an alfalfa seed (0.84 millimeter) will resist blowing. Clod formation is directly related to soil texture. Normally from 0 to 12 percent of the clods in sandy soils are large enough to resist wind erosion. The fine sandy loams have from 12 to 35 percent of these clods, but loams and clay loams average about 50 percent clods of nonerodible size. On the average, coarse-textured soils are more than 8 times more erodible than moderately coarse textured soils, and they are more than 40 times more erodible than medium- and fine-textured soils.

Control of Wind Erosion

Control of wind erosion depends on the conservation of clay and organic matter. When wind erosion occurs, eventually so much fine material is lost that there is no longer enough clay to produce clods.

The rougher the surface, the higher the wind needed to start soil blowing. Roughness of a field depends on the height, length, spacing, and type of vegetative cover. It also depends on the size, shape, and spacing of clods, ridges, and ripples. For example, listing has long been depended on to help control soil blowing. The effectiveness of listing depends largely on whether enough clay and moisture are in the soil to produce clods and on the amount of stalk or stubble left standing in the beds. It also depends on surface roughness produced by listing.

Residues from the previous crops can be used to help control soil blowing (fig. 7). They help to slow down the

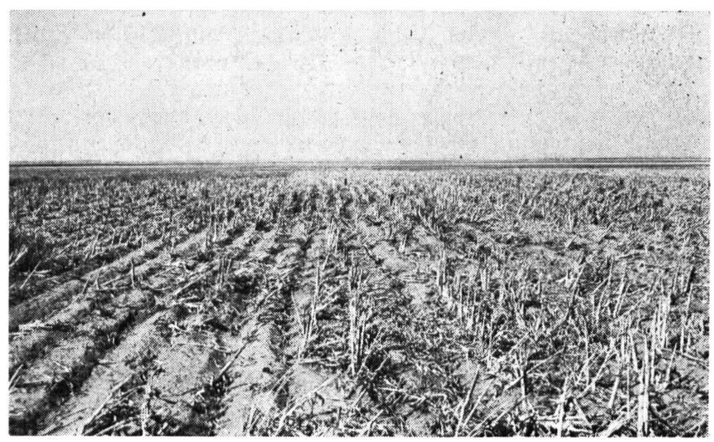

Figure 7.—**Grain-sorghum stubble helps control wind erosion on Brownfield fine sand, thick surface.**

wind at the ground surface. Standing stubble reduces wind force more than flattened stubble, and close-spaced stubble reduces it more than the same amount of wide-spaced stubble.

The best way to control wind erosion is by maintaining a vegetative cover or by properly managing crop residues. If adequate residues are not available, emergency tillage should be used to produce roughness and clods.

Some areas in Lamb County have been eroded to the extent that they are no longer cultivated. It is evident that many other soils will eventually erode to the same degree if wind erosion is not controlled.

Use and Management of the Soils

In this section the major management practices used on cropland are discussed. The system of soil capability groupings is explained and the soils of Lamb County are grouped into capability units. For each unit, the component soils are listed and soil characteristics, principal crops, soil problems and management, and suggested cropping systems are discussed. A yield table gives the estimated yields of each cultivated soil in the county under two levels of management. Range management and the range sites in the county are also discussed in this section.

Soil Management Practices

Low erratic rainfall, high winds, a short growing season, and the hazard of erosion are major factors that determine the type of management practices needed in Lamb County.

Following is a discussion of the major practices used in Lamb County. These practices are referred to in the section "Management by Capability Units."

Stubble mulching.—This is a system of plowing, planting, cultivating, and harvesting that leaves enough crop residue on the surface to protect the soil throughout the year.

Crops that normally produce enough residue for stubble mulching are grain sorghum and forage sorghum, small grains, perennial grasses, and certain legumes, such as alfalfa, vetch, winter peas, sesbania, and sweetclover.

Stubble mulching (1) will provide enough cover to protect the soil from wind and water erosion when it is not in crops; (2) will conserve moisture by increasing the infiltration rate and by reducing evaporation; and (3) will help maintain the content of organic matter.

Often there may not be enough stubble mulch to control erosion during or after years of low rainfall, after clean-tilled crops have been harvested, or on the sandier soils. Under such conditions, tillage can be used to provide additional cloddiness and roughness to supplement the cover.

The use of crop residues.—Crop residues should be managed so as to leave a protective cover on the surface soil during a critical part of the year. In Lamb County this is usually fall, winter, and spring.

Crop residues should be used on all cropland where it is not necessary to stubble mulch. If crop residues are not adequate to control erosion, emergency tillage should be used to provide additional cloddiness and roughness.

If stubble mulching is suggested for a soil in "Management by Capability Units," and residues are limited, the amount of residues available should be used with emergency tillage.

Cover cropping.—This is the use of crops on cropland primarily for soil protection and improvement. Cover crops are close-growing crops grown between periods of regular crop production. Some suitable cover crops for Lamb County are small grains, vetch, Austrian winter peas, and sweetclover. If possible, these crops should be planted in the fall and left on the ground until April 1 or later.

The purpose of cover crops is to protect the soil from wind and water erosion. Cover crops also improve the physical, chemical, and biological condition of the soil.

Stripcropping.—This is a system of growing crops in alternate strips or bands that serve as vegetative barriers to wind and water erosion.

Some suitable crops for use in protective strips are grain and forage sorghum, sudan, or tall perennial grasses and legumes. The strip not only protects the companion crop from sand blasting by wind but also protects the land after the companion crop has been harvested.

Deep plowing.—Deep plowing is effective only where from one-fourth to one-third of the deep furrow slice is fine-textured material. When this fine-textured material is mixed with the sandy surface soil, a fine sandy loam surface layer, or plow layer, is formed. If tillage is properly timed after deep plowing, these soils can be roughened so that they form stable clods of nonerodible size. This helps greatly to control wind erosion. Under normal dryland farming in which row crops are grown, it is almost impossible to grow enough crop residues and keep them on the surface to control soil blowing. After deep plowing is used, crop residues, cloddiness, and roughness can be combined to control wind erosion. Deep plowing alone will not control wind erosion for a long period.

If erosion is not controlled after deep plowing, the surface soil will continue to drift until clayey material cannot be reached by further deep plowing. The deep mantle of sand that results is then more hazardous than the original thin mantle.

Calcareous soils should not be deep plowed. Materials that are high in lime will not form clods that resist wind erosion.

Application of cotton burs.—This practice not only protects erodible land but also adds organic matter to the soil, increases the infiltration rate, reduces evaporation, helps regulate soil temperatures, and generally improves the condition of the soil (fig. 8).

The rate of application on dry land should be a minimum of 3 tons of dry burs per acre; the optimum amount is 4 to 5 tons. On irrigated land 5 to 12 tons can be used, but about 8 tons per acre produces the optimum results.

Some nitrogen fertilizer should be applied with the burs. The county agent or a representative of the soil con-

Figure 8.—**Cotton burs are used to improve the soil and to protect erodible land.**

servation district should be consulted concerning the amount needed.

In wind-eroded areas, cotton burs should be uniformly distributed and left on the surface until April 1.

Use of commercial fertilizers.—The use of fertilizers is fairly new in Lamb County. However, most of the irrigation farmers are using fertilizer in some form.

Most of the soils in Lamb County that are irrigated need nitrogen, phosphorus, and sometimes potassium. The proper use of fertilizers on irrigated crops can be expected to increase cotton yields by one-half bale per acre, and grain sorghum by 2,000 to 3,000 pounds per acre.

Fertilizer on row crops should generally be banded 10 inches to the side and 3 to 4 inches below the seed.

Because the growing season for cotton is short in Lamb County, part of the nitrogen and all of the phosphate should be applied before planting cotton. If the crop is early, it should be sidedressed with the remaining nitrogen when the first squares appear.

All applications of fertilizer should be based on needs determined by soil tests. Amounts and types of fertilizers to apply vary greatly according to such factors as type of soil, crop grown, previous crop, and season.

Since moisture, not fertility, is the limiting factor on dryland soils, fertilizers are generally not needed. For latest information on the use of commercial fertilizers, advances made, and new experiments run each year, the county agent or representatives of the soil conservation district should be consulted.

Terraces and contour farming.—These practices hold water where it falls and thus save moisture and prevent water erosion. Moisture conservation is most important in this area of low rainfall. Farmers have reported that moisture saved from one rain on terraced land produced one-half bale more cotton per acre than was made on adjoining land that was not terraced.

Engineers of the soil conservation district, or other qualified engineers, should be consulted for information on terracing.

Conservation cropping systems.—This is a practice that protects, improves, and adds fertility to the soil. It consists of growing crops in a rotation or sequence in which the soil-improving crops balance the soil-depleting crops in their effect on the soil.

The following practices are to be considered in planning a conservation cropping system:

1. The kind, pattern, and sequence of crops used, as well as residue management, should control erosion and maintain the soil productivity.
2. There should be plenty of vegetative cover (either growing or dead) to protect the land from wind erosion.
3. The soil should be kept in good physical condition.

A conservation cropping system suitable for dryland farming must be based on the two major crops, cotton and grain sorghum. Cotton, a low residue-producing crop (it returns little residue to the soil), is grown in rotation with grain sorghum (a crop that produces large amounts of residue). This residue can be managed for soil protection and improvement. The frequency of planting the high residue-producing crop is determined by the hazard of wind erosion.

The following crop sequence is generally followed in dryland farming to maintain plenty of residue for control of wind erosion:

1. On soils having a slight hazard of wind erosion—1 year of cotton followed by 1 year of grain sorghum.
2. On soils having a moderate hazard of wind erosion—1 year of cotton followed by 2 years of grain sorghum.
3. On soils having a high hazard of wind erosion—grain sorghum grown continuously in close-spaced rows.

Other high residue-producing crops used by some farmers are small grains, millet, sudan, and perennial grasses.

Summer legumes, such as cowpeas, mungbeans, and guar have increased the yields of the crops that follow, but they leave little residue for helping control wind erosion. Cowpeas or mungbeans should be interplanted with grain sorghum to improve the soil (fig. 9).

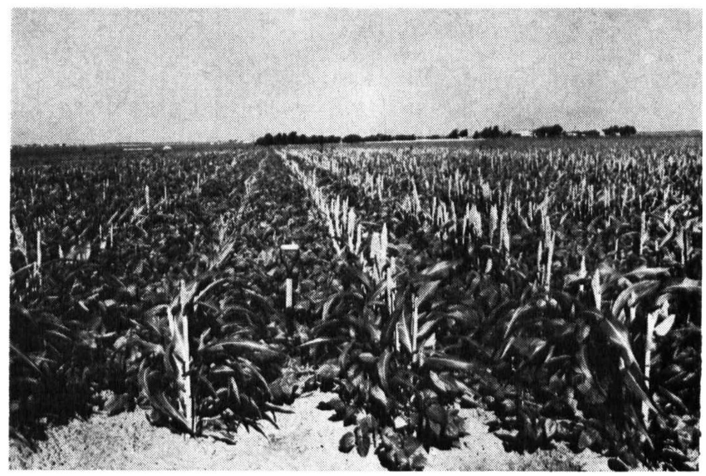

***Figure 9.*—Cowpeas interplanted with grain sorghum to improve the soil on Amarillo fine sandy loam, 0 to 1 percent slopes.**

All dryland rotations are suited to irrigated farming. Following are some rotations that are possible because of the additional crops that can be grown under irrigation:

1. On soils having a slight hazard of wind erosion.
   a. Two years of cotton followed by 3 years of alfalfa.
   b. Two years of cotton followed by 1 year of grain sorghum interplanted with cowpeas.
2. On soils having a moderate to high hazard of wind erosion.
   a. Cotton, 3 years alfalfa, cotton, grain sorghum.
   b. Cotton (overseeded in fall with vetch or rye or both), cotton, grain sorghum.
3. On soils having a very high hazard of wind erosion (all crops are close-spaced or sown).
   a. Three years of alfalfa followed by 3 years of grain sorghum.
   b. Three years of perennial grass followed by 3 years of grain sorghum with interplanted cowpeas or mungbeans.

Other rotations may be used that are as good as, if not better than, those listed. The county agent, or personnel of the soil conservation district, should be consulted about suitable cropping systems.

Irrigation

Since World War II, irrigation has become widespread in Lamb County. At present there are more than 5,000 wells irrigating about 350,000 acres. Water is pumped from depths varying between 70 and 200 feet deep. Sizes of pumps range from 3 inches in the marginal irrigated areas to 10 inches in areas with more water.

The quality of the water is very good. Sprinkler and surface-flow methods of applying water are used in the county. Sprinkler systems are more practical on sandy soils or soils that cannot be leveled economically. Surface-flow methods require level or nearly level, uniform grades. The irrigation water applied should be the amount the soil will hold in the root zone of the crop that is grown. An irrigation system must be designed to distribute the water evenly over the field without causing erosion or excessive losses.

Irrigation wells should be spaced far enough apart to prevent interference between the wells. Water moves very slowly through the water-bearing formation, so that an inverted cone of water depletion temporarily occurs beneath a well that has been pumping water. The depth of this depletion below the level of the static water table is known as the drawdown.

If wells are located too close together, the inverted cones overlap and the yields of both wells are greatly reduced. The yield per foot of drawdown may vary for each well. Studies on several wells pumping 1,000 gallons of water per minute for 30 days showed a drawdown of 10 feet at a distance of 200 feet and a drawdown of 1 foot at 2,000 feet from the well. Personnel of the High Plains Underground Water Conservation District No. 1, headquarters, Lubbock, Tex., should be consulted for information on correct well spacing.

Drawdown discharge curves provide reliable information on designing a pump and power plant for a well. These curves can be developed by installing a test pump, pumping the wells for several hours at different rates of discharge, and then measuring the pumping level. This information will show the most efficient pumping levels and the yield rate for the well.

Engineers in the Soil Conservation Service or the County agricultural extension agent will aid in designing an irrigation system or in solving other irrigation problems. They will help you design a conservation irrigation system that is suited to your soil, water supply, and selected crops.

The following things are among those that must be considered in designing a system for conservation irrigation:

1. The quality and quantity of available water.
2. How fast the soil will take water and how much it will hold.
3. The water needs for crops grown.
4. The topography of the irrigated land.

Conservation irrigation should accomplish the following:

1. Maintain or increase soil productivity.
2. Control erosion.
3. Use rainfall and irrigation water efficiently.
4. Prevent excess leaching of plant nutrients.
5. Dispose of excess water without causing erosion.
6. Prevent waterlogging and the accumulation of harmful salts.

Maintaining or increasing soil productivity is most important. Unless the soil is managed well, the best system for control and distribution of water will not be successful.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels, the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and landforms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, grazing, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated 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* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates 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 a few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils 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 of soils for many statements about their management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

Soils are classified in capability classes, subclasses, and units according to the degree and kind of their permanent limitations; but without consideration of major and generally expensive landforming that would change the slope, depth, or other characteristics of the soils; and without consideration of possible but unlikely major reclamation projects.

Capability classes in the system, and the subclasses and units in Lamb County, are given in the following list. Because some of the hazards of climate are removed by irrigation, many of the soils are in a more favorable capability class for irrigation than for dryland farming. The capability grouping is one that covers the soils of several counties, and there are some gaps in the numbering system when only the units of this county are listed.

Class I.—Soils that have few limitations that restrict their use. (None in the county.)

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

Subclass IIe.—Soils that have a moderate risk of erosion if they are not protected.

Capability unit IIe-1 (for irrigation).—Dark-brown or reddish-brown loams and clay loams, nearly level. The same soils for dryland farming are in unit IIIce-1.

Capability unit IIe-2 (for irrigation).—Reddish-brown to grayish-brown fine sandy loams, nearly level. For dryland farming, IIIe-2.

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

Subclass IIIe.—Soils that have a severe risk of erosion if they are cultivated and not protected.

Capability unit IIIe-1 (for irrigation or dryland farming).—Reddish-brown to grayish-brown fine sandy loams, 1 to 3 percent slopes.

Capability unit IIIe-3 (for irrigation or dryland farming).—Dark-brown or reddish-brown loams, 1 to 3 percent slopes.

Capability unit IIIe-4 (for irrigation).—Deep, light-colored sandy soils, 0 to 3 percent slopes. For dryland farming, IVe-4.

Capability unit IIIe-5 (for irrigation).—Reddish-brown to grayish-brown fine sandy loams or loam, shallow over caliche, 0 to 3 percent slopes. For dryland farming, IVe-5.

Capability unit IIIe-6 (for irrigation).—High-lime, grayish soils, 0 to 3 percent slopes. For dryland farming, IVe-1.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVe.—Soils that have a very severe risk of erosion if they are cultivated and not protected.

Capability unit IVe-2 (for irrigation or dryland farming).—Grayish-brown loams, 3 to 5 percent slopes.

Capability unit IVe-3 (for irrigation or dryland farming).—Reddish-brown to grayish-brown, moderately sandy soils, 3 to 5 percent slopes.

Capability unit IVe-6 (for irrigation).—Grayish-brown, calcareous (limy) soils, short, steep slopes of 3 to 5 percent. Without irrigation, VIe-1.

Capability unit IVe-7 (for irrigation).—Light-colored, deep sandy soils, 0 to 5 percent slopes. Without irrigation, VIe-2.

Subclass IVw.—Soils that have very severe limitations for cultivation because of excess water.

Capability unit IVw-1.—Sandy playa beds.

Class V.—Soils that have little or no erosion hazard but have other limitations that are impractical to remove without major reclamation, that limit their use largely to pasture, range, woodland, or wildlife food and cover. (None in the county.)

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

Subclass VIe.—Soils severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIe-3.—Calcareous (limy) soils, 5 to 8 percent slopes.

Capability unit VIe-5.—High-lime soils, 5 to 20 percent slopes.

Subclass VIw.—Soils severely limited by excess water and generally unsuitable for cultivation.

Capability unit VIw-1.—Dark-colored, poorly drained clays of the playa beds.

Class VII.—Soils that have very severe limitations that make them unsuited to cultivation without major reclamation, and that restrict their use largely to grazing, woodland, or wildlife.

Subclass VIIe.—Soils very severely limited, chiefly by risk of erosion if protective cover is not maintained.

Capability unit VIIe-1.—Light-colored, deep, sandy soils of the sandhills.

Subclass VIIs.—Soils very severely limited by thickness or nature of the root zone.

Capability unit VIIs-1.—Very shallow soils over hard or soft lime, gently sloping to steep.

Class VIII.—Soils and landforms that have limitations that preclude their use, without major reclamation, for commercial production of plants and restrict their use to recreation, wildlife, water supply or esthetic purposes.

Subclass VIIIe.—Soils subject to extreme erosion.

Capability unit VIIIe-1.—Deep sand dunes, not stabilized.

Management by capability units

In this section the soils of the county are placed in capability units. Most of the soils are classified both for dryland farming and for irrigation farming. The capability units and some management practices for dry-farmed and irrigated soils are discussed.

CAPABILITY UNIT: IIIce-1, DRYLAND FARMING; IIe-1, IRRIGATION

These soils are dark-brown to reddish-brown loams and clay loams with slopes of 0 to 1 percent. They are deep and moderately to slowly permeable. The soils are:

Amarillo loam, 0 to 1 percent slopes.
Lea clay loam.
Lofton clay loam.
Olton loam, 0 to 1 percent slopes.
Portales loam, 0 to 1 percent slopes.
Spur loam.
Zita loam, 0 to 1 percent slopes.

These soils make up about one-fourth of the county. About 95 percent of the acreage is cultivated; 7 percent of the cultivated acreage is used for dryland farming. These soils are well suited to cultivation and are productive. All crops suited to the area produce well on them.

Cotton is the main cash crop grown on these soils. Grain sorghum and small grains are grown as cash crops and produce large amounts of crop residues. These residues can be managed to help control wind erosion.

Vetch, sweetclovers, cowpeas and alfalfa are legumes that can be used to improve the soil under irrigation.

Under cultivation these soils have a high capacity to hold plant nutrients but are subject to slight wind erosion. To prevent this erosion and to maintain productivity, most successful farmers on the High Plains use a cropping system that (1) increases and maintains the content of organic matter, and (2) maintains enough cover, roughness, and cloddiness to control wind erosion.

Dryland farming.—If these soils are dry-farmed, a crop that will produce much residue, such as grain sorghum or small grain, should be grown about half of the time. Stubble mulching or the use of crop residues will help to maintain the content of organic matter and also to increase the surface cover and roughness needed for control of wind erosion. If enough cover is not produced during dry years to keep the soil from blowing, chiseling or listing will add the needed clods and roughness.

Contour farming or a complete system of terraces on long slopes will save valuable moisture for crop production. Lack of moisture, not fertility, restricts high production on these soils.

Irrigation.—If the soils are irrigated, a crop that produces much residue or improves the soil should be grown 1 year in 3. Management should include the use of crop residues or stubble mulching. In places it is profitable to apply commercial fertilizers to help maintain high production. Irrigation also helps to grow deep-rooted legumes that maintain good tilth and supply nitrogen to the crops that follow.

A conservation irrigation system uses water most efficiently (fig. 10). Surface or sprinkler systems are suggested for these soils.

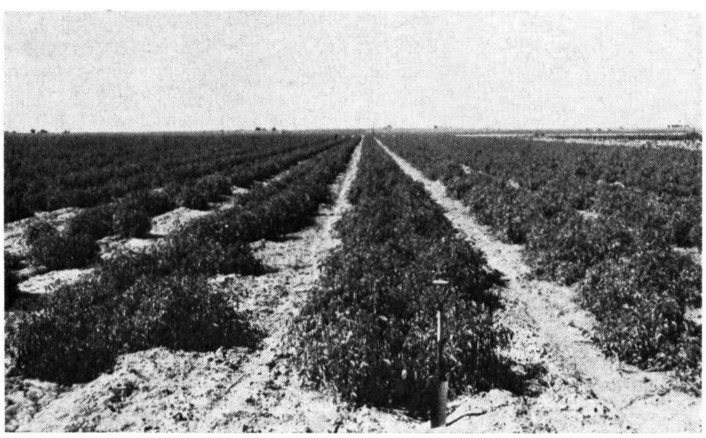

Figure 10.—**Irrigated tomatoes on Olton loam, 0 to 1 percent slopes.**

CAPABILITY UNIT: IIIe-2, DRYLAND FARMING; IIe-2, IRRIGATION

These are reddish-brown to grayish-brown fine sandy loams with slopes of 0 to 1 percent. The soils are:

Amarillo fine sandy loam, 0 to 1 percent slopes.
Arvana fine sandy loam, 0 to 1 percent slopes.
Lubbock fine sandy loam.
Portales fine sandy loam, 0 to 1 percent slopes.
Spur fine sandy loam.
Zita fine sandy loam, 0 to 1 percent slopes.

The acreage of these soils makes up about one-fourth of the county. About 95 percent of the total acreage is cultivated, and about 60 percent of the cultivated acreage is irrigated. These soils are well suited to cultivation and are productive when properly managed. Most crops suited to the area grow well on them.

Cotton is the main cash crop grown on these soils (fig. 11). Grain sorghum and small grains are grown as cash crops and to produce large amounts of crop residues for control of wind erosion. Alfalfa, vetch, sweetclovers, and cowpeas are legumes that improve the soil under irrigation.

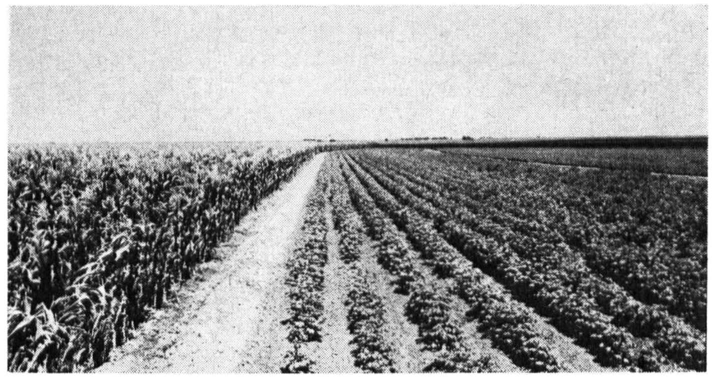

Figure 11.—**Cotton and corn in level borders on Amarillo fine sandy loam, 0 to 1 percent slopes.**

These soils are subject to moderate wind erosion and slight water erosion. They have a moderate to high capacity to hold water and plant nutrients.

Good management on these soils includes a cropping system that will (1) maintain enough cover, roughness, and cloddiness to control wind erosion, (2) maintain or increase organic matter, and (3) control runoff.

Dryland farming.—A cropping system that includes a high-residue crop should be used on these soils about 2 years in 3 if they are dry-farmed. Stubble mulching or the use of crop residue will help to maintain or increase organic matter. It will also help to increase the surface cover and roughness needed to control wind erosion. During or after years of low rainfall, the land should be chiseled or listed if there is not enough cover to prevent soil blowing. These practices will also add the needed roughness and clods.

Terracing and contouring on the long slopes will conserve moisture and prevent water erosion.

Irrigation.—If the soils in this unit are irrigated, the cropping system should include, during 1 year in 3, a crop that produces a large amount of residue and improves the soil. The soils should be fertilized in amounts determined by soil tests, crop needs, and economic feasibility. The experience of local farmers has indicated that yields decline after the fourth or fifth year under irrigation unless nitrogen and phosphate are used.

Engineers of the soil conservation district or other qualified agencies can help plan a conservation irrigation system.

CAPABILITY UNIT: IIIe-1, DRYLAND FARMING OR IRRIGATION

This unit consists of reddish-brown to grayish-brown fine sandy loams on slopes of 1 to 3 percent. These soils are deep and have moderate to moderately rapid permeability. The soils in this unit are:

Amarillo fine sandy loam, 1 to 3 percent slopes.
Arvana fine sandy loam, 1 to 3 percent slopes.

Berthoud fine sandy loam, 1 to 3 percent slopes.
Portales fine sandy loam, 1 to 3 percent slopes.
Springer fine sandy loam, undulating.
Zita fine sandy loam, 1 to 3 percent slopes.

The acreage of these soils makes up about 17 percent of the county. About 90 percent of the acreage is cultivated, and 60 percent of this is irrigated. These soils are well suited to cultivation and are productive if properly managed. Most crops suited to the area grow well on them.

Cotton is the main cash crop grown on these soils. Grain sorghum and small grains are grown for cash crops, as well as for large amounts of residues to help control wind erosion. Alfalfa, vetch, sweetclovers, and cowpeas are legumes that can be used in cropping systems to improve the soils under irrigation.

These soils are subject to moderate wind and water erosion under cultivation. They have a moderate to high capacity to hold water and plant nutrients.

Good management includes a cropping system and accompanying practices that will (1) maintain adequate cover, roughness, and cloddiness for control of wind erosion, (2) increase the content of organic matter, and (3) control runoff.

Dryland farming.—If these soils are dry-farmed, a crop that produces much residue should be grown 2 years in 3. If cotton or other clean-tilled crops are grown, terracing and contouring should be used on all soils except Springer fine sandy loam. Because the Springer soil has undulating slopes, crops that produce much residue should be grown on it each year.

All of these soils need stubble mulching or crop residues to help maintain cover and roughness for prevention of wind erosion. These also help to maintain or increase the supply of organic matter. During or after years of low rainfall, when there is not enough cover to prevent soil blowing, chiseling or listing will add cloddiness and roughness to prevent wind erosion.

Irrigation.—If the soils are irrigated, a high-residue crop that improves the soil should be grown about half the time. Fertilizer should be used to produce the highest yields economically feasible. Amounts should be determined by soil tests and crop needs. The local farmers have found that yields on these soils decline after the fourth or fifth year under irrigation unless nitrogen and phosphate are used.

Engineers of the soil conservation district or other qualified agencies can help plan a conservation irrigation system.

CAPABILITY UNIT: IIIe-3, DRYLAND FARMING OR IRRIGATION

This unit consists of dark-brown to reddish-brown loams with slopes of 1 to 3 percent. The soils in this unit are:

Amarillo loam, 1 to 3 percent slopes.
Berthoud loam, 1 to 3 percent slopes.
Olton loam, 1 to 2 percent slopes.
Portales loam, 1 to 3 percent slopes.
Zita loam, 1 to 2 percent slopes.

The acreage of these soils makes up only about 4 percent of the county. About 90 percent of the acreage is cultivated; 10 percent of this is dry-farmed. These soils are well suited to cultivation and are productive if properly managed. Most crops suited to the area grow well on them.

Cotton is the main cash crop grown on these soils. Grain sorghum and small grains are grown as cash crops and to produce large amounts of crop residues for control of wind erosion. Legumes, such as vetch, sweetclovers, cowpeas, and alfalfa, can be included in cropping systems under irrigation.

The soils in this unit have a high capacity for holding plant nutrients and moisture. On cultivated areas, the hazard of water erosion is moderate, and that of wind erosion is slight. To offset the erosion hazard, most successful farmers manage these soils by using a cropping system that will (1) maintain a high content of organic matter, (2) maintain cover, roughness, and cloddiness to control wind erosion, and (3) control runoff.

Dryland farming.—A properly managed crop that produces much residue should be grown about 2 years in 3 on areas of these soils that are dry-farmed. It will help to control erosion and to maintain the content of organic matter. During or following years of low rainfall, when little crop residue is produced, chiseling or listing can be used to make the soil cloddy and rough. Such practices will help control wind erosion.

Water conservation is most important on these soils. Terraces and contour farming will help to control water erosion and will also save valuable moisture. Terracing and contouring are accepted practices on these soils. Farmers have learned from experience that saving soil moisture is absolutely necessary for profitable yields.

Irrigation.—A crop that produces much residue should be grown about half of the time on irrigated areas. A deep-rooted legume, such as alfalfa or sweetclover, should be grown in the cropping system to keep the soils in good condition. Growing perennial grasses in a long-time rotation will also help. Fertilizers should be used in amounts determined by soil tests and crop needs.

Engineers of the soil conservation district, or other qualified engineers, can help design a conservation irrigation system.

CAPABILITY UNIT: IVe-4, DRYLAND FARMING; IIIe-4, IRRIGATION

These are deep, light-colored, sandy soils with slopes of 0 to 3 percent. They are:

Amarillo loamy fine sand, 0 to 3 percent slopes.
Zita loamy fine sand, overblown.

The acreage of these soils makes up less than 5 percent of the county. Nearly 90 percent of the acreage is cultivated, and about half of this is irrigated.

These soils are highly susceptible to wind erosion. Although they are best suited to perennial vegetation, they can be farmed and protected by (1) maintaining a continuous cover of either living or dead vegetation, (2) increasing the clay content of the surface soil by deep plowing, and (3) fertilizing in amounts determined by soil tests and crop needs.

These soils have a low capacity to hold water and plant nutrients in the sandy surface soil. Under irrigation they will become low in fertility much sooner than the less sandy soils.

Dryland farming.—A close-spaced crop grown every year will generally provide enough residue to stubble mulch for control of wind erosion. The crop should be one that produces much residue. Deep plowing will increase the clay content of the surface layer and make emergency tillage more effective in controlling soil blowing.

Cowpeas or mungbeans, interplanted with grain sorghum, or vetch intersown with small grains, will help to maintain the nitrogen supply.

Irrigation.—If these soils are irrigated, a more intensive cropping system may be used. Irrigation helps assure the production of adequate stubble for control of wind erosion and increases the stabilizing effect of emergency tillage. Farmers have found that they can grow a clean-tilled crop, such as cotton, about one-third of the time and still control wind erosion.

These soils need commercial fertilizers to maintain production under irrigation. Sprinkler irrigation is the only kind suited to these soils (fig. 12). Engineers of the soil conservation district or other qualified agencies can design a conservation irrigation system for these soils.

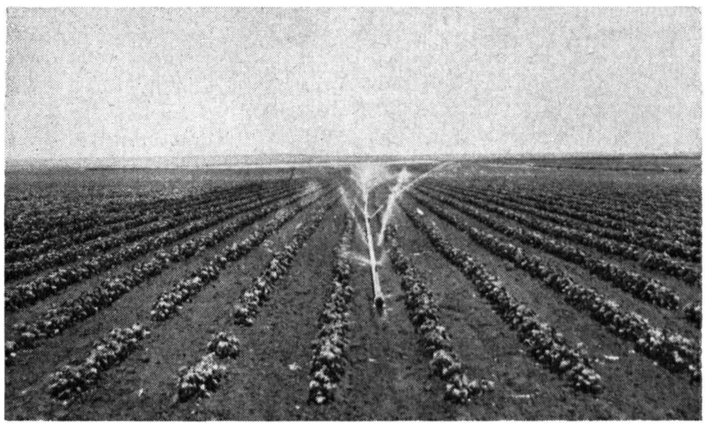

***Figure 12.*—Sprinkler irrigation of cotton on Amarillo loamy fine sand, 0 to 3 percent slopes.**

CAPABILITY UNIT: IVe-5, DRYLAND FARMING; IIIe-5, IRRIGATION

This unit consists of reddish-brown to grayish-brown loams and fine sandy loams. The soils are shallow and have slopes of 0 to 3 percent.

Arvana fine sandy loam, shallow, 0 to 1 percent slopes.
Arvana fine sandy loam, shallow, 1 to 3 percent slopes.
Mansker loam, 0 to 1 percent slopes.
Mansker loam, 1 to 3 percent slopes.
Mansker fine sandy loam, 0 to 1 percent slopes.
Mansker fine sandy loam, 1 to 3 percent slopes.

The acreage of these soils makes up 2 percent of the county. About 80 percent of the acreage is cultivated, and about 40 percent of this is farmed as dryland.

The major limitation of these soils under cultivation is their shallow depth that restricts their capacity to hold water and plant nutrients. These soils are subject to moderate wind erosion. Because of their limited water-holding capacity, they are often droughty and produce little stubble for control of wind erosion.

Some grain sorghum and small grain are grown. Cowpeas, vetch, and sweetclovers are suitable legumes on irrigated areas. Some cotton is also grown under irrigation.

Dryland farming.—For the protection of the soil under dryland farming, only perennial grasses or close-spaced crops that produce much residue should be grown. Stubble mulching should be used to help control wind erosion.

Irrigation.—A more intensive cropping system may be used on irrigated areas than on dryland. Also, a clean-tilled crop, such as cotton, can be grown about every third year without depleting fertility or causing erosion. The soil should be fertilized in amounts determined by soil tests.

Because of limited water-holding capacity, these soils require smaller and more frequent waterings than soils of other groups. Irrigation is therefore more costly.

CAPABILITY UNIT: IVe-1, DRYLAND FARMING; IIIe-6, IRRIGATION

These are grayish soils that are high in lime. Slopes range from 0 to 3 percent. The soils are:

Arch loam.
Arch fine sandy loam.
Church clay loam.
Drake soils, 1 to 3 percent slopes.

The acreage of these soils makes up only about 1 percent of the county. About 35 percent of the acreage is cultivated; 85 percent of this is irrigated. These soils are poorly suited to dryland farming. They are only moderately well suited to cultivated crops when irrigated. The better suited crops are legumes or perennial grasses.

Grain sorghum and small grains are the main crops grown on these soils. Cotton and alfalfa are sometimes grown under irrigation.

These soils are highly susceptible to wind erosion. The hazard of water erosion is slight. The high content of lime makes some of the iron in these soils unavailable, as is shown by the frequent yellowing of sorghum.

Dryland farming.—A close-spaced crop that produces much residue is needed each year to protect these soils under dryland farming. Stubble mulching should be used to prevent erosion, or perennial grasses may be planted.

Irrigation.—In irrigated areas of these soils, it is possible to grow a clean-tilled crop, such as cotton, 1 year in 3 and still maintain enough stubble to prevent soil blowing. Alfalfa produces fair yields, though it requires frequent watering.

The high lime content of these soils makes the banding of fertilizer important.

CAPABILITY UNIT: IVe-2, DRYLAND FARMING OR IRRIGATION

This unit consists of a grayish-brown loam with slopes of 3 to 5 percent. The soil in this unit is:

Berthoud loam, 3 to 5 percent slopes.

This soil has a very small total acreage. Most of it is rangeland; none is now farmed as dryland.

The soil is poorly suited to cultivation because of its steep slopes. It is highly susceptible to water erosion. Perennial grasses are much better suited than cultivated crops.

Dryland farming.—If this soil is dry-farmed, a close-spaced or sown crop that produces much residue should be grown each year. Stubble mulching helps to control wind erosion. Contouring and terracing are needed to help control water erosion and to conserve moisture.

Irrigation.—Perennial grasses and legumes should be grown in irrigated areas. Annual crops, however, may be grown 2 years in 7. Fertilizers should be used in amounts determined by soil tests and crop needs. A conservation irrigation system is needed. Stubble mulching helps to control wind erosion.

CAPABILITY UNIT: IVe-3, DRYLAND FARMING OR IRRIGATION

This unit consists of reddish-brown to grayish-brown, moderately sandy soils with slopes of 3 to 5 percent. The soils in this unit are:

Amarillo fine sandy loam, 3 to 5 percent slopes.
Berthoud fine sandy loam, 3 to 5 percent slopes.
Springer fine sandy loam, hummocky.

The acreage of these soils makes up less than 2 percent of the county. About 60 percent of the acreage is cultivated, and about half of this is irrigated.

These soils are poorly suited to cultivation because of their steep slopes. They are much better suited to perennial grasses. They are highly susceptible to water erosion. The hazard of wind erosion is moderate.

Dryland farming.—If the soils in this group are dry-farmed, a sown crop that produces large amounts of residue should be grown each year. Stubble mulching aids in control of erosion. Terracing and contouring are needed to help control water erosion and to conserve moisture.

Irrigation.—If the soils are irrigated, a close-spaced crop that produces much residue should be grown each year, or perennial grasses should be drilled on the contour. Fertilizer needs should be determined by soil tests.

Engineers of the soil conservation district or other qualified agencies can help design a conservation irrigation system for these soils.

CAPABILITY UNIT: VIe-1, WITHOUT IRRIGATION; IVe-6, IRRIGATION

These are grayish-brown, calcareous soils with short, steep slopes of 3 to 5 percent. The soils are:

Drake soils, 3 to 5 percent slopes.
Mansker loam, 3 to 5 percent slopes.
Mansker fine sandy loam, 3 to 5 percent slopes.

The acreage of these soils makes up less than 1 percent of the county. About 60 percent of the acreage is cultivated, and half of this is irrigated. These soils are best suited to native vegetation. If the soils are cultivated, it is best to establish either native or imported perennial grasses. Water erosion is the major hazard on these soils. The hazard of wind erosion is moderate.

Dryland farming.—These soils are not suited to dryland farming.

Irrigation.—With careful management, perennial grasses and close-spaced crops that produce much residue can be successfully grown under irrigation. The soils in this group should be fertilized in amounts determined by soil tests and crop needs. Engineers of the soil conservation district or other qualified agencies can help design a conservation irrigation system.

CAPABILITY UNIT: VIe-2, WITHOUT IRRIGATION; IVe-7, IRRIGATION

These are light-colored, deep sandy soils with slopes of 0 to 5 percent. The soils are:

Arch loamy fine sand, overblown.
Brownfield fine sand, thick surface.
Likes loamy fine sand, undulating.
Portales loamy fine sand, overblown.
Springer loamy fine sand, hummocky.

The acreage of these soils makes up about 7 percent of the county. Only about 10 percent of the acreage is cultivated; half of this is irrigated.

These soils are not suited to dryland farming. They are well suited to the tall native grasses. Under irrigation these soils are used for limited production of grain sorghum and small grains and also for various close-spaced crops or sown perennial grasses.

These soils are very highly susceptible to wind erosion and have a low capacity to hold water and plant nutrients. If they are cultivated under irrigation, close-spaced crops that produce much residue should be grown each year to maintain adequate stubble for control of wind erosion. Deep plowing to increase the clay content of the thick, sandy surface is not practical. Fertilizers are needed to maintain production. Sprinkler irrigation is the only type suitable.

CAPABILITY UNIT: IVw-1

This unit consists of playa beds that have a sandy surface soil. The soil in this unit is:

Randall fine sandy loam.

This soil is very limited in area. It is seldom completely covered by water. After heavy rains, the surface layer is normally dry within a week.

This soil can be successfully cultivated except during years of very high rainfall. Most of the acreage is used to grow cotton and grain sorghum. Generally, these crops produce high yields.

CAPABILITY UNIT: VIe-3

This unit consists of calcareous, deep, and shallow soils with slopes of 5 to 8 percent. The soils in this unit are:

Berthoud fine sandy loam, 5 to 8 percent slopes.
Mansker loam, 5 to 8 percent slopes.
Mansker fine sandy loam, 5 to 8 percent slopes.

The acreage of these soils makes up less than 1 percent of the county. These soils are used mainly for range. Because the hazard of water erosion is high, they are best suited to native vegetation.

More information on the use of these soils for range is given in the section "Range Management."

CAPABILITY UNIT: VIe-5

This unit consists of high-lime soils with slopes of 5 to 20 percent. The soils in this unit are:

Drake soils, 5 to 20 percent slopes.

Because of the high hazard of water and wind erosion, these soils are unsuited to cultivation. Under range conditions, they should be managed with care to prevent erosion.

More information on the use of these soils for range is given in the section "Range Management."

CAPABILITY UNIT: VIw-1

This unit comprises dark, very heavy, poorly drained playa beds. The soil in this unit is:

Randall clay.

The acreage of this soil makes up about 2 percent of the county. Frequent flooding by runoff from the surrounding areas makes farming hazardous. Some areas can be farmed during long dry spells, or if the outside water is controlled.

CAPABILITY UNIT: VIIe-1

This unit consists of a light-colored, deep, sandy soil often referred to as the sandhills. The soil in this unit is:

Tivoli fine sand.

586762—62——3

The acreage of this soil makes up about 6 percent of the county. Because of the very high hazard of wind erosion, Tivoli fine sand is not suited to cultivation. This soil produces tall grasses because it lacks runoff and has a high percentage of available moisture. More information on the use of this soil for range is given in the section "Range Management."

CAPABILITY UNIT: VIIs-1

This unit consists of very shallow, gently sloping to steep soils. The soils in this unit are:

Kimbrough soils.
Potter soils, 1 to 8 percent slopes.
Potter soils, 8 to 30 percent slopes.

The acreage of these soils makes up about 1 percent of the county. The very shallow depth (less than 10 inches) makes these soils unsuited to cultivation. Range supports limited vegetation and needs careful management to prevent soil loss.

The section "Range Management" contains more information on the use of these soils for range.

CAPABILITY UNIT: VIIIe-1

This unit consists of a miscellaneous land type consisting of unstabilized deep sand. This land type is:

Active dunes.

This land type is susceptible to continuous blowing. It is suitable only for wildlife or as a site for recreation. It should be fenced to prevent grazing by livestock.

Estimated Yields

The yields of any soil reflect the management that the soil has had. Consistently high yields on a particular soil indicate that the soil has been properly managed. Soil that is properly managed is also being conserved and improved.

The farmers of Lamb County, as elsewhere, farm under various levels of management. Crop yields are influenced by soil management.

Table 3 shows estimated average yields per acre for principal crops grown under two levels of management. In columns A are yields produced under a low level of management on dryland and irrigated soils. In columns B are yields produced under a high-level of management on dryland and irrigated soils.

The practices used on dryland under a low level of management are as follows:

1. Tillage alone is depended on to control wind erosion.
2. No particular effort is made to conserve water.
3. Soil-building crops are not used in the cropping system.

The practices used on irrigated soils under a low level of management are as follows:

1. No effort is made to save rainfall.
2. Crop residues are turned under.
3. Erratic irrigation is used with little regard for crop needs.
4. Fertilizer is not used or is used in a haphazard way.

Practices used on dryland under a high level of management are as follows:

1. Moisture that falls on the land is saved.
2. The fertility of the soil is improved, and crops producing much residue are grown in the cropping system.
3. Crop residues are used to help control wind erosion.

The practices used on irrigated soils under a high level of management are as follows:

1. A conservation irrigation system is used to save all rainfall and supply water according to crop needs.
2. Fertilizers are used in amounts determined by soil analysis and crop needs.
3. Crop residues are used to help control wind erosion.
4. The fertility of the soil is improved, and crops producing much residue are grown in the cropping system.

Nearly all the farmers of Lamb County use a high level of insect, disease, and weed control.

Range Management [2]

In Lamb County, ranching ranks second to irrigation and dryland farming. About twenty-one percent of the farm and ranch land is used for range. This range is in four major land areas. The largest of these is a narrow belt of sandhills running east and west through the central part of the county. The second largest area occurs in the south-central part of the county and includes two large saline lakes plus the land area adjacent to the lakes. The third takes in two large draws in the central and northeastern part of the county. The remaining range occurs as isolated playa lakes and adjoining dunes throughout the county. These playa lakes and dunes range from 25 to 150 acres in size and are used as small pastures on farms.

At present there are 22 ownerships considered as ranching units. These consist primarily of cow-calf operations. Several feedlots of various sizes are located throughout the county. A total of 8,000 to 12,000 calves are fattened on these lots each year.

Principles of range management

High production of forage and conservation of soil, water, and plants are obtained by maintenance of range already in good and excellent condition and by improvement of native vegetation. Vegetation is improved by managing the grazing so as to encourage the growth of the better native forage plants and to increase their number. Where native stands have been destroyed or depleted by overuse, drought, and selective grazing, suitable plants must be introduced.

Leaf development, root growth, flower-stalk formation, seed production, forage regrowth, and food storage in the roots are essential stages in the development and

[2] This section by JOE B. NORRIS, range conservationist, Soil Conservation Service.

Table 3.—*Estimated average yields per acre for principal crops under two levels of management*

[Soils omitted from table are not suited to cultivation, and therefore no yield data are available]

Soil	Capability unit		Dryland				Irrigated			
	Dryland	Irrigated	Cotton (lint)		Grain sorghum		Cotton (lint)		Grain sorghum	
			A	B	A	B	A	B	A	B
			Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Amarillo fine sandy loam, 0 to 1 percent slopes.	IIIe-2	IIe-2	145	175	800	1, 200	650	850	4, 000	7, 000
Amarillo fine sandy loam, 1 to 3 percent slopes.	IIIe-1	IIIe-1	120	140	600	900	550	750	3, 000	5, 000
Amarillo fine sandy loam, 3 to 5 percent slopes.	IVe-3	IVe-3	85	([1])	300	500	350	([1])	1, 500	3, 200
Amarillo loam, 0 to 1 percent slopes	IIIce-1	IIe-1	140	170	800	1, 100	650	850	4, 000	7, 000
Amarillo loam, 1 to 3 percent slopes	IIIe-3	IIIe-3	120	140	600	800	550	750	3, 000	5, 000
Amarillo loamy fine sand, 0 to 3 percent slopes.	IVe-4	IIIe-4	125	([1])	700	900	525	700	3, 000	5, 000
Arch fine sandy loam	IVe-1	IIIe-6	85	([1])	450	560	400	500	1, 900	2, 400
Arch loam	IVe-1	IIIe-6	85	([1])	450	560	400	500	1, 900	2, 400
Arch loamy fine sand, overblown	VIe-2	IVe-7	75	([1])	300	([1])	400	([1])	1, 400	2, 800
Arvana fine sandy loam, 0 to 1 percent slopes	IIIe-2	IIe-2	135	160	775	1, 050	575	750	3, 500	6, 000
Arvana fine sandy loam, 1 to 3 percent slopes	IIIe-1	IIIe-1	115	135	580	800	500	650	2, 800	4, 500
Arvana fine sandy loam, shallow, 0 to 1 percent slopes.	IVe-5	IIIe-5	75	([1])	475	580	370	475	2, 300	2, 700
Arvana fine sandy loam, shallow, 1 to 3 percent slopes.	IVe-5	IIIe-5	65	([1])	465	570	340	465	2, 250	2, 650
Berthoud fine sandy loam, 1 to 3 percent slopes.	IIIe-1	IIIe-1	110	130	575	750	500	625	2, 600	4, 200
Berthoud fine sandy loam, 3 to 5 percent slopes.	IVe-3	IVe-3	85	([1])	285	470	350	([1])	1, 500	2, 800
Berthoud loam, 1 to 3 percent slopes	IIIe-3	IIIe-3	115	135	550	750	500	625	2, 700	4, 200
Berthoud loam, 3 to 5 percent slopes	IVe-2	IVe-2	80	([1])	285	470	350	([1])	1, 500	2, 800
Brownfield fine sand, thick surface	VIe-2	IVe-7	80	([1])	300	([1])	350	([1])	1, 800	3, 500
Church clay loam	IVe-1	IIIe-6	70	([1])	400	500	425	550	2, 400	3, 000
Drake soils, 1 to 3 percent slopes	IVe-1	IIIe-6	65	([1])	400	500	375	475	1, 800	2, 300
Drake soils, 3 to 5 percent slopes	VIe-1	IVe-6	50	([1])	350	([1])	300	([1])	900	1, 200
Lea clay loam	IIIce-1	IIe-1	140	160	800	1, 000	575	800	2, 700	6, 000
Likes loamy fine sand, undulating	VIe-2	IVe-7	80	([1])	300	([1])	350	([1])	1, 400	2, 800
Lofton clay loam	IIIce-1	IIe-1	140	165	800	1, 000	575	850	3, 700	7, 000
Lubbock fine sandy loam	IIIe-2	IIe-2	150	180	900	1, 350	650	850	4, 000	7, 000
Mansker fine sandy loam, 0 to 1 percent slopes.	IVe-5	IIIe-5	75	([1])	525	630	425	550	2, 400	3, 000
Mansker fine sandy loam, 1 to 3 percent slopes.	IVe-5	IIIe-5	65	([1])	515	610	400	500	2, 350	2, 900
Mansker fine sandy loam, 3 to 5 percent slopes.	VIe-1	IVe-6	50	([1])	400	([1])	300	([1])	900	1, 200
Mansker loam, 0 to 1 percent slopes	IVe-5	IIIe-5	80	([1])	500	600	425	550	2, 400	3, 000
Mansker loam, 1 to 3 percent slopes	IVe-5	IIIe-5	70	([1])	500	600	400	500	2, 350	2, 900
Mansker loam, 3 to 5 percent slopes	VIe-1	IVe-6	50	([1])	400	([1])	300	([1])	900	1, 200
Olton loam, 0 to 1 percent slopes	IIIce-1	IIe-1	140	165	800	1, 000	650	850	4, 000	7, 000
Olton loam, 1 to 2 percent slopes	IIIe-3	IIIe-3	115	135	600	775	550	750	3, 000	5, 000
Portales fine sandy loam, 0 to 1 percent slopes	IIIe-2	IIe-2	130	160	750	1, 050	550	725	3, 500	5, 900
Portales fine sandy loam, 1 to 3 percent slopes	IIIe-1	IIIe-1	110	130	575	750	500	625	2, 600	4, 100
Portales loam, 0 to 1 percent slopes	IIIce-1	IIe-1	135	160	700	900	560	780	3, 500	6, 000
Portales loam, 1 to 3 percent slopes	IIIe-3	IIIe-3	115	135	550	750	500	625	2, 700	4, 200
Portales loamy fine sand, overblown	VIe-2	IVe-7	85	([1])	350	([1])	400	([1])	1, 600	3, 300
Randall fine sandy loam	IVw-1	IVw-1	145	([1])	900	1, 300	600	([1])	4, 000	7, 000
Springer fine sandy loam, undulating	IIIe-1	IIIe-1	100	125	450	700	450	590	2, 400	4, 050
Springer fine sandy loam, hummocky	IVe-3	IVe-3	80	([1])	275	450	300	([1])	1, 500	3, 000
Springer loamy fine sand, hummocky	VIe-2	IVe-7	80	([1])	275	([1])	300	([1])	1, 500	3, 000
Spur fine sandy loam	IIIe-2	IIe-2	145	175	900	1, 300	650	850	4, 000	7, 000
Spur loam	IIIce-1	IIe-1	140	175	800	1, 100	670	900	4, 000	7, 000
Zita fine sandy loam, 0 to 1 percent slopes	IIIe-2	IIe-2	145	175	800	1, 200	650	850	4, 000	7, 000
Zita fine sandy loam, 1 to 3 percent slopes	IIIe-1	IIIe-1	120	140	600	900	550	750	3, 000	5, 000
Zita loam, 0 to 1 percent slopes	IIIce-1	IIe-1	140	170	800	1, 100	650	850	4, 000	7, 000
Zita loam, 1 to 2 percent slopes	IIIe-3	IIIe-3	120	140	600	900	550	750	3, 000	5, 000
Zita loamy fine sand, overblown	IVe-4	IIIe-4	125	([1])	700	900	525	700	3, 000	5, 000

[1] Crop not suitable because of the severe limitation of the soil or hazard to the soil if the crop is grown.

growth of grass. A maximum forage yield and high animal production are maintained by regulation of grazing to allow these natural processes of growth.

Livestock are selective in grazing and seek out the more palatable and nutritious plants. If grazing is not carefully regulated, the better plants are eventually eliminated. Second-choice plants will increase. If heavy grazing is continued, even the second-choice plants will be thinned out, and undesirable plants will take their place.

Research and the experience of ranchers have shown that continuous grazing of more than half the yearly volume of grass produced will damage plants so that they will not respond quickly to management. This damage can only be repaired by several years of intensive management. Intensive management permits full development of the root systems and, in turn, increases forage yields. If about half the grass produced yearly is left on the range, it has the following effect:

1. It produces litter or mulch on the soil surface and reduces surface crusting and evaporation of moisture. The infiltration rate and content of organic matter are increased, and available moisture is better utilized.
2. It protects the surface soil from wind and water erosion.
3. It allows established plants to form root systems that reach greater depths for water.
4. It provides a favorable seedbed for the growth of seedlings.
5. It reduces wide variations in soil temperatures. Grass can survive extremes in climate but does best when fluctuations are not so abrupt.
6. It increases food storage in roots for initial spring growth.
7. It provides a reserve of feed for dry periods that otherwise might force the sale of livestock.
8. It maintains the better plants in high vigor. Healthy plants furnish the most competition for invading plants.

The maintenance and improvement of suitable vegetation are essential in range management. A livestock program that is in balance with forage produced is also necessary. Severe droughts, snows, and other climatic extremes must be expected. Reserve pastures, stored feed, and a part of the herd kept readily salable are a buffer against low forage yields. Flexibility of the herd allows the rancher to adjust his management without permanently damaging grassland or selling breeding animals.

Range sites and condition classes

Different kinds of range produce different kinds and amounts of grass. To manage grassland properly, a rancher should know the various kinds of land, or range sites, in his holdings and the plants each site can grow. Management can then be used that will favor the growth of the best forage plants on each kind of land.

Range sites are kinds of rangeland that differ from one another in their ability to produce a significantly different kind or amount of climax, or original, vegetation (fig. 13). A significant difference is one that is great enough to require different grazing use or management to maintain or improve the present vegetation. Climax vegetation is the combination of plants that originally grew on a given site. The most productive combination of range plants on a site is generally the climax type of vegetation.

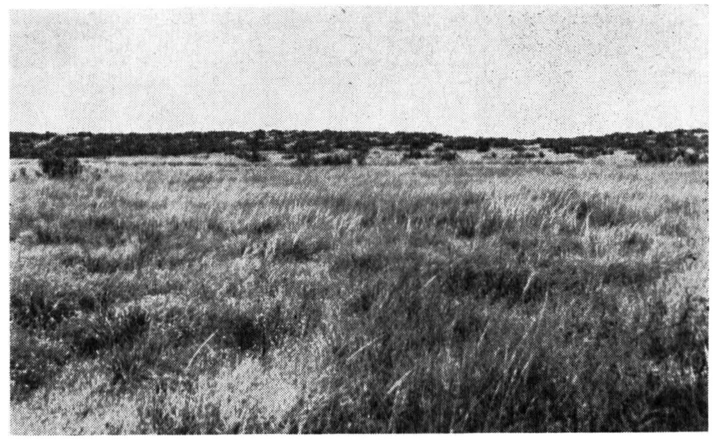

***Figure 13.*—High lime range site—good condition. Arch loam in foreground; Drake soils, 5 to 20 percent slopes, in background. Most of the grass is alkali sacaton.**

The six range sites in the county, the soils in each of them, the dominant plants in the climax vegetation, and the estimated amount of herbage that they will produce are given in table 4.

The Sandy Land range site will produce a wide variety of tall grasses when properly managed (fig. 14). The Deep Hardland and Mixed Land range sites support short and mid grasses. Inferior types of vegetation have invaded these range sites as a result of continued heavy use of the original forage. On the Sandy Land sites skunkbush, sand sagebrush, hackberry, catclaw, and numerous annuals are the principal invaders. Mesquite, yucca, and broom snakeweed have invaded depleted Deep Hardland and Mixed Land sites.

***Figure 14.*—Sandy Land range site—excellent condition. Brownfield fine sand, thick surface, in foreground; Tivoli fine sand in background. The tall grasses are Indiangrass, switchgrass, sand bluestem, and little bluestem.**

Range condition is classified by comparing the present vegetation with the climax vegetation on the site. Range condition is expressed as follows:

Condition class:	*Percentage of climax vegetation on the site*
Excellent	76–100
Good	51–75
Fair	26–50
Poor	0–25

TABLE 4.—*Soils, climax vegetation, estimated production, and acreage of the range sites in Lamb County*

Range site and soils [1]	Dominant climax vegetation	Estimated air-dry weight of herbage produced annually	Approximate acreage of site	General soil description
		Lbs. per acre		
Bottom Land Sp Spur fine sandy loam. Sr Spur loam.	Indiangrass, switchgrass, Canada wild-rye, side-oats grama, blue grama, vine-mesquite, and western wheatgrass; also alkali sacaton under saline conditions.	1,000–1,300	904	Deep, medium to moderately coarse textured dark-brown soils.
Sandy Land AmB Amarillo loamy fine sand, 0 to 3 percent slopes. As Arch loamy fine sand, overblown. Br Brownfield fine sand, thick surface. Lk Likes loamy fine sand, undulating. Pn Portales loamy fine sand, overblown. Sh Springer loamy fine sand, hummocky. Tv Tivoli fine sand. Zo Zita loamy fine sand, overblown.	Indiangrass, switchgrass, sand bluestem, little bluestem, New Mexico feathergrass, needle-and-thread grass, sand lovegrass, hairy grama, and silver bluestem.	600–1,000	81,765	Deep, coarse textured, moderate to rapidly permeable soils ranging in color from pale brown to brown.
Mixed Land AfA Amarillo fine sandy loam, 0 to 1 percent slopes. AfB Amarillo fine sandy loam, 1 to 3 percent slopes. AfC Amarillo fine sandy loam, 3 to 5 percent slopes. AvA Arvana fine sandy loam, 0 to 1 percent slopes. AvB Arvana fine sandy loam, 1 to 3 percent slopes. AxA Arvana fine sandy loam, shallow, 0 to 1 percent slopes. AxB Arvana fine sandy loam, shallow, 1 to 3 percent slopes. BeB Berthoud fine sandy loam, 1 to 3 percent slopes. BeC Berthoud fine sandy loam, 3 to 5 percent slopes. BeD Berthoud fine sandy loam, 5 to 8 percent slopes. Lu Lubbock fine sandy loam. MfA Mansker fine sandy loam, 0 to 1 percent slopes. MfB Mansker fine sandy loam, 1 to 3 percent slopes. MfC Mansker fine sandy loam, 3 to 5 percent slopes. MfD Mansker fine sandy loam, 5 to 8 percent slopes. PfA Portales fine sandy loam, 0 to 1 percent slopes. PfB Portales fine sandy loam, 1 to 3 percent slopes. Sf Springer fine sandy loam, undulating. Sg Springer fine sandy loam, hummocky. ZfA Zita fine sandy loam, 0 to 1 percent slopes. ZfB Zita fine sandy loam, 1 to 3 percent slopes.	Blue grama, side-oats grama, plains bristlegrass, and Arizona cottontop.	800–1,200	21,224	Shallow to deep, moderately coarse textured soils ranging in color from grayish brown to reddish brown.

See footnote at end of table.

TABLE 4.—*Soils, climax vegetation, estimated production, and acreage of the range sites in Lamb County*—Continued

Range site and soils [1]	Dominant climax vegetation	Estimated air-dry weight of herbage produced annually	Approximate acreage of site	General soil description
		Lbs. per acre		
Shallow Land	Blue grama, side-oats grama, little bluestem, New Mexico feathergrass, buffalograss, hairy grama, and black grama; small amounts of sand bluestem, switchgrass, and Canada wild-rye.	500–800	9,318	Shallow to very shallow, medium-textured brown soils.
Km Kimbrough soils.				
MkA Mansker loam, 0 to 1 percent slopes.				
MkB Mansker loam, 1 to 3 percent slopes.				
MkC Mansker loam, 3 to 5 percent slopes.				
MkD Mansker loam, 5 to 8 percent slopes.				
PsC Potter soils, 1 to 8 percent slopes.				
PsE Potter soils, 8 to 30 percent slopes.				
High Lime	Blue grama, side-oats grama, alkali sacaton, vine-mesquite, and giant and sand dropseed.	500–800	9,495	Moderately deep, fine to moderately coarse textured soils ranging in color from light gray to brown.
Ao Arch loam.				
An Arch fine sandy loam.				
Ch Church clay loam.				
DrB Drake soils, 1 to 3 percent slopes.				
DrC Drake soils, 3 to 5 percent slopes.				
DrE Drake soils, 5 to 20 percent slopes.				
Deep Hardland	Blue grama, side-oats grama, vine-mesquite, western wheatgrass, and buffalograss.	600–900	8,528	Deep, fine- to medium-textured soils ranging in color from grayish brown to reddish brown.
AlA Amarillo loam, 0 to 1 percent slopes.				
AlB Amarillo loam, 1 to 3 percent slopes.				
BhB Berthoud loam, 1 to 3 percent slopes.				
BhC Berthoud loam, 3 to 5 percent slopes.				
Le Lea clay loam.				
Lo Lofton clay loam.				
OtA Olton loam, 0 to 1 percent slopes.				
OtB Olton loam, 1 to 2 percent slopes.				
PmA Portales loam, 0 to 1 percent slopes.				
PmB Portales loam, 1 to 3 percent slopes.				
ZmA Zita loam, 0 to 1 percent slopes.				
ZmB Zita loam, 1 to 2 percent slopes.				

[1] Randall clay and Randall fine sandy loam are in the bottom of playa lakes and are included in range sites with adjoining lands. These two soils comprise 8,914 acres.

Ranges in good condition provide better soil and water conservation and greater forage yields. Ranges in poor condition need the most intensive conservation practices to restore desirable vegetation. As the range continues to improve, it responds more readily to management. Knowledge of range sites and range condition classes helps ranchers determine the value and needs of the range.

Range practices

Range practices and a range management program should be based on the needs of the land. The program should take into account specific sites and, particularly, specific range conditions.

Management practices that improve range vegetation, that cost little to apply, and that are needed on all rangeland, regardless of other practices used, are defined as follows:

Proper range use.—This is the rate of grazing that will maintain adequate residues for soil and water conservation. In addition, the quality of vegetation that has deteriorated is improved by this practice (fig. 15). Proper range use is necessary on all rangelands, regardless of the type of vegetation now grown.

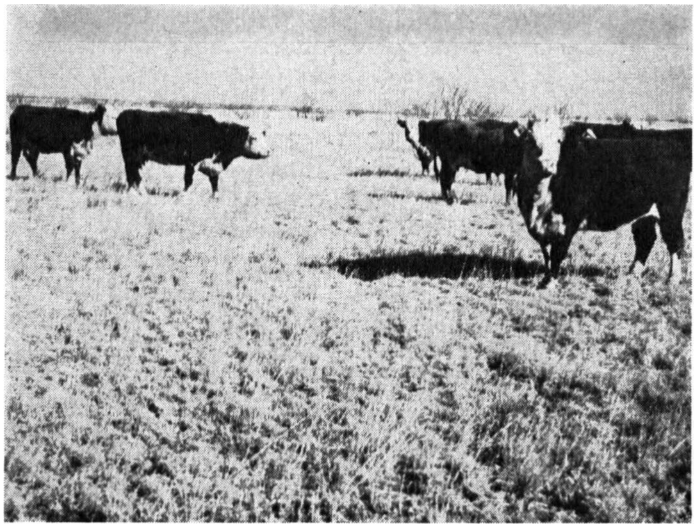

***Figure 15.*—Deep Hardland range site in excellent condition on Olton loam, 0 to 1 percent slopes. Proper range use is practiced. The short grass is blue grama.**

Deferred grazing.—This is the postponement of grazing on a range to increase the vigor of the forage or to permit the desirable plants to reproduce naturally by seed. In addition, deferred grazing will build up a reserve of forage for later use.

Salting.—Salting at different places periodically will improve grazing distribution. Salt should normally be located away from water, roads, or other well-traveled areas. These salting locations draw livestock into areas that are not frequently grazed because of their topography, lack of water, or odd shape.

Supplemental feeding.—This practice is needed during the winter or when the supply of forage is low. Supplemental feeding should be away from water or salting areas. As with salting, the feeding places should be progressively distributed so that the vegetation will not be depleted in any one area.

Chemical or mechanical control of undesirable plants.—This is one of the most important improvement practices. It has the following advantages: (1) Moisture that was used by undesirable plants is released for the remaining vegetation; (2) desirable seedbeds are prepared when mechanical control is used; and (3) livestock handling is made easier.

Range seeding.—This is the establishment of perennial or improved reseeding grasses to prevent the loss of soil and water and to restore ranges or lands converted from other use. Native grassland is seeded, following preparation of seedbeds, by broadcasting or by suitable drills.

A different method is used to establish perennial grasses on cropland. During the year before seeding, an annual crop of sudan or forage sorghum is drilled or broadcast. This crop should not be allowed to mature seed. During the following year, the desired grasses are drilled or row planted in the undisturbed, dead cover, which, if properly managed, creates a mulch. This mulch holds moisture near the surface of the soil, reduces high temperatures, and helps to prevent surface crusting.

Unlike annual crops, perennial grasses have a different method of growth and require more intensive seedbed preparation. After they are established, perennial grasses need management for maintenance and improvement.

Water developments.—A sound range conservation plan should include adequate water locations and fencing. If possible, water should be so located over the entire range that livestock will not have to go too far. Good distribution of water helps achieve uniform use of the range. Generally, wells, ponds, developed springs, and pipelines furnish water for livestock. In some places water must be hauled. The nature of each range determines which type of water development is the most practical.

Fencing.—Fences should be constructed to provide for good livestock and range management. Different kinds of stock may need separation, and sites may have to be provided for seasonal use. In some places range sites that are large enough and have enough differences should be fenced separately.

The determination of range sites and range conditions is a specialized procedure. Considerable knowledge of range management is needed to prepare a good plan for ranch operations.

Engineering Applications [3]

The information in this section may be helpful in planning and making estimates of various engineering construction jobs. *It will not eliminate, however, the need for sampling and testing for design and construction of specific engineering works.*

Information in this report can be used to:

1. Make soil and land use studies that will aid in the selection and development of industrial, business, residential, and recreational sites.
2. Make preliminary estimates of the engineering properties of soils in the planning of agricultural structures, such as farm ponds, irrigation systems, and soil and water conservation practices.
3. Make preliminary evaluations of soil and ground conditions that will aid in the selection of highway and airport locations and in planning detailed soil investigations of the selected locations.
4. Locate probable sources of topsoil and other construction material for use in structures.
5. Correlate performance of engineering structures with soil mapping units and thus develop information that will be useful in designing and maintaining the structures.
6. Determine the suitability of soils for the cross-county movement of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs in order to make maps and reports that can be used readily by engineers.

[3] This section by Y. E. McAdams, area engineer, Soil Conservation Service, Lubbock, Tex.

8. Develop other preliminary estimates for construction purposes in the particular area.
9. Select locations for pipelines.

Some of the terms used by the soil scientist may have a significance in engineering. These terms may be unfamiliar to the engineer and are defined in the Glossary.

Engineering Classification Systems

Most highway engineers classify soil materials according to the system approved by the American Association of State Highway Officials (*1*). In this system soil materials are classified in seven principal groups. The groups range from A–1, in which are gravelly soil of high bearing capacity, to A–7, which consists of clay soil having a low strength when wet. In each group the relative engineering value of the soil material is indicated by a group index number. Group indexes range from 0 for the best material to 20 for the poorest. The group index number is shown in parentheses following the soil group symbol in the next to last column in table 5.

Some engineers prefer to use the Unified soil classification system (*13*). In this system soil materials are divided into 15 classes: 8 classes are for coarse-grained materials (GW, GP, GM, GC, SW, SP, SM, SC), 6 for fine-grained materials (ML, CL, OL, MH, CH, OH), and 1 for highly organic material (Pt). Mechanical analyses are used to determine the GW, GP, SW, and SP classes of material; mechanical analyses, liquid limit, and plasticity index are used to determine GM, GC, SM, SC, and fine-grained soils. The soils of the county have been classified only in the SP, SM, SC, ML, CL and CH classes of material (see table 6).

TABLE 5.—*Test*

Soil	Texas report number	Depth	Horizon	Percentage of fraction passing sieve [2]— No. 4 (4.76 mm.)	Percentage of fraction passing sieve [2]— No. 10 (2.0 mm.)
Amarillo fine sandy loam:		*Inches*			
2.0 miles northwest of Sudan; 2,000 feet east and 900 feet south of the northwest corner of labor 2, league 217. (Modal profile.)	58–306–R	0–11	A_1		100
	58–307–R	11–27	B_2		
	58–308–R	38–56	C_{ca}	76	72
2.0 miles west and 1 mile south of Bainer; 600 feet east and 1,000 feet south of northwest corner labor 20, league 686.	58–320–R	0–9	A_1		
	58–321–R	12–26	B_2		100
	58–322–R	42–72	C_{ca}	97	95
3 miles west and 2 miles north of Littlefield; 200 feet west and 50 feet south of northeast corner labor 5, league 663.	58–299–R	0–8	A_p		100
	58–300–R	8–17	B_{21}		100
	58–301–R	28–54	B_3	99	98
Amarillo loam:					
2 miles north, 1 mile west of Olton; 900 feet west and 150 feet north of southeast corner section 13, block A. (Modal profile.)	58–310–R	0–10	A_p		
	58–311–R	10–32	B_{21} and B_{22}		
	58–312–R	56–80	C_{ca}	98	97
3 miles east of Littlefield, 800 feet south and 60 feet east of northwest corner labor 3, league 671.	58–325–R	0–12	A_p		100
	58–326–R	12–25	B_2		100
	58–327–R	37–66	C_{ca}	98	96
3 miles east and 2 miles south of Littlefield; 800 feet east and 100 feet south of northwest corner labor 17, league 671.	58–328–R	0–11	A_p		100
	58–329–R	11–21	B_2		100
	58–330–R	26–70	C_{ca}	99	98
Brownfield fine sand:					
4 miles south and 3 miles west of Springlake; 1,800 feet south and 50 feet west of northeast corner labor 1, league 240. (Modal profile.)	58–331–R	0–28	A_1		100
	58–332–R	28–55	B_2		100
12 miles north and 1 mile west of Littlefield; 900 feet west and 3,300 feet north of southeast corner of section 17, league 244.	58–315–R	0–16	A_1		100
	58–316–R	16–28	B_2		
	58–317–R	37–77	B_{2b}		
5 miles north of Fieldton; 2,300 feet south and 50 feet east of northwest corner section 7, block 05.	58–313–R	0–18	A_1		100
	58–314–R	18–38	B_2		100

See footnotes at end of table.

Soil Test Data and Engineering Properties of the Soils

The Bureau of Public Roads and the Texas State Highway Department have furnished some data on seven soils of the Amarillo, Brownfield, Portales, and Randall series. This data is given in table 5.

Brief descriptions of all the soils in Lamb County and estimates of properties that are significant to engineering are given in table 6.

In table 6 the Unified and AASHO classifications for the Amarillo, Brownfield, Portales, and Randall soils were based on test data in table 5. These classifications for the Mansker soils in table 6 were based on data furnished by the Bureau of Public Roads from samples from Lynn County, Tex. Classifications for the rest of the soils were based on data from field tests or from the soil survey reports of Dawson, Hansford, and Lynn Counties (*10, 11, 12*).

Permeability, as shown in table 6, was estimated for the soil material as it occurs without compaction.

The available water capacity in inches per foot of depth is an estimate of the capillary water when the soil is wet to field capacity. This amount of water will wet the soil material when the soil is air dry to a depth of 1 foot without deeper percolation.

The shrink-swell potential indicates the degree of volume change to be expected.

Dispersion for all the soils was estimated from experience of local personnel of the Soil Conservation Service.

Additional information for the engineering section was based on experience of the personnel of the Bureau of Public Roads, the Texas State Highway Department, and local representatives of the Soil Conservation Service.

data on seven soils [1]

Percentage of fraction passing sieve [2]—Con.		Grain diameter percentage smaller than [2]—			Liquid limit	Plasticity index	Volume change	Classification	
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.				AASHO [3]	Unified [4]
							Percent		
99	52	42	18	15	24	7	10.9	A-4(3)	ML-CL.
100	60	54	33	28	35	19	18.6	A-6(9)	CL.
68	46	43	29	22	30	14	10.9	A-6(3)	SC.
100	50	36	16	14	22	5	10.9	A-4(3)	SM-SC.
99	62	53	33	28	37	20	24.4	A-6(9)	CL.
90	66	64	52	37	26	12	9.3	A-6(7)	CL.
95	42	34	13	11	19	5	7.5	A-4(1)	SM-SC.
97	45	38	21	20	29	14	5.4	A-6(3)	SC.
97	61	54	29	26	32	17	20.6	A-6(8)	CL.
100	51	44	22	20	25	10	12.9	A-4(3)	CL.
100	67	60	34	32	35	18	24.4	A-6(10)	CL.
95	74	68	48	35	30	15	9.4	A-6(10)	CL.
99	67	57	26	23	31	14	22.2	A-6(8)	CL.
99	72	65	39	35	41	22	34.0	A-7-6(12)	CL.
93	66	57	34	28	30	16	15.2	A-6(9)	CL.
99	62	53	30	22	29	13	12.7	A-6(7)	CL.
99	71	64	39	34	40	20	27.9	A-6(11)	CL.
94	64	62	34	28	32	18	14.9	A-6(9)	CL.
98	10	8	6	6	22	2	0.0	A-2-4(0)	SM-SP.
99	44	39	26	24	33	18	14.3	A-6(4)	SC.
99	9	8	4	3	23	4	16.7	A-2-4(0)	SP-SC.
100	31	29	20	18	27	12	7.0	A-2-6(0)	SC.
100	43	37	25	23	30	15	10.7	A-6(3)	SC.
99	9	5	3	3	24	4	0.0	A-2-4(0)	SP-SC.
99	37	35	24	23	30	15	8.8	A-6(2)	SC.

TABLE 5.—*Test data*

Soil	Texas report number	Depth	Horizon	Percentage of fraction passing sieve [2]— No. 4 (4.76 mm.)	Percentage of fraction passing sieve [2]— No. 10 (2.0 mm.)
Portales fine sandy loam:		*Inches*			
1 mile south and 1 mile west of Bainer; 800 feet west and 300 feet north of southeast corner labor 14, league 687. (Modal profile.)	58-323-R	0–12	A_1	----------	100
	58-324-R	36–72	C_{ca}	95	87
3 miles north and 1 mile east of Littlefield; 1,200 feet west and 30 feet south of northeast corner labor 7, league 658.	58-304-R	0–11	A_p	----------	100
	58-305-R	30–70	C_{ca}	----------	----------
3 miles west and 2 miles north of Littlefield; 1,000 feet west and 50 feet south of northeast corner labor 5, league 663.	58-302-R	0–11	A	99	99
	58-303-R	30–66	C_{ca}	95	91
Randall clay:					
.5 mile south of Olton. 500 feet west and 300 feet south of center of section 34, block 02. (Modal profile.)	58-309-R	10–23	A_{12}	----------	100
South edge of Littlefield city limits; 900 feet east and 500 feet south of northwest corner labor 2, league 673.	58-297-R	11–29	A_{12}	----------	----------
	58-298-R	50–68	AC_2	----------	----------
Randall fine sandy loam:					
11 miles north of Littlefield; 300 feet west and 200 feet south of northeast corner labor 8, league 635.	58-318-R	0–18	A_{11}	----------	----------
	58-319-R	18–35	A_{12}	----------	100
Amarillo loamy fine sand:					
1 mile southwest of Union School. 350 feet north and 100 feet east of the southwest corner of section 43, block T., Terry County, Tex. (Modal profile.)	58-393-R	0–16	A_p	----------	----------
	58-394-R	16–60	B_{21} and B_{22}	----------	----------
13 miles west and 16 miles north of Brownfield; 100 feet east and south of northwest corner of section 50, block D-11, Terry County, Tex.	58-405-R	0–8	A_p	----------	100
	58-406-R	18–60	B_{22}	----------	100
16 miles southeast of Brownfield, .25 mile west and 300 feet north of the southeast corner section 20, block C-41, Terry County, Tex.	58-411-R	0–22	A_p	----------	100
	58-412-R	22–48	B_2	----------	----------

[1] Data by the Bureau of Public Roads and the Texas Highway Department.

[2] Mechanical analyses according to the American Association of State Highway Officials Designation T 88. Results by this procedure frequently may differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming texture classes for soils.

on seven soils [1]—Continued

Percentage of fraction passing sieve [2]—Con.		Grain diameter percentage smaller than [2]—			Liquid limit	Plasticity index	Volume change	Classification	
No. 40 (0.42 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.005 mm.	0.002 mm.				AASHO [3]	Unified [4]
							Percent		
99	46	39	18	15	24	6	9. 0	A-4(2)	SM-SC.
80	47	42	28	23	28	14	13. 0	A-6(4)	SC.
99	53	42	21	16	26	11	14. 6	A-6(4)	CL.
100	89	78	58	55	50	28	28. 8	A-7-6(17)	CL-CH.
98	55	42	17	13	25	8	10. 9	A-4(4)	CL.
88	66	59	47	33	30	15	12. 8	A-6(8)	CL.
99	90	86	57	47	56	32	46. 6	A-7-6(19)	CH.
100	77	71	45	40	41	24	40. 9	A-7-6(14)	CL.
100	80	72	43	33	42	23	42. 5	A-7-6(14)	CL.
100	47	38	20	18	24	5	8. 7	A-4(2)	SM-SC.
99	61	53	35	33	37	20	20. 6	A-6(9)	CL.
100	19	18	11	10	19	2	1. 7	A-2-4(0)	SM.
100	30	28	19	18	24	7	3. 5	A-2-4(0)	SM-SC.
98	18	17	12	11	19	3	0. 0	A-2-4(0)	SM.
99	39	38	28	28	32	16	10. 6	A-6(2)	SC.
99	20	19	11	10	18	2	1. 7	A-2-4(0)	SM.
100	38	36	23	21	25	11	9. 0	A-6(1)	SC.

[3] Based on Standard Specifications for Highway Materials and Methods of Sampling and Testing (Pt. 1, Ed. 7): The Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes. AASHO Designation M 145-49 (*1*).

[4] Based on the Unified Soil Classification System, Technical Memorandum No. 3-357, Volume 1, Waterways Experiment Station, Corps of Engineers, March 1953 (*13*).

TABLE 6.—*Brief descriptions of the soils of Lamb County, Tex.,*

Map symbol	Soil	Description	Depth from surface	Classification	
				Texture USDA	Unified
			Inches		
AfA AfB AfC	Amarillo fine sandy loam, 0 to 1 percent slopes. Amarillo fine sandy loam, 1 to 3 percent slopes. Amarillo fine sandy loam, 3 to 5 percent slopes.	6 to 10 inches of fine sandy loam over 30 to 50 inches of moderately permeable, well-drained sandy clay loam; developed on unconsolidated alluvial and eolian, moderately sandy sediments.	0–10 10–26 26–46 46–72	Fine sandy loam Sandy clay loam Sandy clay loam Sandy clay loam	ML–CL or SM–SC. CL SC or CL SC or CL
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes.	Same as Amarillo fine sandy loam, but the surface soil is 8 to 16 inches of loamy fine sand.	0–14 14–45	Loamy fine sand Sandy clay loam	SM SC
AlA AlB	Amarillo loam, 0 to 1 percent slopes. Amarillo loam, 1 to 3 percent slopes.	Same as Amarillo fine sandy loam, but the surface soil is 6 to 10 inches of loam, and the subsoil is 24 to 48 inches of moderately permeable, well-drained sandy clay loam.	0–10 10–26 26–42 42–72	Loam Sandy clay loam Sandy clay loam Sandy clay loam	CL CL CL CL
An	Arch fine sandy loam.	6 to 10 inches of well-drained, strongly calcareous fine sandy loam in shallow valleys and slight depressions; developed from chalky earth that is old alluvium apparently modified by deposits of calcium carbonate from ground water.	0–8 8–20 20–40	Fine sandy loam Sandy clay loam Sandy clay loam	SM–SC CL CL
Ao	Arch loam.	Same as Arch fine sandy loam, but the surface soil is 4 to 8 inches of loam.	0–6 6–20 20–40	Loam Clay loam Clay loam	CL CL CL
As	Arch loamy fine sand, overblown.	Same as Arch fine sandy loam, but the surface soil is 10 to 24 inches of loamy fine sand.	0–14 14–22 22–48	Loamy fine sand Fine sandy loam Sandy clay loam	SM–SC SM–SC CL
AvA AvB	Arvana fine sandy loam, 0 to 1 percent slopes. Arvana fine sandy loam, 1 to 3 percent slopes.	4 to 10 inches of moderately permeable, well-drained fine sandy loam over sandy clay loam; mainly in the southwestern part of the county on nearly level to gently sloping areas; developed from a thin, sandy eolian mantle deposited over rocklike caliche.	0–6 6–30 ([1])	Fine sandy loam Sandy clay loam ---	SM–SC CL ---
AxA AxB	Arvana fine sandy loam, shallow, 0 to 1 percent slopes. Arvana fine sandy loam, shallow, 1 to 3 percent slopes.	Same as Arvana fine sandy loam, but the subsoil is thinner (6 to 12 inches thick) sandy clay loam over rocklike caliche.	0–6 6–20	Fine sandy loam Sandy clay loam	SM–SC CL
BhB BhC	Berthoud loam, 1 to 3 percent slopes. Berthoud loam, 3 to 5 percent slopes.	Deep, well-drained, calcareous, permeable loams; occur along the slopes of natural drains and below escarpments on west side of saline lakes; developed from alluvial materials from higher adjoining areas.	0–18 18–36 36–60	Loam Clay loam Clay loam	ML or CL ML or CL CL
BeB BeC BeD	Berthoud fine sandy loam, 1 to 3 percent slopes. Berthoud fine sandy loam, 3 to 5 percent slopes. Berthoud fine sandy loam, 5 to 8 percent slopes.	Same as Berthoud loam, but the profile is sandier.	0–10 10–40	Fine sandy loam Sandy clay loam	SM–SC SC
Br	Brownfield fine sand, thick surface.	16 to 30 inches of fine sand over 30 to 50 inches of well-drained, moderately permeable sandy clay loam; occurs on broad, gently undulating areas in the sandhills of the county; developed from sandy earths that appear to be eolian.	0–20 20–50	Fine sand Sandy clay loam	SP–SM SC

See footnotes at end of table.

and estimated physical properties significant to engineering

Classification—Continued	Percentage passing sieve—			Permeability	Structure	Available water capacity	Reaction	Dispersion	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200						
				Inches per hour		*Inches per foot of depth*	*pH*		
A-4	100	100	40–55	0. 75–2. 0	Structureless	1. 5	6. 7–7. 8	Low	Low.
A-6	100	100	50–60		Prismatic	1. 8	7. 0–7. 8	Moderate	Moderate.
A-6	99	98	45–65		Prismatic	1. 6	7. 5–8. 0	Moderate	Moderate.
A-6	75–95	70–95	45–65			1. 5	8. 0–8. 5	Moderate	Moderate.
A-2-4	100	100	15–20	1. 0–2. 0	Structureless	1. 0	7. 0–7. 8	Low	Low.
A-6	100	100	30–40		Prismatic	1. 5	7. 0–7. 8	Moderate	Low.
A-4 or A-6	100	100	50–65	0. 5–1. 5	Structureless	1. 8	7. 0–7. 8	Moderate	Low.
A-6	100	100	65–70		Prismatic and subangular blocky.	1. 8	6. 8–7. 5	Moderate	Moderate.
A-6	100	100	55–65		Prismatic and subangular blocky.		7. 5–8. 0		Moderate.
A-6	98–100	96–98	65–75			1. 5	8. 0–8. 5	Moderate	Moderate.
A-4	99–100	99–100	40–50	1. 0–2. 5	Weak, subangular blocky	1. 5	8. 0–8. 5	Low	Low.
A-6	99–100	99–100	50–65		Weak, subangular blocky	1. 6	8. 0–8. 5	Low	Low.
A-6	95–100	95–100	50–65			1. 5	8. 0–8. 5	Low	Low.
A-6	99–100	99–100	55–65	0. 75–2. 0	Weak, subangular blocky	1. 8	8. 0–8. 5	Low	Low.
A-6	90–100	99–100	60–70		Weak, subangular blocky	1. 8	8. 0–8. 5	Low	Low.
A-6	95–100	95–100	60–70			1. 6	8. 0–8. 5	Low	Low.
A-2 or A-4	100	100	10–20	1. 5–3. 0	Granular	1. 0	7. 5–8. 2	Low	Low.
A-4	90–100	99–100	40–50		Weak, subangular blocky	1. 5	8. 0–8. 5	Low	Low.
A-6	95–100	95–100	50–60			1. 5	8. 0–8. 5	Moderate	Moderate.
A-4	100	100	40–50	0. 75–2. 0	Structureless	1. 5	6. 7–7. 8	Low	Low.
A-6	100	100	50–60		Prismatic	1. 7	7. 0–7. 8	Moderate	Moderate.
A-4	100	100	40–50	0. 75–2. 0	Structureless	1. 6	6. 8–7. 5	Low	Low.
A-6	100	100	50–60		Prismatic	1. 7	7. 0–7. 5	Moderate	Moderate.
A-4 or A-6	98–100	98–100	55–65	1. 0–2. 0	Weak, subangular blocky	2. 0	7. 8–8. 3	Moderate	Low.
A-6	95–100	95–100	55–70		Weak, subangular blocky	2. 0	7. 8–8. 3	Moderate	Low.
A-6	95–100	95–100	55–70			1. 2	8. 0–8. 3	Moderate	Moderate.
A-4	98–100	98–100	40–50	1. 5–3. 0	Weak, subangular blocky	1. 6	7. 8–8. 3	Low	Low.
A-4 or A-6	95–100	90–100	40–50		Weak, subangular blocky	1. 7	7. 8–8. 3	Low	Moderate.
A-2-4	100	100	5–10	1. 5–3. 0	Single grain	0. 8	6. 8–7. 2	Low	Low.
A-6	100	100	35–45		Prismatic	1. 5	6. 8–7. 2	Moderate	Moderate.

TABLE 6.—*Brief descriptions of the soils of Lamb County, Tex.,*

Map symbol	Soil	Description	Depth from surface	Classification	
				Texture USDA	Unified
			Inches		
Ch	Church clay loam.	0 to 6 inches of clay loam over strongly calcareous clay; poorly drained; the water table often within 2 feet of the surface; occurs in nearly level areas generally west of large saline lakes; parent materials strongly calcareous clays formed under very wet conditions; this soil is saline in places.	0–6 6–20 20–40	Clay loam Clay Clay	CL or CH CL or CH CL or CH
DrB DrC DrE	Drake soils, 1 to 3 percent slopes. Drake soils, 3 to 5 percent slopes. Drake soils, 5 to 20 percent slopes.	Strongly calcareous soils that have little development; comprise low dunes generally east of playas; areas are crescent shaped and are from 10 to 40 acres in size; parent materials are wind-deposited loams from the playas.	0–6 6–15 15–72	Loam Loam Loam	CL CL CL
Km	Kimbrough soils.	Very shallow, fine sandy loam developed over thick beds of stonelike caliche; rock outcrops on some areas.	0–6 (1)	Fine sandy loam	SM–SC
Le	Lea clay loam.	2 feet of noncalcareous clay loam over rocklike caliche; occurs on broad, level areas.	0–13 13–27	Clay loam Clay loam	CL CL or CH
Lk	Likes loamy fine sand, undulating.	4 to 6 feet of calcareous, permeable, well-drained loamy fine sand; topography rolling or undulating; windblown deposits on very small areas.	0–14 14–72	Loamy fine sand Loamy fine sand	SM SM
Lo	Lofton clay loam.	Deep, compact clay soil; occurs as first benches southeast of the playas; benches are slightly higher than the lakebeds but may be inundated for short periods; surface soil noncalcareous; soil becomes calcareous at 20 to 36 inches.	0–6 6–54 45–72	Clay loam Clay Clay loam	CL CH CL
Lu	Lubbock fine sandy loam.	8 to 15 inches of fine sandy loam surface soil over 12 to 24 inches of slowly permeable clay; surface soil is noncalcareous; soil grades to strongly calcareous at a depth of 2 to 4 feet; parent material is soft caliche; occurs on nearly level, slightly depressed areas ranging from 5 to 30 acres in size; well drained but may receive runoff from adjoining areas.	0–8 8–18 18–36 36–72	Fine sandy loam Sandy clay loam Clay Clay loam	SM–SC CL CL or CH CL
MkA MkB MkC MkD	Mansker loam, 0 to 1 percent slopes. Mansker loam, 1 to 3 percent slopes. Mansker loam, 3 to 5 percent slopes. Mansker loam, 5 to 8 percent slopes.	Profile has less than 20 inches of calcareous loam over soft caliche; well drained; soils occur throughout the county on slopes above playas and along natural drains.	0–6 6–18 18–40	Loam Clay loam Clay loam	CL CL CL
MfA MfB MfC MfD	Mansker fine sandy loam, 0 to 1 percent slopes. Mansker fine sandy loam, 1 to 3 percent slopes. Mansker fine sandy loam, 3 to 5 percent slopes. Mansker fine sandy loam, 5 to 8 percent slopes.	Similar to Mansker loam but has more sand throughout the profile.	0–6 6–18 18–40	Fine sandy loam Sandy clay loam Sandy clay loam	SM–SC CL CL
OtA OtB	Olton loam, 0 to 1 percent slopes. Olton loam, 1 to 2 percent slopes.	Deep, well-drained, noncalcareous, slowly permeable loams; occur on broad, nearly level to gently sloping areas mainly in the northeastern part of the county; soft caliche 30 to 50 inches below the surface.	0–8 8–42 42–72	Loam Clay loam Clay loam and caliche.	CL CL or CH CL
PmA PmB	Portales loam, 0 to 1 percent slopes. Portales loam, 1 to 3 percent slopes.	Well-drained, calcareous, deep loams; occur in all parts of the county on large, nearly level to gently sloping areas; parent materials very strongly calcareous, soft caliche.	0–8 8–30 30–56	Clay loam Clay loam Clay loam and caliche.	CL CL CL

See footnotes at end of table.

and estimated physical properties significant to engineering—Continued

Classification—Continued	Percentage passing sieve—			Permeability	Structure	Available water capacity	Reaction	Dispersion	Shrink-swell potential
AASHO	No. 4	No. 10	No. 200						
				Inches per hour		*Inches per foot of depth*	*pH*		
A–7–6	100	100	80–90	0. 2–0. 9	Subangular blocky	2. 0	7. 8–8. 3	Moderate	Moderate.
A–7–6	100	100	80–90		Subangular blocky	2. 2	8. 0–8. 5	Moderate	High.
A–7–6	100	100	80–90			1. 8	8. 0–8. 5	Moderate	High
A–6	100	100	50–60	0. 75–2. 5	Weak, subangular blocky	1. 8	8. 0–8. 5	Moderate	Low.
A–6	100	100	55–65		Weak, subangular blocky	1. 8	8. 0–8. 5	Moderate	Low.
A–6	100	100	55–65			1. 6	8. 0–8. 5	Moderate	Low.
A–4	98–100	98–100	40–50	0. 5–1. 0	Weak, granular	1. 0	7. 5–8. 2	Low	Low.
A–6	100	100	55–65	0. 5–1. 0	Subangular blocky	2. 1	7. 5–8. 0	Moderate	Moderate.
A–7–6	100	100	60–70		Blocky	2. 2	7. 5–8. 2	Moderate	Moderate.
A–2	100	100	10–20	2. 5–5. 0	Weak, very coarse, prismatic, and single grain.	1. 0	8. 0–8. 5	Low	Low.
A–2	100	100	10–20		Weak, very coarse, prismatic, and single grain.	1. 0	8. 0–8. 5	Low	Low.
A–6 or A–7–6	100	100	60–70	0. 2–0. 5	Subangular blocky	2. 1	7. 2–7. 8	Moderate	High.
A–7–6	100	100	65–75		Blocky	2. 2	7. 2–7. 8	Moderate	High.
A–6	100	100	60–70			1. 8	7. 5–8. 2	Moderate	High.
A–4	100	100	40–50	0. 6–1. 2	Structureless	1. 6	6. 8–7. 5	Low	Low.
A–6	100	100	50–60		Prismatic	1. 8	7. 0–7. 5	Moderate	Moderate.
A–6 or A–7–6	100	100	70–80		Blocky	2. 0	7. 0–7. 5	Moderate	High.
A–6	95–100	95–100	55–65			1. 6	7. 5–8. 3	Moderate	High.
A–4	95–100	95–100	50–60	1. 0–2. 0	Weak, subangular blocky	2. 0	8. 0–8. 3	Moderate	Moderate.
A–4 or A–6	100	100	55–65		Weak, subangular blocky	2. 0	8. 0–8. 5	Moderate	Moderate.
A–6	100	95–100	60–70			1. 0	8. 0–8. 5	Moderate	Moderate.
A–4	95–100	95–100	40–50	1. 5–3. 0	Weak, subangular blocky	1. 5	8. 0–8. 3	Low	Low.
A–4 or A–6	98–100	98–100	50–60		Weak, subangular blocky	1. 8	8. 0–8. 3	Moderate	Moderate.
A–4 or A–6	95–100	95–100	50–60			. 8	8. 0–8. 5	Moderate	Moderate.
A–6	100	100	55–65	0. 5–1. 0	Subangular blocky	2. 1	7. 5–8. 0	Moderate	Moderate.
A–6 or A–7–6	100	100	70–80		Fine, blocky	2. 2	7. 2–7. 8	Moderate	High.
A–6 or A–7–6	96–100	95–99	60–70			1. 6	8. 0–8. 5	Moderate	Moderate.
A–4 or A–6	98–100	98–100	55–65	1. 0–2. 0	Structureless	1. 8	8. 0–8. 3	Moderate	Moderate.
A–6	98–100	98–100	55–65		Weak, prismatic	1. 8	8. 0–8. 3	Moderate	Moderate.
A–6	96–100	95–99	55–65			1. 2	8. 0–8. 5	Moderate	Moderate.

TABLE 6.—*Brief descriptions of the soils of Lamb County, Tex.,*

Map symbol	Soil	Description	Depth from surface	Classification	
				Texture USDA	Unified
			Inches		
PfA PfB	Portales fine sandy loam, 0 to 1 percent slopes. Portales fine sandy loam, 1 to 3 percent slopes.	Similar to Portales loam, but the surface soil is fine sandy loam, and the profile is sandier throughout.	0–11 11–30 30–70	Fine sandy loam Sandy clay loam Sandy clay loam and caliche.	SM–SC CL SC or CL
Pn	Portales loamy fine sand, overblown.	Similar to Portales fine sandy loam, but the surface layer is 10 to 20 inches of loamy fine sand.	0–16 16–30 30–56	Loamy fine sand Sandy clay loam Sandy clay loam and caliche.	SM SC SC
PsC PsE	Potter soils, 1 to 8 percent slopes. Potter soils, 8 to 30 percent slopes.	Less than 10 inches deep over thick beds of soft caliche; occur along natural drains or escarpments on the west side of saline lakes on slopes ranging up to 30 percent.	0–5 5–36	Loam Clay loam and caliche.	ML or CL CL
Ra	Randall clay.	Profile consists of dense clays to a depth of 6 feet; the soil may be calcareous or noncalcareous; occupies areas in intermittent lakebeds that range in size from 5 to 60 acres; from 3 to 50 feet below the level of the surrounding plain; receives runoff from adjoining areas and is submerged for long periods; parent material calcareous clay.	0–10 10–26 26–50 50–70	Clay Clay Clay Clay	CL CL [2] CH [2] CL [2] CH [2] CL
Rf	Randall fine sandy loam.	Similar to Randall clay, but the surface has a sandier, overblown layer, and the profile is sandier.	0–18 18–35 35–70	Fine sandy loam Sandy clay loam Clay	SM–SC CL CL
Sf Sg	Springer fine sandy loam, undulating. Springer fine sandy loam, hummocky.	Well-drained, noncalcareous fine sandy loams that are of wind-deposited material to a depth of 6 feet or more; occur mainly along the sides of sandhills as long, narrow ridges or knolls.	0–8 8–36 36–72	Fine sandy loam Fine sandy loam Fine sandy loam	SM–SC SM–SC SM–SC
Sh	Springer loamy fine sand, hummocky.	Same as Springer fine sandy loam, but 10 to 20 inches of the surface layer is loamy fine sand.	0–12 12–30 30–72	Loamy fine sand Fine sandy loam Loamy fine sand	SM SM–SC SM–SC
Sr	Spur loam.	Deep, dark soils along the bottoms of the draws; well drained but subject to occasional overflow; parent materials have washed from higher soils.	0–8 8–48 48–72	Loam Clay loam Sandy clay loam	CL CL CL
Sp	Spur fine sandy loam.	Very similar to Spur loam, but the surface soil is 6 to 12 inches of fine sandy loam.	0–12 12–26 26–72	Fine sandy loam Sandy clay loam Sandy clay loam	SM–SC SC or CL CL
Tv	Tivoli fine sand.	Windblown deposits of noncalcareous fine sands 6 to 75 feet high; the dunes may be deposited over buried soils similar to Arch or Amarillo soils; Tivoli fine sand occurs in a strip 2 to 6 miles wide that bisects the north-central part of the county from west to east.	0–72	Fine sand	SP–SM
ZmA ZmB	Zita loam, 0 to 1 percent slopes. Zita loam, 1 to 2 percent slopes.	Profile is deep, well-drained, and noncalcareous in the top 20 inches; it grades to very strongly calcareous, soft, chalky caliche in the parent material; soils occur in all parts of the county, generally on areas of less than 50 acres.	0–6 6–20 20–48	Loam Clay loam Clay loam and caliche.	CL CL CL
ZfA ZfB	Zita fine sandy loam, 0 to 1 percent slopes. Zita fine sandy loam, 1 to 3 percent slopes.	Similar to Zita loam, but it has a sandier profile.	0–8 8–20 20–48	Fine sandy loam Sandy clay loam Sandy clay loam	SC CL CL
Zo	Zita loamy fine sand, overblown.	Similar to Zita fine sandy loam, but the surface soil is loamy fine sand.	0–10 10–24 24–48	Loamy fine sand Sandy clay loam Sandy clay loam and caliche.	SM–SC CL CL

[1] Indurated caliche.

and estimated physical properties significant to engineering—Continued

Classification—Continued AASHO	Percentage passing sieve— No. 4	No. 10	No. 200	Permeability	Structure	Available water capacity	Reaction	Dispersion	Shrink-swell potential
				Inches per hour		*Inches per foot of depth*	*pH*		
A-4	99-100	99-100	45-50	1.5-3.0	Structureless	1.5	8.0-8.5	Low	Low.
A-6	99-100	99-100	50-60		Weak, prismatic	1.7	8.0-8.5	Moderate	Low.
A-6	95	85-90	45-65		Weak, prismatic	1.2	8.0-8.5	Moderate	Low.
A-2 or A-4	100	100	15-35	2.0-4.0	Single grain	1.0	8.0-8.3	Low	Low.
A-6	98-100	98-100	40-50		Coarse, prismatic	1.6	8.0-8.3	Moderate	Low.
A-6	95-98	90-96	40-50			1.2	8.0-8.5	Moderate	Low.
A-4 or A-6	90-98	85-95	50-60	1.0-2.0	Weak, subangular blocky	1.8	8.0-8.5	Moderate	Low.
A-6	85-95	85-95	50-60				8.0-8.5	Moderate	Low.
A-7-6	100	100	60-70	0.02-0.2	Blocky	2.2	6.8-8.0	Low	High.
A-7-6	100	100	75-90		Blocky	2.2	6.8-8.0	Low	High.
A-7-6									
A-7-6	100	100	80-90			2.2	7.0-8.0	Moderate	High.
A-7-6									
A-7-6	100	100	80-90			2.2	7.5-8.2	Moderate	High.
A-4	100	100	45-50	0.2-0.8	Subangular blocky	1.5	6.8-7.5	Moderate	Moderate.
A-6	100	100	55-65		Blocky	2.2	6.8-7.5	Low	High.
A-7-6	100	100	75-85			2.2	7.5-8.2	Low	High.
A-4	100	100	35-45	2.0-4.0	Structureless	1.2	6.8-7.5	Low	Low.
A-4	100	100	35-45		Weak, prismatic	1.2	6.8-7.5	Low	Low.
A-2 or A-4	100	100	20-40			1.0	6.8-7.5	Low	Low.
A-2 or A-4	100	100	15-40	2.5-5.0	Single grain	1.0	6.8-7.5	Low	Low.
A-4	100	100	35-45		Weak, prismatic	1.2	6.8-7.5	Low	Low.
A-2 or A-4	100	100	20-30			.8	6.8-7.5	Low	Low.
A-4 or A-6	100	100	55-65	0.8-1.8	Weak, subangular blocky	2.1	7.5-8.3	Moderate	Moderate.
A-6	100	100	55-65		Moderate, subangular blocky.	2.1	7.5-8.3	Moderate	Moderate.
A-6	98-100	98-100	50-60			1.8	8.0-8.4	Moderate	Moderate.
A-4	100	100	40-50	1.0-3.0	Subangular blocky	1.5	7.5-8.2	Moderate	Low.
A-4 or A-6	100	100	40-55		Subangular blocky	1.7	7.5-8.2	Moderate	Moderate.
A-6	100	95-100	50-60			1.6	8.0-8.4	Moderate	Moderate.
A-3	100	99-100	2-10	3.0+	Single grain	.8	7.0-7.5	Low	Low.
A-6	100	100	55-65	1.0-2.0	Structureless	2.0	7.5-8.0	Moderate	Moderate.
A-6	100	100	55-65		Subangular blocky	2.0	7.5-7.8	Moderate	Moderate.
A-6	95-100	95-100	50-60			1.0	8.0-8.5	Moderate	Moderate.
A-4 or A-6	100	100	40-50	1.0-2.5	Structureless	1.6	7.5-8.0	Low	Low.
A-6	100	100	50-60		Subangular blocky	1.8	7.5-8.0	Moderate	Moderate.
A-6	95-100	90-100	50-60			1.0	8.0-8.5	Moderate	Moderate.
A-2 or A-4	100	100	20-40	1.5-3.0	Structureless	1.0	7.5-8.0	Low	Low.
A-6	100	100	50-60		Subangular blocky	1.8	7.5-8.0	Moderate	Moderate.
A-6	95-99	90-96	50-60			1.0	8.0-8.5	Moderate	Moderate.

[2] Two sites.

Engineering Interpretations of the Soils

The evaluation of the soils for engineering use is given in table 7. Specific features in the soil profile that may affect engineering work are pointed out. These features are estimated from data in table 5, actual test data available, and field experience in the performance of the soils.

In table 7, the rating of the soil for road subgrade is based on the estimated classification of the soil materials. On flat terrain the rating applies to the soil materials in the A and B horizons. On steeper terrain (6 percent slopes or steeper), it applies primarily to the soil materials in the C horizon. Soils that have a plastic clay layer, such as Church clay loam, Lofton clay loam, and Randall clay, impede internal drainage

TABLE 7.—*Engineering*

Soil	Suitability of soil for—					Soil characteristics affecting—	
	Road subgrade	Road fill	Topsoil	Vertical alinement of highways		Dikes or levees	Farm ponds
				Materials	Drainage		Reservoir area
Amarillo fine sandy loam, 0 to 1 percent slopes. Amarillo fine sandy loam, 1 to 3 percent slopes. Amarillo fine sandy loam, 3 to 5 percent slopes.	Poor to fair.	Fair	Fair	Fair	Good	Moderate permeability; fair stability.	Moderate to excessive seepage.
Amarillo loamy fine sand, 0 to 3 percent slopes.	Fair	Fair	Poor to fair.	Fair	Good	Moderate permeability; fair stability in subsoil.	Moderate to excessive seepage.
Amarillo loam, 0 to 1 percent slopes. Amarillo loam, 1 to 3 percent slopes.	Poor	Poor to fair.	Fair to good.	Poor to fair.	Fair	Moderate permeability; fair stability.	Moderate to excessive seepage.
Arch loam	Poor	Poor to fair.	Poor	Poor	Fair	Moderately rapid permeability; fair stability.	Excessive seepage.
Arch fine sandy loam	Poor to fair.	Fair	Poor	Poor to fair.	Good	Moderately rapid permeability; fair stability.	Excessive seepage.
Arch loamy fine sand, overblown.	Fair	Fair	Poor	Poor	Good	Moderately rapid permeability; poor stability.	Excessive seepage.
Arvana fine sandy loam, 0 to 1 percent slopes. Arvana fine sandy loam, 1 to 3 percent slopes.	Poor to fair.	Fair	Fair	Poor to fair. [1]	Good	Moderate permeability; fair stability.	Moderate to excessive seepage.
Arvana fine sandy loam, shallow, 0 to 1 percent slopes. Arvana fine sandy loam, shallow, 1 to 3 percent slopes.	Poor to fair.	Fair	Fair	Poor to fair.[1]	Good	Moderate permeability; good stability; hard caliche at depths of 10 to 20 inches.	Moderate seepage; hard caliche substrata.
Berthoud loam, 1 to 3 percent slopes. Berthoud loam, 3 to 5 percent slopes.	Poor	Poor to fair.	Fair	Fair	Fair	Moderate permeability; fair stability.	Moderate seepage loss.
Berthoud fine sandy loam, 1 to 3 percent slopes. Berthoud fine sandy loam, 3 to 5 percent slopes. Berthoud fine sandy loam, 5 to 8 percent slopes.	Poor to fair.	Fair	Fair	Fair	Good	Moderately rapid permeability; fair stability.	Moderate seepage loss.

See footnotes at end of table.

and have low stability when wet. Such soils are rated as "Poor." The loamy fine sands, which are very erodible and have a large percentage passing the No. 200 sieve, are rated "Poor to fair." This rating is based on their poor grading and general lack of stability unless they are properly confined. The coarser textured and better graded soils are rated as "Fair."

The suitability of the soil for road fill depends largely on its natural water content and texture. Plastic soils that have a high content of natural water, such as Church clay loam and Randall clay, are difficult to handle, to compact, and to dry to the desired content of water. Therefore, they are rated "Poor." The very sandy soils are difficult to place and compact because they do not contain enough binding material. These soils are rated "Poor to fair."

interpretation of the soils

Soil characteristics affecting—Continued					
Farm ponds—Con.	Irrigation		Land leveling	Field terraces and diversion terraces	Waterways
Embankment	Sprinkler system	Surface system			
Good stability to fair stability.	Moderately high water-holding capacity.	High intake rate; high seepage loss in earthen ditches.	Generally not practical on slopes above 3 percent.	Gully and sheet erosion.	Erodible.
Fair stability in subsoil.	Moderately high water-holding capacity.	Very high intake rate; excessive seepage loss in earthen ditches.	High wind erosion	High wind erosion	Highly erodible.
Good stability	High water-holding capacity.	Moderate intake rate; moderate seepage loss in earthen ditches.	No problem	Gully and sheet erosion.	Erodible.
Fair stability	Moderately high water-holding capacity.	High intake rate; high seepage loss in earthen ditches.	High wind erosion	Moderate wind erosion.	Erodible.
Fair stability	Moderate water-holding capacity.	Very high intake rate; excessive seepage loss in earthen ditches.	High wind erosion	High wind erosion	Erodible.
Poor stability	Low water-holding capacity.	Very high intake rate; earthen ditches unstable and have excessive seepage.	Very high wind erosion.	Very high wind erosion; poor stability.	Highly erodible.
Good stability to fair stability.	Low water-holding capacity.	High intake rate; high seepage loss in earthen ditches.	Cuts generally limited.	Gully and sheet erosion.	Erodible.
Good stability	Very low water-holding capacity.	High intake rate; light applications of irrigation water.	Shallow	Shallow	Shallow; hard caliche at depths of 10 to 20 inches.
Fair stability	Moderately high water-holding capacity.	Moderate intake rate; short slopes.	Generally not practical on slopes above 3 percent.	Gully and sheet erosion.	Erodible.
Fair stability	Moderately high water-holding capacity.	High intake rate; short slopes.	Generally not practical on slopes over 3 percent.	Gully and sheet erosion.	Erodible.

TABLE 7.—*Engineering*

Soil	Suitability of soil for—					Soil characteristics affecting—	
	Road subgrade	Road fill	Topsoil	Vertical alinement of highways		Dikes or levees	Farm ponds
				Materials	Drainage		Reservoir area
Brownfield fine sand, thick surface.	Fair	Fair	Poor	Poor to fair.	Good	Fair stability in subsoil.	Excessive seepage
Church clay loam.	Poor	Poor	Poor	Poor	Poor	Unstable	Low seepage
Drake soils, 1 to 3 percent slopes. Drake soils, 3 to 5 percent slopes. Drake soils, 5 to 20 percent slopes.	Poor to fair.	Poor to fair.	Poor	Poor	Good	Fair stability; high wind erosion.	High seepage
Kimbrough soils.	Fair to good.	Fair	Fair	Poor to fair.[1]	Good	Very shallow; hard substrata.	Moderately rapid permeability.
Lea clay loam	Poor	Poor to fair.	Fair	Poor to fair.[1]	Fair	Fair stability; slow permeability.	High seepage in substrata.
Likes loamy fine sand, undulating.	Fair	Fair	Poor	Poor	Good	Moderately rapid permeability; poor stability.	High seepage
Lofton clay loam	Poor	Fair	Fair to good.	Poor to fair.	Poor	Slow permeability; fair stability.	Permeable in substrata; will seal.
Lubbock fine sandy loam	Poor to fair.	Fair	Fair to good.	Poor to fair.[2]	Poor	Slow permeability; fair stability.	Moderate seepage in substrata.
Mansker loam, 0 to 1 percent slopes. Mansker loam, 1 to 3 percent slopes. Mansker loam, 3 to 5 percent slopes. Mansker loam, 5 to 8 percent slopes.	Poor to fair.	Fair	Fair to poor.	Fair	Good	Moderately rapid permeability; fair stability.	Excessive seepage
Mansker fine sandy loam, 0 to 1 percent slopes. Mansker fine sandy loam, 1 to 3 percent slopes. Mansker fine sandy loam, 3 to 5 percent slopes. Mansker fine sandy loam, 5 to 8 percent slopes.	Poor to fair.	Fair	Fair	Fair	Good	Moderately rapid permeability.	Excessive seepage
Olton loam, 0 to 1 percent slopes Olton loam, 1 to 2 percent slopes	Poor	Fair	Poor to fair.	Poor to fair.	Poor	Slow permeability	Permeable in substrata; will seal.
Portales loam, 0 to 1 percent slopes. Portales loam, 1 to 3 percent slopes.	Poor to fair.	Fair	Poor to fair.	Fair	Good	Moderately rapid permeability; fair stability.	Moderate seepage
Portales fine sandy loam, 0 to 1 percent slopes. Portales fine sandy loam, 1 to 3 percent slopes.	Poor to fair.	Fair	Fair	Fair	Good	Moderately rapid permeability; fair stability.	Moderate seepage

See footnotes at end of table.

interpretation of the soils—Continued

Soil characteristics affecting—Continued					
Farm ponds—Con.	Irrigation		Land leveling	Field terraces and diversion terraces	Waterways
Embankment	Sprinkler system	Surface system			
Fair stability in subsoil.	Moderate water-holding capacity.	Very high intake rate.	High wind erosion	High wind erosion	Highly erodible.
Poor stability	Low intake rate	Nearly level, uniform slopes.	Limited to shallow cuts.	Slight erosion	Slightly erodible.
Fair stability	Moderate water-holding capacity.	Moderate intake rate.	Generally not practical on slopes over 3 percent.	High wind erosion	High wind erosion.
Fair stability, very shallow; hard substrata.	Very shallow	Very shallow	Very shallow	Very shallow	Very shallow.
Good stability	Low intake rate	Low water-holding capacity.	Limited to shallow cuts.	Slight erosion	Slightly erodible.
Poor stability	Low water-holding capacity.	Very high intake rate; undulating topography.	High wind erosion; undulating topography.	High wind erosion	Highly erodible.
Fair stability; good core material.	Very low intake rate	Nearly level, short uniform slopes.	No problems	No problems	Slightly erodible.
Fair stability	Low intake rate	Moderate permeability for light applications.	No problems	No problems	Erodible.
Fair stability	Low water-holding capacity.	Moderate permeability.	Very shallow cuts; not practical on slopes over 3 percent.	Shallow	Erodible on flat slopes; hard to stabilize on steeper slopes.
Fair stability with flat sideslopes.	Low water-holding capacity.	High intake rate	Shallow cuts not practical above 3 percent slopes.	Shallow	Highly erodible.
Fair stability	Very low intake rate	Fairly uniform slopes.	No problems	No problems	Slightly erodible.
Fair stability	Permeable; moderate water-holding capacity.	Moderate intake rate	No problems on slopes less than 3 percent.	Gully and sheet erosion.	Erodible.
Fair stability	Moderate water-holding capacity.	Very high intake rate.	High wind erosion	High wind erosion	Highly erodible.

TABLE 7.—*Engineering*

Soil	Suitability of soil for—					Soil characteristics affecting—	
	Road subgrade	Road fill	Topsoil	Vertical alinement of highways		Dikes or levees	Farm ponds
				Materials	Drainage		Reservoir area
Portales loamy fine sand, overblown.	Fair	Fair	Poor	Poor	Good	Moderately rapid permeability; poor stability.	Excessive seepage
Potter soils, 1 to 8 percent slopes. Potter soils, 8 to 30 percent slopes.	Poor to fair.	Fair	Poor	Fair	Good	Very shallow; moderately rapid permeability.	Excessive seepage.
Randall clay	Poor	Poor	Poor	Poor	Poor	Very slow permeability; poor stability.	Practically impervious.
Randall fine sandy loam	Poor	Poor to fair.	Fair	Poor to fair.	Poor	Very slow permeability; poor stability.	Practically impervious.
Springer fine sandy loam, undulating. Springer fine sandy loam, hummocky.	Poor to fair.	Fair	Fair	Poor to fair.	Good	Moderately rapid permeability; fair stability.	Excessive seepage.
Springer loamy fine sand, hummocky.	Fair	Fair	Poor	Poor	Good	Moderately rapid permeability; poor stability.	Excessive seepage.
Spur loam	Poor	Poor to fair.	Good	Poor to fair.	Good	Moderate permeability; fair stability.	Moderate seepage.
Spur fine sandy loam	Poor to fair.	Fair	Fair	Fair	Good	Moderately rapid permeability; fair stability.	High seepage
Tivoli fine sand	Poor	Fair	Poor	Poor	Good	Rapid permeability; poor stability.	Excessive seepage.
Zita loam, 0 to 1 percent slopes. Zita loam, 1 to 2 percent slopes.	Poor	Poor to fair.	Good	Fair	Good	Moderate permeability; fair stability.	Moderate seepage.
Zita fine sandy loam, 0 to 1 percent slopes. Zita fine sandy loam, 1 to 3 percent slopes.	Poor to fair.	Fair	Fair	Fair	Good	Moderate permeability; fair stability.	Moderate to excessive seepage.
Zita loamy fine sand, overblown.	Fair	Fair	Poor to fair.	Fair	Good	Moderately permeable subsoil; fair stability.	Excessive seepage.
Active dunes	Poor	Fair	Poor	Poor	Good	Rapid permeability; poor stability.	Excessive seepage.

[1] Rocklike caliche at depth of 2 to 3 feet.
[2] Highly plastic clays at depth of 1½ feet.

interpretation of the soils—Continued

Soil characteristics affecting—Continued					
Farm ponds—Con.	Irrigation		Land leveling	Field terraces and diversion terraces	Waterways
Embankment	Sprinkler system	Surface system			
Poor stability	Low water-holding capacity.	Very high intake rate.	High wind erosion	High wind erosion	Highly erodible.
Fair stability	Very shallow	Very shallow	Very shallow	Very shallow	Very shallow.
Suitable for cores with uniform moisture level.	Very low intake rate.	Nearly level, uniform slopes.	Difficult to maintain uniform grade.	No water erosion	Not applicable.
Suitable for cores with uniform moisture level.	Very low intake rate.	Nearly level, uniform slopes.	Susceptible to wind erosion.	No water erosion	Not applicable.
Fair stability with proper control.	Moderate water-holding capacity.	Undulating topography; high intake rate.	High wind erosion	Undulating topography.	Highly erodible.
Poor stability	Low water-holding capacity.	Undulating topography; very high intake rate.	Very high wind erosion.	Undulating topography; very high wind erosion.	Very high wind erosion.
Fair stability	High water-holding capacity.	Moderate intake rate.	Subject to occasional overflow.	Slight erosion	Slightly erodible.
Good stability	Moderately high water-holding capacity.	High intake rate	Subject to occasional overflow.	Slight erosion	Erodible.
Poor stability	Very low water-holding capacity.	Very high intake rate; dune topography.	Dune topography	Dune topography; very high wind erosion.	Not applicable.
Fair stability	High water-holding capacity.	Moderate intake rate.	No problems	Gully and sheet erosion.	Slightly erodible.
Good stability to fair stability.	Moderately high water-holding capacity.	High intake rate; excessive seepage in earthen ditches.	High wind erosion	High wind erosion	Highly erodible.
Fair stability in subsoil.	Moderate water-holding capacity.	Very high intake rate; excessive seepage in earthen ditches.	High wind erosion	High wind erosion	Highly erodible.
Poor stability	Very low water-holding capacity.	Very high intake rate; dune topography.	Dune topography	Dune topography; very high wind erosion.	Not applicable.

The soils in Lamb County do not provide a source of sand or gravel. The surface layer is generally suitable for topsoil. The Arvana, Kimbrough, Lea, and Potter soils provide a possible source of hard caliche for use in road construction and surfacing. Bedrock is not likely to be encountered.

The vertical alinement, or placement of the roadway, is affected by factors listed in two columns in table 7 headed "Materials" and "Drainage." Cuts made into sand dunes, such as Drake soils and Likes loamy fine sand, expose highly erodible material to the action of wind and water. Cut slopes in soils that have highly plastic clay layers, such as Church clay loam and Randall clay, are more susceptible to sloughing and sliding than in other soils. Cuts in these soils, therefore, should be on flatter slopes. Because of a layer of rocklike caliche, as in Arvana soils, Kimbrough soils, and Lea clay loam, special equipment may be needed to excavate the material.

Drainage factors that affect vertical alinement include high water table, seasonal floods, and seepage over impermeable strata in the back slopes of cuts. In areas that are occasionally or seasonally flooded, or where the water table is high, the pavement surface should be built at least 3 feet above the high water table or ground water table to provide satisfactory drainage. Interceptor ditches or underdrains may be needed where there is subsurface seepage.

Accumulations of windblown material in waterways on highly erodible soils create a difficult maintenance problem. If the permanent vegetation is covered, the water-carrying capacity of the waterway is reduced. Embankments for impounding water can be safely constructed from practically all the soils, but they must be carefully placed and compacted. In places the reservoir area for ponds needs special practices to reduce excessive seepage.

The soils in this area are suited to the sprinkler and surface methods of irrigation. Sprinkler irrigation may be used on all the soils but is best suited to coarse-textured, sandy soils and more rolling topography. If the depth of the soil is 20 inches or more, surface irrigation may be used in preference to the sprinkler method on fine- and medium-textured soils with flat, uniform slopes.

Field terraces and diversion terraces constructed from coarse-textured soils are difficult to maintain. Both wind and water erosion are serious hazards in maintaining terrace ridges and channels at desired specifications.

Winter grading and frost action are not considered problems, because the soils generally have a low moisture content during the winter, and subfreezing temperatures occur in fairly short periods.

Formation, Classification, and Morphology of the Soils

Factors of Soil Formation

Soil is a function of climate, living organisms, parent materials, topography, and time. The nature of the soil at any point on the earth depends upon the combination of the five major factors at that point. All five of these factors come into play in the genesis of every soil. The relative importance of each differs from place to place; sometimes one is more important and sometimes another. In extreme cases one factor may dominate in the formation of the soil and fix most of its properties, as is common when the parent material consists of pure quartz sand. Little can happen to quartz sand, and the soils derived from it usually have faint horizons. Even in quartz sand, however, distinct profiles can be formed under certain types of vegetation where the topography is low and flat and a high water table is present. Thus, for every soil the past combination of the five major factors is of the first importance to its present character.

The interrelationships among the factors of soil formation are complex, and the effects of any one factor cannot be isolated and identified with certainty. It is convenient, however, to discuss the factors of soil formation separately and to indicate some of their probable effects. The reader should always remember that the factors interact continually in the processes of soil formation and that the interactions are important to the nature of every soil.

Climate.—Precipitation, temperature, humidity, and wind have been important in the development of the soils of Lamb County. The wet climate of past geologic ages influenced the deposition of parent materials. Later, as a result of limited rainfall that seldom wet the soil below the area of living roots, most of the zonal and intrazonal soils have accumulated a horizon of calcium carbonate. This lack of rainfall has caused many of the younger soils to have free lime throughout the profile.

Wind is an outstanding factor in the development of soils in this area. It has affected soil development from the time it deposited sands over pre-existing alluvial materials in the Illinoian stage of the Pleistocene to its present shifting of coarse sands on the surface (*6*).

Living Organisms.—Vegetation, micro-organisms, earthworms, and other forms of life that live on and in the soil contribute to its development. The type and amount of vegetation are important. They are determined partly by the climate and partly by the kind of parent material. Climate limited the vegetation of Lamb County to grasses. The parent material determined whether the grasses would be tall, as on the sands, or short, as on the clays.

The mixed prairie type of native vegetation contributed large amounts of organic matter to the soil. Decaying grass leaves and stems distributed this organic matter on the soil surface. Decomposition of the fine roots distributed it throughout the solum. The network of tubes and pores left by these decaying roots hastened the passage of air and water through the soil and provided abundant food for bacteria, actinomycetes, and fungi.

Earthworms are the most noticeable animal life in the soil. Despite the low rainfall in this area and periods when the entire solum is dry, the importance of earthworms in soil development is easily seen. About 40 percent of some of the B_2 horizons of the Amarillo soils are wormcasts. Wormcasts add greatly to the movement of air, water, and plant roots in the soil.

Soil-dwelling rodents have had a part in the development of some soil areas. Farmers who occupied the land since it was in native grass know where large prairie-dog towns thrived. The burrowing of these animals did much to offset the leaching of free lime from the soil. It destroyed soil structure that was already formed. A good example of such soils occurs within large areas of Amarillo soils. In contrast to the Amarillo soils around them, these soils are calcareous to the surface, have weaker structure in the subsoil, and have weaker C_{ca} horizons in many places. These soils have characteristics of the Portales soils and were mapped as such.

The influence of men on the soil-forming factors should not be ignored. At first, men fenced the range, overgrazed it, and changed the vegetation. They then plowed the land to plant crops. By harvesting crops and allowing runoff and wind erosion, they reduced the amount of organic matter and the silt and clay particles in the plow layer. Through the use of heavy machinery and poorly timed tillage, men produced compacted areas that reduced infiltration of water and aeration. They have drastically changed the moisture regimes in some areas by irrigating. These things that have occurred in the past 50 years have shown marked effects on the soils of the county.

The way that men treat the soil in future generations will affect its further development.

Parent materials.—All the soils of Lamb County were developed from Rocky Mountain outwash materials deposited in the Quaternary and late Tertiary periods. Wind has reworked most of the outwash since the alluvium was originally deposited. The parent materials are largely alkaline to calcareous, unconsolidated sandy and silty earths.

The lime content in some areas has been increased by a high water table. Some shallow, enclosed basins have received lime from surrounding slopes.

The texture of the parent materials greatly influences soil development. Soils that have developed from fine-textured materials generally have developed more rapidly and to a greater degree than soils that have developed from coarse-textured materials.

Relief.—Relief influences soil development through its effect on drainage and runoff. The degree of profile development depends mainly on the average amount of moisture in the soil if other factors of soil formation are equal. The soils on steep slopes absorb less moisture and normally have less well-developed profiles than soils on flats and in depressions. Besides, the soil-forming processes on steep slopes are retarded by continuous erosion.

Relief also affects the kind and amount of vegetation on a soil; however, this is not so important in Lamb County. Slopes facing north receive less direct sunlight than those facing south; so they lose less moisture through evaporation. As a result, soils on slopes facing north have a denser vegetative cover and are generally more strongly developed. Also, the prevailing westerly winds have deposited soil materials on slopes facing east and have removed soil material from those facing west. As a result, in many areas the soils are deeper and better developed on slopes facing east.

Time.—The characteristics of a soil are determined mainly by the length of time that the soil-forming factors have acted upon the soil. Some materials that have been in place for only a short time have not been influenced enough by climate and living organisms to develop well-defined and genetically related horizons. The bottom-land soils and the eolian dunes bordering playa lakes are examples.

Soils on steep slopes are immature because geologic erosion has removed the effects of soil formation. Soils that have been in place for a long time and have approached equilibrium with their environment are mature or old soils. These soils show marked horizon differentiation. They are well-drained soils that occupy the nearly level to gently sloping areas of the county.

Classification of Soils by Higher Categories

Classification consists of an orderly grouping of defined kinds of soils into classes in a system designed to make it easier to remember soils, including their characteristics and interrelationships, and to organize and apply the results of experience and research to areas ranging in size from plots of several acres to large bodies of millions of square miles. The defined kinds of soils are placed in narrow classes for use in detailed soil surveys and in the application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories so that information can be applied to large geographic areas.

Classes of soils defined on a comparable basis and of the same rank in a classification system comprise what is called a category. A comprehensive system of soil classification, one which will be useful in dealing with the soils of a small field as well as with the soils of a continent, plus land areas of intermediate size, must therefore consist of a number of categories. The higher categories consist of fewer and broader classes than the lower categories.

The system of soil classification now being used in the United States consists of six categories, one above the other. Each successively higher category consists of a smaller total number of classes, and each of those classes has a broader range of characteristics. Thus, there are thousands of classes in the lowest category and no more than three in the highest category. The intermediate categories are also intermediate in number of classes and in permissible span or breadth of each class. Beginning at the top, the six categories in the system of soil classification are the order, suborder, great soil group, family, series, and type.

Four of the six categories have been widely used, and two have been used very little. Of the two higher categories, the order and great soil group have been used widely. Similarly, the two lowest categories, the soil series and soil type, have been widely used. On the other hand, the categories of the suborder and family have never been fully developed and are therefore of little value now. In soil classification and mapping, attention has been largely given to the recognition of soil types and series within countries or comparable areas and to the subsequent grouping of the series into great soil groups and orders. The two lowest categories have been used primarily for study of soils of small geographic areas, whereas the categories of the order and great soil group have been used for the study of soils of large geographic areas.

Differences in the breadth, or span, of individual classes in each category are indicated by the total number of classes in that category. All soils in the United States are included in three classes in the highest category, that of soil orders. These same soils are placed into some three dozen great soil groups, a category of somewhat lower rank. Going down the ladder to the next lower category in general use, approximately 6,000 soil series have been recognized in the United States. More series will be recognized as the study of soils continues, especially in areas where little work has been done in the past. The total number of soil types is not known exactly, inasmuch as records are not maintained for individual soil types as is done for individual soil series. The total number of soil types recognized in the county as a whole, however, would be at least twice as large as the number of series. From comparisons of the respective numbers of orders, great soil groups, series, and types, it is immediately obvious that the ranges permitted in the properties of soils within one class in a category of high rank are broad, whereas ranges with individual classes in a category of low rank are relatively narrow.

The nature of each of the four categories of the order, great soil group, series, and type will not be described at length in this section. The soil series and the soil type are defined in the Glossary. The categories of the soil order and the great soil group are described briefly in the subsequent paragraphs.

The highest category in the present system of soil classification consists of three classes, known as the zonal, intrazonal, and azonal orders. The zonal order comprises soils with evident, genetically related horizons that reflect the dominant influence of climate and living organisms in their formation. The intrazonal order comprises soils with evident, genetically related horizons that reflect the dominant influence of one or more local factors of parent materials, topography, and time over the effects of climate and living organisms. The azonal order comprises soils that lack distinct genetically related horizons because of one or more of the following—youth of parent materials, resistance of parent materials to change, and steep topography. In the text of this report, these orders are often referred to as zonal soils, intrazonal soils, and azonal soils.

Because of the way in which the soil orders are defined, all three can usually be found within a single county, as is true in Lamb County. Two of the orders and sometime all three of them may occur in a single field.

Classification of a soil series into one of the three orders does indicate something about the factors of major importance in the formation of that soil. The classification into orders also indicates something about the degree of expression of horizons in soils, or, in other words, the degree of horizonation. Even so, the ranges in properties are wide among the soils in any one order when all of them are considered collectively. Consequently, the total number of statements that can be made for any one order and which will be valid for all soils within that order are limited. Primarily, the orders indicate something about important factors of soil formation and something about degree of horizonation.

The great soil group is the next lower category beneath the order which has been widely used in this country. Classes in that category have been used to a very great extent because they indicate a number of relationships in the soil genesis and also indicate something of the fertility status, adaptability for crops or trees, and the like.

Each great soil group consists of a large number of soil series with many internal features in common. Thus, all members of a single great soil group in either of the zonal and intrazonal orders have the same number and kind of definitive horizons in their profiles. These definitive horizons need not be expressed to the same degree, nor do they need to be of the same thickness in all soils within one great soil group. Specific horizons must be recognizable, however, in every soil profile of a soil series representing a given great soil group.

Great soil groups in the azonal order are defined in part on the nature of the profile and also in part on history or origin of the soil. All members of a single great soil group have a number of internal features in common but none of the three great soil groups in the azonal order has distinct horizonation. Consequently, all of them still bear a strong imprint of the materials from which they are being formed. Definitions of the great soil groups in the azonal order are centered on the portion of the profile approximately comparable in thickness to the solum of associated great soil groups of the zonal and intrazonal orders.

The classification of soil series in Lamb County into great soil groups and orders follows. Each series recognized in the county has been classified on the basis of the current understanding of the soils and their formation.

ZONAL ORDER:
- Brown soils:
  - Berthoud
- Chestnut soils:
  - Lea
  - Lofton
  - Lubbock
  - Zita
- Reddish-Brown soils:
  - Brownfield
  - Springer
- Reddish Chestnut soils:
  - Amarillo
  - Arvana
  - Olton

INTRAZONAL ORDER:
- Calcisols:
  - Arch
  - Church
  - Mansker
  - Portales
- Grumusols:
  - Randall

AZONAL ORDER:
- Alluvial soils:
  - Spur
- Lithosols:
  - Kimbrough
  - Potter
- Regosols:
  - Drake
  - Likes
  - Tivoli

Morphology

The relationship of the outstanding morphological characteristics of the soils of Lamb County to the factors of soil formation is briefly discussed in this section.

In Lamb County the zonal order includes four great soil groups: Brown, Chestnut, Reddish-Brown, and Reddish Chestnut.

The Brown soil group includes only the Berthoud series in this county. The soils of this series have brown, calcareous surface soils that grade to pale-brown subsoils over light-colored, calcareous, unconsolidated substrata at depths of 3 to 4 feet.

There are four series in the Chestnut group in the county. The Chestnut soils are dark brown or dark grayish brown and grade into whitish, calcareous horizons at depths of 1½ to 4 feet. The series in Lamb County in this group are the Lea, Lofton, Lubbock, and Zita.

Two soil series are included in the Reddish-Brown group in this county. They are the Brownfield and Springer. The soils of these series have reddish-brown surface soils that grade to red subsoils.

The Reddish Chestnut group is the most extensive in Lamb County. It comprises the soils of the Amarillo, Arvana, and Olton series. The soils of these series are reddish brown and normally grade into white or pink caliche at a depth of 36 to 42 inches. They have distinct, genetically related horizons and other soil characteristics that show the predominant influence of climate and living organisms in their formation. These soils have distinct A, B, C horizon sequences (fig. 16).

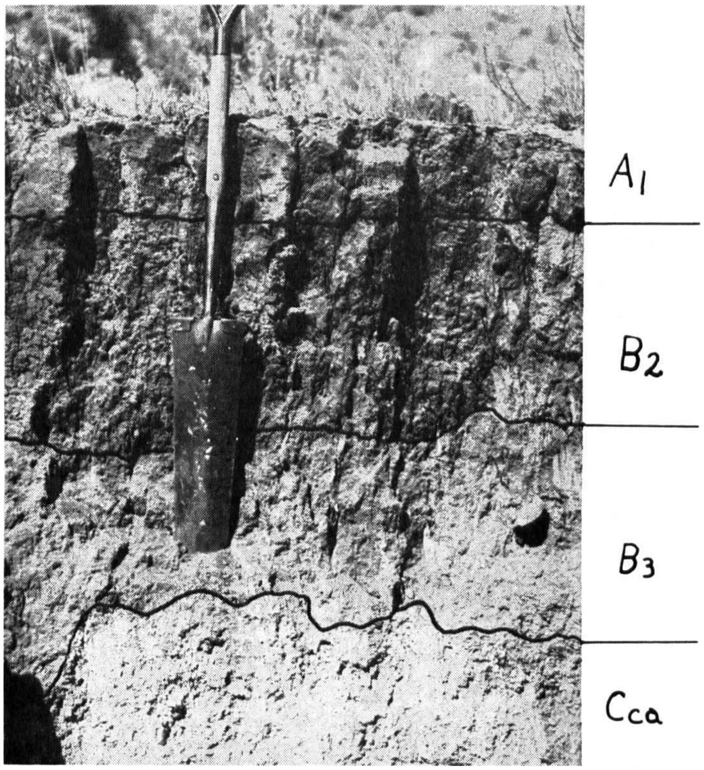

***Figure 16.*—Profile of Amarillo fine sandy loam showing horizon sequence.**

The intrazonal soils in Lamb County contain the Calcisol and Grumusol great soil groups. The Arch, Church, Mansker, and Portales soils are Calcisols. The Randall soils are Grumusols.

Arch, Church, Portales, and Mansker soils are considered Calcisols because of the thick accumulation of calcium carbonate, 10 to 36 inches below the soil surface.

Arch and Church soils have developed from highly calcified parent material. Until very recent geologic times this material made up lakebeds. The Church soils developed in more clayey sediments than the Arch soils.

Portales soils have developed from much the same parent materials as Arch soils. However, they have had a longer time to develop, or because of a more favorable microrelief, they may have received extra water to speed up the leaching of lime.

The lack of development in Mansker soils may be caused by relief, age, or parent material.

Theoretically, Arch soils should develop with time into soils resembling the Mansker series, then into the Portales series, and then into Chestnut soils resembling the Zita series.

The soils of the Randall series, the only Grumusols in Lamb County, have developed in the playa beds from clayey materials. Because of relief, they developed under wet conditions.

The azonal order in this county contains three great soil groups. These are the Alluvial, Lithosol, and Regosol groups. The azonal soils usually show only a weak A_1 horizon (fig. 17).

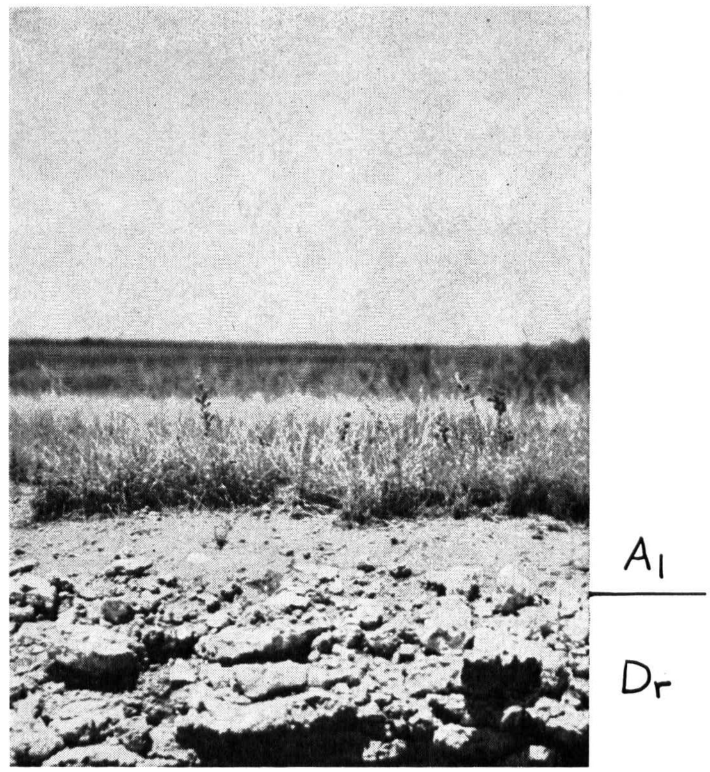

***Figure 17.*—Profile of a Kimbrough soil showing thin soil development over rocklike caliche.**

Soils of the Spur series are Alluvial soils. They are dark brown and very immature. They occur in the draws of the county.

The Kimbrough and Potter soils are Lithosols. Kimbrough soils are very shallow, because they have developed over hard, rocklike caliche. Potter soils lack development because of geologic erosion on the steep slopes.

The Drake, Likes, and Tivoli soils are Regosols. Drake soils lack development because of youth and parent materials that are very high in lime. Likes soils much resemble Drake soils but have developed from much sandier materials. Tivoli soils are young soils, and their parent materials contain very little clay or minerals subject to weathering.

The outstanding genetic and morphological relationships of the major soils of Lamb County are shown in table 8. All the soils of Lamb County are neutral or alkaline. Most of them have a base saturation of 80 to 100 percent.

TABLE 8.—*Classification by higher categories and genetic and*

Order, great soil group, and dominant soil type of each series [1]	Horizon	Thickness	Texture	Color (dry)
Zonal:				
Brown:		*Inches*		
Berthoud fine sandy loam	A_{1p}	6	Fine sandy loam	Brown (7.5YR 4/4)
	A_{12}	6	Sandy clay loam	Brown (10YR 5/3)
	AC	20	Sandy clay loam	Pale brown (10YR 6/3)
Chestnut:				
Zita fine sandy loam	A_{1p}	8	Fine sandy loam	Dark grayish brown (10YR 4/2)
	A_{12}	12	Fine sandy loam	Dark grayish brown (10YR 4/2)
	AC	6	Sandy clay loam	Grayish brown (10YR 5/2)
	C_{ca}	18	Clay loam	Very pale brown (10YR 7/3)
	C		Clay loam	Very pale brown (10YR 7/3)
Reddish Brown:				
Brownfield fine sand	A_{11}	6	Fine sand	Brown (7.5YR 4/4)
	A_{12}	16	Fine sand	Light brown (7.5YR 6/4)
	B_2	24	Sandy clay loam	Red (2.5YR 4/6)
	B_3	12	Sandy clay loam	Yellowish red (5YR 5/8)
	C		Sandy clay loam	Yellowish red (5YR 5/6)
Reddish Chestnut:				
Amarillo fine sandy loam	A_p	10	Fine sandy loam	Brown (7.5YR 4/4)
	B_2	18	Sandy clay loam	Reddish brown (5YR 4/4)
	B_3	16	Sandy clay loam	Yellowish red (5YR 4/6)
	C_{ca}	18	Sandy clay loam	Pink (5YR 7/3)
	C		Sandy clay loam	Yellowish red (5YR 5/6)
Arvana fine sandy loam	A_p	6	Fine sandy loam	Brown (7.5YR 4/4)
	B_{21}	8	Sandy clay loam	Reddish brown (5YR 4/4)
	B_{22}	12	Sandy clay loam	Reddish brown (5YR 4/4)
	B_3	4	Sandy clay loam	Yellowish red (5YR 5/6)
Olton loam	A_p	8	Loam	Brown (7.5YR 4/3)
	B_{21}	8	Clay loam	Reddish brown (5YR 4/3)
	B_{22}	14	Clay loam	Reddish brown (5YR 4/3)
	B_3	18	Clay loam	Reddish brown (5YR 5/4)
	C_{ca}	14	Clay loam	Pink (5YR 8/4)
	C		Clay loam	Light reddish brown (5YR 6/4)
Intrazonal:				
Calcisols:				
Arch fine sandy loam	A_{1p}	8	Fine sandy loam	Light brownish gray (10YR 6/2)
	A_{12}	6	Fine sandy loam	Very pale brown (10YR 7/3)
	AC	8	Sandy clay loam	Light gray (10YR 7/2)
	C_{ca}		Sandy clay loam	White (10YR 8/2)
Church clay loam	A_{1p}	6	Clay loam	Dark grayish brown (10YR 4/2)
	A_{12}	6	Clay loam	Grayish brown (10YR 5/2)
	AC	8	Clay	Grayish brown (10YR 5/2)
	C_{ca}	12	Clay	Light gray (10YR 7/2)
	C		Clay	Light gray (10YR 7/1)
Mansker fine sandy loam	A_p	8	Fine sandy loam	Brown (7.5YR 5/4)
	AC	10	Sandy clay loam	Pale brown (10YR 6/3)
	C_{ca}	10	Sandy clay loam	Very pale brown (10YR 8/4)
	C		Sandy clay loam	White (10YR 8/2)

See footnote at end of table.

morphological relationships of the major soils of Lamb County

Structure	Reaction	Underlying material	Topography
Weak, granular	Weakly calcareous	C horizon is soft, unconsolidated material washed from nearby soils.	Slopes along ancient drainageways.
Weak, coarse, prismatic and subangular blocky.	Strongly calcareous		
Weak, subangular blocky	Strongly calcareous		
Weak, subangular blocky	Mildly alkaline	In places the C_{ca} horizon has 30 to 60 percent calcium carbonate that is usually soft. C horizon is soft, unconsolidated material.	Nearly level to gently sloping areas that appear to have been ancient lakebeds or drainageways.
Weak, coarse, prismatic and subangular blocky.	Mildly alkaline		
Weak, subangular blocky	Strongly calcareous		
	Very strongly calcareous		
	Very strongly calcareous		
Single grain	Neutral	C horizon is fine sandy loam to sandy clay loam in texture and is unconsolidated material.	Gently undulating uplands; higher elevations where associated with Amarillo soils.
Single grain	Neutral		
Moderate, coarse, prismatic and weak, subangular blocky.	Neutral		
Weak, coarse, prismatic, and subangular blocky.	Neutral		
	Neutral		
Weak, granular	Neutral to mildly alkaline	C_{ca} horizon is about 30 percent soft and hard concretions of calcium carbonate. C horizon is many feet of thick, soft, unconsolidated material.	Nearly level to gently sloping uplands.
Moderate, coarse, prismatic and weak, subangular blocky.	Neutral to mildly alkaline		
Weak, coarse, prismatic and subangular blocky.	Weakly calcareous		
	Very strongly calcareous		
	Very strongly calcareous		
Structureless	Neutral to mildly alkaline	Hard, platy caliche, several feet thick, occurs at depths of 20 to 30 inches.	Nearly level to gently sloping uplands.
Moderate, coarse, prismatic	Neutral to mildly alkaline		
Weak, coarse, prismatic	Neutral to mildly alkaline		
Weak, coarse, prismatic and subangular blocky.	Weakly calcareous		
Weak, subangular blocky	Neutral to mildly alkaline	C_{ca} horizon is about 40 percent soft and hard concretions of calcium carbonate. C horizon is soft, unconsolidated material many feet thick.	Nearly level to gently sloping uplands.
Moderate, fine, subangular blocky.	Neutral to mildly alkaline		
Moderate, fine, blocky	Neutral to mildly alkaline		
Weak, subangular blocky	Weakly calcareous		
	Very strongly calcareous		
	Very strongly calcareous		
Weak, subangular blocky	Very strongly calcareous	C_{ca} horizon is thick, soft unconsolidated material that is very high in lime.	Nearly level to gently sloping areas that have been ancient lakebeds or drainageways.
Weak, subangular blocky	Very strongly calcareous		
Weak, subangular blocky	Very strongly calcareous		
	Very strongly calcareous		
Structureless	Strongly calcareous	C horizon is soft, unconsolidated material that is very high in lime.	Nearly level areas that appear to have been ancient lakebeds or drainageways.
Moderate, medium to fine, subangular blocky.	Strongly calcareous		
Moderate, medium, blocky	Strongly calcareous		
Moderate, fine, subangular blocky.	Very strongly calcareous		
	Very strongly calcareous		
Weak, granular	Strongly calcareous	C_{ca} horizon is indurated in places. C is soft, unconsolidated material.	Sloping areas along draws and around playas; some nearly level areas in association with Amarillo and Portales soils.
Weak, coarse, prismatic and granular.	Very strongly calcareous		
	Very strongly calcareous		
	Very strongly calcareous		

TABLE 8.—*Classification by higher categories and genetic and morpho-*

Order, great soil group, and dominant soil type of each series [1]	Horizon	Thickness	Texture	Color (dry)
Intrazonal—Con.				
Calcisols—Con.		*Inches*		
Portales fine sandy loam	A_{1p}	8	Fine sandy loam	Brown (10YR 5/3)
	A_{12}	8	Fine sandy loam	Dark brown (10YR 4/3)
	AC	14	Sandy clay loam	Pale brown (10YR 6/3)
	C_{ca}	24	Sandy clay loam	Very pale brown (10YR 7/3)
Grumusols:				
Randall clay	A_{11}	10	Clay	Dark gray (10YR 4/1)
	A_{12}	14	Clay	Gray (10YR 5/1)
	AC	40	Clay	Grayish brown (10YR 5/2)
	C		Clay	Grayish brown (10YR 5/2)
Azonal:				
Alluvial:				
Spur loam	A_{1p}	8	Loam	Dark grayish brown (10YR 4/2)
	A_{12}	18	Clay loam	Very dark grayish brown (10YR 3/2)
	AC	24	Clay loam	Brown (10YR 5/3)
	C		Clay loam	Light brownish gray (10YR 6/2)
Lithosols:				
Kimbrough soils	A_1	6	Fine sandy loam	Brown (7.5YR 5/4)
	D_r			
Potter soils	A_1	6	Loam	Pale brown (10YR 6/3)
	C		Clay loam	Pink (7.5YR 7/4)
Regosols:				
Drake soils	A_1	6	Loam	Light gray (10YR 7/2)
	AC	20	Loam	Light brownish gray (10YR 6/2)
	C		Loam	Light gray (10YR 7/2)
Tivoli fine sand	A_1	8	Fine sand	Pale brown (10YR 6/3)
	C		Fine sand	Yellow (10YR 7/6)

[1] The Lea, Lofton, Lubbock, Likes, and Springer are minor soils in the county and are not included in this table.

logical relationships of the major soils of Lamb County—Continued

Structure	Reaction	Underlying material	Topography
Weak, granular	Strongly calcareous	C_{ca} horizon has 30 percent concretions of calcium carbonate in places. C horizon is soft, unconsolidated material.	Nearly level to gently sloping areas that appear to be ancient lakebeds or drainageways.
Weak, subangular blocky and granular.	Strongly calcareous		
Weak, subangular blocky and granular.	Very strongly calcareous		
	Very strongly calcareous		
Moderate, fine, blocky	Neutral to strongly calcareous	C horizon is sticky and plastic clay.	Level floors of playas; remains under water for extended periods.
Moderate, medium, blocky	Neutral to strongly calcareous		
Weak, medium, blocky	Strongly calcareous		
Weak, medium, blocky	Strongly calcareous		
Weak, subangular blocky	Mildly alkaline to weakly calcareous.	C horizon is soft, unconsolidated material washed from nearby slopes. D horizon of sandier materials is in many places.	Nearly level terraces along drainageways; subject to infrequent overflows.
Moderate, medium to fine, subangular blocky.	Mildly alkaline to weakly calcareous.		
Weak, subangular blocky	Strongly calcareous		
	Strongly calcareous		
Weak, granular	Mildly alkaline	D_r horizon is hard, platy caliche many feet thick.	Gently sloping uplands.
Weak, granular	Strongly calcareous	C horizon is soft, unconsolidated material.	Steep slopes along ancient drains.
	Very strongly calcareous		
Weak, granular	Very strongly calcareous	C horizon is soft, unconsolidated material blown from nearby lakes.	Dunes to east of lakes.
Weak, granular	Very strongly calcareous		
	Very strongly calcareous		
Single grain	Neutral	C horizon is loose sand many feet thick.	Dune topography; most dunes are stabilized.
Single grain	Neutral		

Additional Facts About the County

In this section the climate, geology, and history of the county are discussed. Information is also given about agricultural statistics, natural resources, public facilities and farm improvements, industries, and transportation and markets.

Climate

Lamb County has a semiarid, warm, continental climate characteristic of the Southern High Plains. The mean annual temperature is 59.5°, but sudden and wide variations occur for short periods.[4] Rapidly moving cold fronts in the early spring are common. April is the month of extremes. The daytime temperatures may be in the 80's and 90's one day and in the 30's and 40's the next.

March and April make up the spring windy season. Strong winds that blow 6 to 48 hours and have velocities up to 70 miles per hour are common during this period.

July and August have the highest temperatures and the lowest wind velocities of the year. The normal monthly rainfall is between 1½ and 2 inches during these months. The summer precipitation occurs in local thunderstorms and is relatively ineffective because of the high evaporation caused by low humidity and high temperatures. Although daytime temperatures are high during this period, the nights are cool because of radiation and clear skies. September and October bring cooler days and more effective rainfall.

Hail frequently damages crops considerably during the thunderstorms of early summer. One or two tornadoes generally occur each year.

Table 9 shows the temperature at Lubbock, Tex., and the precipitation at Littlefield, Tex. At the Lubbock station, April 14 is the average date of the last killing frost in spring, and November 1 is the average date of the first killing frost in fall. These killing frosts have occurred as late as May 7 and as early as October 19. The average growing season is 201 days.

The average rainfall recorded at Littlefield for a period of 48 years (from 1911 to 1958) is 18.91 inches.[5] This average ranged from as little as 8.73 inches in 1917 to 40.55 inches in 1941 (fig. 18). Normal precipitation is probably about 16.25 inches, because 60 percent of the time the average rainfall is below 18.91 inches.

As shown in figure 19, the period of highest precipitation is April through October. In this 7-month period, 83 percent of the annual rainfall occurs. For this reason it is difficult to grow winter cover crops to control wind erosion. In addition, the protective stubble needed to control wind erosion must be grown during the period from April to October.

[4] Temperature records were supplied by the U.S. Weather Bureau, Lubbock, Tex.

[5] Precipitation records were supplied by the Western Cottonoil Mill at Littlefield, Tex.

TABLE 9.—*Temperature and precipitation*

[Temperature data from U.S. Weather Bureau station at Lubbock, Tex. (elevation 3,243 feet); and precipitation data from the Western Cottonoil Mill at Littlefield, Tex. (elevation, 3,556 feet)]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1917)	Wettest year (1941)	Average snowfall [3]
	° F.	*° F.*	*° F.*	*Inches*	*Inches*	*Inches*	*Inches*
December	40.6	83	−2	0.65	0.00	0.72	1.1
January	38.8	87	−10	.58	.35	.55	2.3
February	43.1	89	−17	.65	.05	.61	1.9
Winter	40.8	89	−17	1.88	.40	1.88	5.3
March	49.7	95	−2	.83	.21	3.56	.6
April	59.5	100	18	1.40	.58	2.23	(4)
May	67.8	104	29	2.85	1.07	12.69	------
Spring	59.0	104	−2	5.08	1.86	18.48	.6
June	76.4	109	39	2.36	.64	4.13	------
July	79.3	109	49	2.07	1.42	3.68	------
August	78.4	107	43	1.88	1.16	1.85	------
Summer	78.0	109	39	6.31	3.22	9.66	------
September	71.2	105	33	2.84	3.03	4.47	------
October	61.2	97	19	2.21	.14	5.89	------
November	48.6	89	5	.59	.08	.17	.4
Fall	60.3	105	5	5.64	3.25	10.53	.4
Year	59.5	109	−17	18.91	8.73	40.55	6.3

[1] Average temperature based on a 41-year record, through 1955; highest and lowest temperatures on a 38-year record, through 1952.

[2] Average precipitation based on a 47-year record, through 1958; wettest and driest years based on a 47-year record, in the period 1911–1958.

[3] Estimate.

[4] Trace.

Geology

The outstanding geologic event in the history of Lamb County was the deposition of the Ogallala formation. This formation is the main source of irrigation water in the county. It was formed from materials deposited more than a million years ago, during the early Pliocene epoch. To understand how this underground formation developed, it is necessary to review the geologic history of the area.

About 180 million years ago (shortly before the uplift of the Appalachian Mountains), a shallow sea covered the area that is now western Texas. Marine sediments that were deposited during this period formed the Permian Red Beds. While the Appalachian Mountains were being formed, the High Plains rose above the level of the sea. Streams that flowed over the exposed Permian rocks eroded fine-textured materials and redeposited them along the

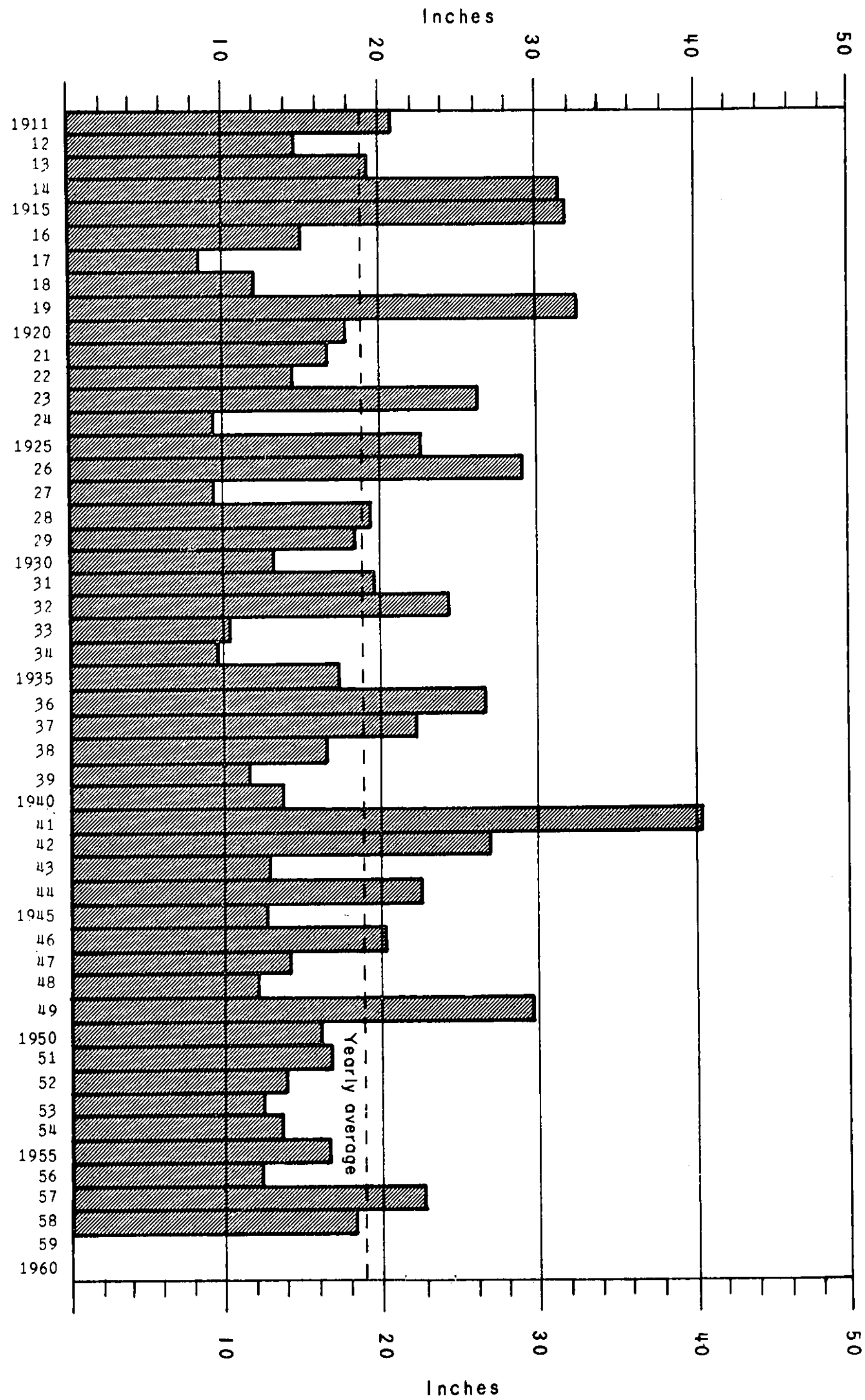

Figure 18.—Annual precipitation at Littlefield, Tex., 1911 to 1958.

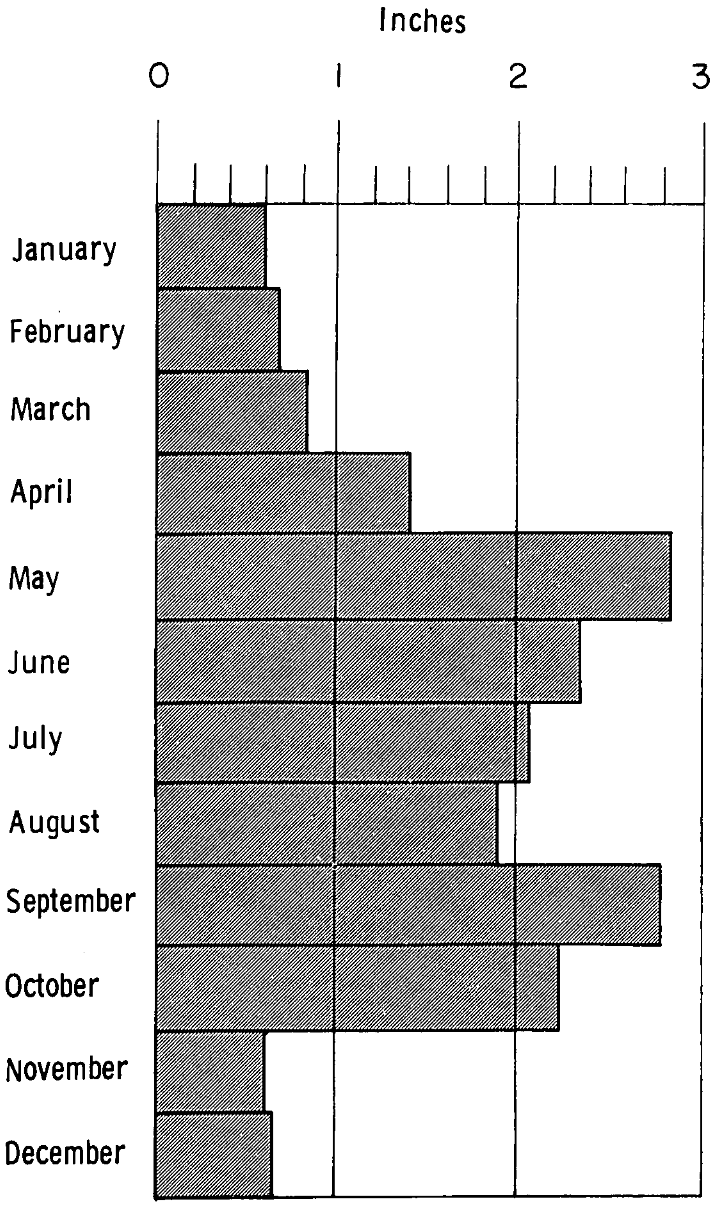

Figure 19.—**Average monthly precipitation at Littlefield, Tex., 1911 to 1958.**

flood plains. These materials formed the Triassic Red Beds, or the impervious stratum that underlies the Ogallala formation.

During the Cretaceous period, a shallow arm of the sea again partly covered the High Plains. Sand, clay, and limestone were deposited over most of the area.

The formation of the Rocky Mountains was the next significant development. Swift streams from the mountains cut valleys and canyons through the Cretaceous rock formed from the deposits of the Cretaceous period and into the underlying Triassic Red Beds. Most of the Cretaceous material that had been deposited on the High Plains was washed away. In Lamb County the Cretaceous formation remains only in the southwestern part. Outcrops occur locally along the western shores of Bull and Illusion Lakes (fig. 20).

The northernmost boundary of the Cretaceous material is shown by the dashed line AB in figure 21. Because this material is so near the surface, irrigation is very unimportant in the southwestern one-fourth of the county. The Ogallala formation of water-bearing sand is between 200 and 300 feet thick north of line AB and about 100 feet thick south of the line. Saturated sand is generally thin in the southwestern part of the county but is between 100 to 200 feet thick in the northern part. The average depth to water in Lamb County is 100 feet.

When the Rocky Mountains reached their maximum height, they began to erode. Coarse, gravelly material was carried great distances by the swift streams. As the mountains were eroded, the streams became less swift and began to deposit gravel, sand, and silt near their sources. These deposits formed alluvial fans of gravelly, coarse material along the foot slopes of the mountains. The finer materials were transported and spread farther to the east. The Ogallala formation developed from these deposits of outwash more than a million years ago. This outwash was deposited just before the beginning of the ice age. The glaciers did not move as far south as Texas, but during the ice age a much moister climate prevailed in this area. Because of an increase in precipitation, streams formed and flowed across the Ogallala formation. The draws crossing Lamb County are probably the remains of these streams.

The source of the underground water in Lamb County is the saturated beds of sand and gravel in the lower part of the Ogallala formation and not an underground river or lake. The Triassic Red Beds underneath the Ogallala formation are fairly impervious, so it is not likely that water could be obtained from any of the lower strata. During the development of the Ogallala formation in a period of nearly a million years, water from the Rocky Mountains was stored in its water-bearing stratum. When the Ogallala formation was cut off from the mountains, its source of water was blocked. At present rain or snow that falls on the High Plains probably is the only source of water to replenish the underground supply.

The water table slopes gently to the southeast, and the water moves very slowly. The natural rate of flow is probably not more than 1 or 2 feet a day. Before wells were drilled for irrigation, the water was discharged mainly by springs along the caprock at about the same rate it was replenished. At present water is being pumped for irrigation faster than it is being restored.

The amount of water available varies considerably in places because of variations in the thickness of the water-producing stratum and the depth to the Red Beds. Apparently, the Red Beds are undulating, and in places they rise nearly to the static water table, or above it (7). Certain areas of Lamb County have no irrigation water, probably for this reason.

The materials from which the soils of the county developed were deposited during the Pliocene epoch, and were then reworked in the Pleistocene epoch. Wind did most of this reworking during the Illinoian age. This age was fairly dry, and the wind shifted and sorted the surface materials. During this age Lamb County was probably a prairie with a scant supply of water.

As the glaciers moved southward into the United States, the climate of Texas became much wetter. During this time Lamb County probably consisted of humid prairies

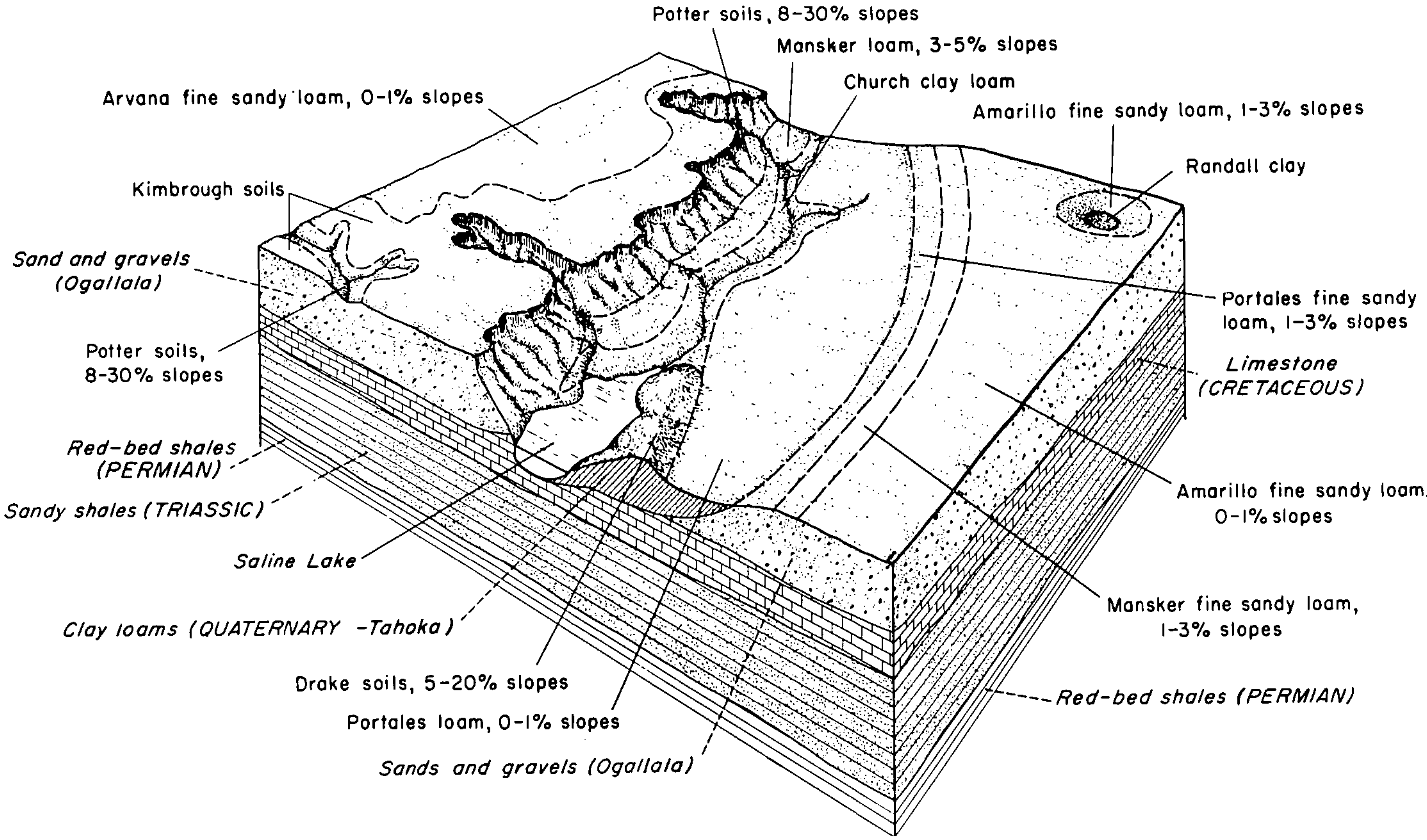

Figure 20.—**Soils and underlying formations surrounding a saline lake (now Bull and Illusion Lakes).**

and wooded areas along streams. When the glaciers receded, the climate became more arid, and the soils and vegetation developed as they now are.

History

Lamb County was formed from Bexar Territory in 1876. It was organized in 1908. The county was named for Lt. George A. Lamb, who was killed in the Battle of San Jacinto.

In 1870, thousands of buffalo roamed the area. Various tribes of Plains Indians hunted and camped in the area. Favorite Indian watering places were Springlake Springs and Sod House Spring near Earth and in Yellowhouse Canyon near Yellow Lake.

The Spaniards called this region Llano Estacado, which means staked plains, since rock stakes were set up at intervals to lead to watering places.

Buffalo hunters arrived about 1874. The early ranchers came soon afterward. In 1882 Texas gave 3 million acres of land to the Capitol Land Syndicate, for which the Syndicate was to erect the capitol building at Austin, Tex. Part of this land was in Lamb County. This Capitol land was known as the XIT Ranch.

In 1901 George W. Littlefield bought about 235,000 acres, and W. E. Halsell bought about 185,000 acres of this Capitol land, most of which was in Lamb County. A few ranchers and farmers arrived in the area soon after the beginning of the century, but farming was not widespread until after World War I.

In 1900 there were only 31 people in Lamb County. According to the U.S. Census reports, the population had increased to 17,452 in 1930, and to 20,015 in 1950.

Cotton and grain sorghum have been the main crops over the years. Large acreages of other crops, however, could be grown if markets existed.

Agricultural Statistics

According to the Federal census, there were 1,787 farms in the county in 1954. The average size of all farms was approximately 369 acres. According to the records of local agricultural agencies, the average dryland farm was 380 acres and the average irrigated farm was approximately 250 acres. The average ranch consisted of about 6,500 acres.

According to the Federal census, cropland harvested totaled 419,812 acres; cultivated summer fallow, 4,296 acres; and improved pasture, 3,125 acres. The acreage in cotton in 1954 was 197,934 acres, and that in sorghum was 203,125 acres.

Also reported were 17,923 cattle and calves, 2,171 of which were dairy cows; 78,880 chickens, 4 months old or over; and 676 turkeys raised.

Natural Resources

Soil is the greatest natural resource in Lamb County. The original product of the soil, good grass, attracted the first cattle ranchers. The native fertility of a soil devel-

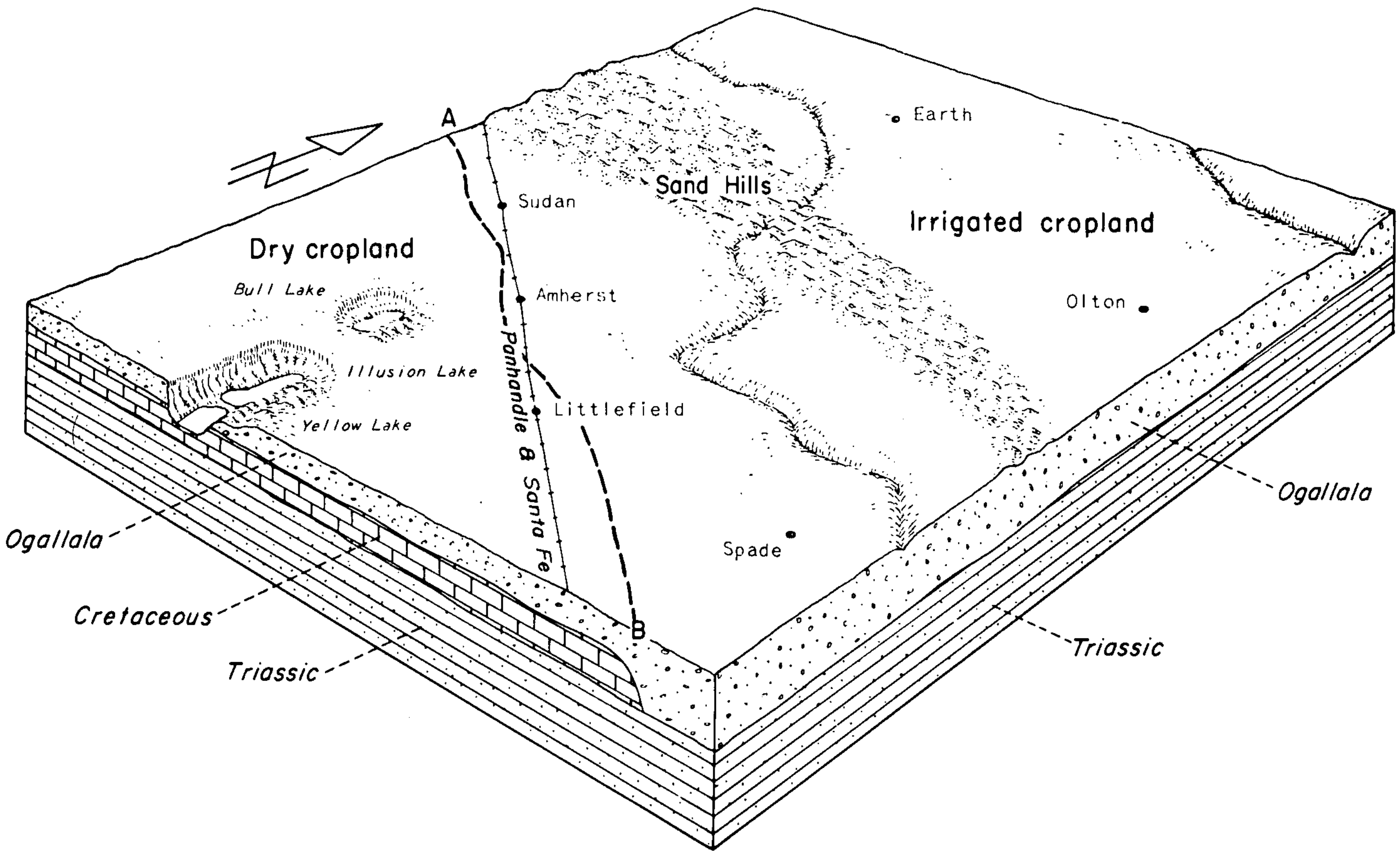

Figure 21.—**Irrigated and dry cropland of Lamb County, Tex.**

oped under grass provided good yields of cotton, grain sorghum, and other products and encouraged agricultural development.

Oil has also contributed to the growth of the county. In 1958 there were about 117 oil wells in the county.

Irrigation water is also an important natural resource. There was little irrigation in the county before World War II, but in 1959 it is estimated that there were more than 5,000 irrigation wells, irrigating about 350,000 acres.

The only resident game birds now in the county are blue quail, bobwhite quail, and doves. Migratory ducks, geese, and sandhill cranes are plentiful in the fall and winter. A few antelopes and prairie chickens are on the ranches.

Public Facilities and Farm Improvements

High schools are located at Amherst, Littlefield, Olton, Spade, Springlake, and Sudan. The county has churches of nearly all denominations.

All rural sections have electricity. According to the 1954 census, 26 percent of the farms had telephones.

Farm dwellings are generally well kept. Farm equipment is also kept in good repair. In 1954, 1,602 farms reported a total of 3,181 tractors. Farmers depend on Latin-American laborers to hoe and harvest cotton.

Farmers and ranchers became concerned about soil erosion and land deterioration during the droughts and duststorms. On August 12, 1946, they organized the Lamb County Soil Conservation District. The purpose was to encourage proper use of land and to conserve the soil and water resources in the county.

Industries

Most industries in Lamb County are connected with agriculture. More than 30 cotton gins are located throughout the county. There are also cotton compresses, cotton-oil mills, and delinting plants. A large commercial fertilizer plant is located in Littlefield. Grain elevators and large storage buildings are in various towns.

Nonagricultural industries are oil production and caliche mining. There is also a plant that produces electricity for all or part of 20 counties in eastern New Mexico and western Texas.

Transportation and Markets

The railroads and highways meet the needs of agriculture and industry. Very few farms are more than 3 miles from a paved road. All roads are well maintained.

U.S. Highway Nos. 70, 84, and 385, and Farm Road 54 are important roads in the county. The Panhandle and Santa Fe Railway connects the county to important shipping points. Motortruck and bus lines on the main highways connect the county to all parts of the State.

Glossary

Aggregate (of soil). Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism. Many properties of the aggregate differ from those of an equal mass of unaggregated soil.

Alkaline soil. Generally, a soil that is alkaline throughout most or all of the parts of it occupied by plant roots; although the term is commonly applied to only a specific layer or horizon of a soil. Precisely, any soil horizon having a pH value greater than 7.0; practically, a soil having a pH above 7.3.

Alluvium (alluvial deposits). Soil materials deposited on land by streams.

Base saturation. The relative degree to which soils have metallic cations adsorbed. The proportion of the cation-exchange capacity that is saturated with metallic cations. These cations are mainly calcium, potassium, magnesium, and sodium.

Calcareous soil. Soil that contains enough calcium carbonate to effervesce (fizz) when treated with dilute hydrochloric acid. Soil that is alkaline in reaction because of the presence of free calcium carbonate. The pH is usually more than 7.8.

Caliche. A broad term for secondary calcareous material in layers near the surface. As the term is used, caliche may be soft and clearly recognized, as the C_{ca} horizon of the soil, or it may exist in hard, thick beds beneath the solum or exposed at the surface.

Clay. (1) As a soil separate, the mineral soil particles less than 0.002 millimeters in diameter. (2) As a soil textural class, soil material that contains 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Clay film. A coating or film of clay that has been deposited on the surface of a soil aggregate.

Concretions. Local concentration of certain chemical compounds, such as calcium carbonate or compounds of iron, that forms nodules of mixed composition and of various sizes, shapes, and coloring.

Consistence, soil. The attributes of soil material that are expressed by the degree and kind of cohesion and adhesion or by the resistance to deformation or rupture. Terms commonly used to describe consistence are *loose, soft,* or *hard* when dry; *loose, friable,* or *firm* when moist; and *sticky* or *plastic* when wet. *Friable* soil, for example, is easily crumbled by the fingers.

Dispersion, soil. The breaking down of soil aggregates to single grains. Ease of dispersion is an important factor influencing the erodibility of soils. Generally speaking, the more easily dispersed the soil, the more erodible it is.

Eolian deposits. Wind-deposited materials moved fairly short distances.

Indurated. Very strongly cemented. In Lamb County indurated refers to rocklike caliche.

Infiltration rate. The maximum rate at which a soil, in a given condition at a given time, can absorb water. Also, the maximum rate at which a soil will absorb water impounded on the surface at a shallow depth when adequate precautions are taken regarding border or fringe effects (*4*).

Lacustrine deposits. Materials deposited in the waters of lakes and exposed by lowering of the water level or by the elevation of the land. In Lamb County most of this material was deposited during Pleistocene times.

Liquid limit. The moisture content at which a soil passes from a plastic to a liquid state.

Lithosol. A soil having little or no evidence of soil development and consisting mainly of a partly weathered mass of rock fragments or of nearly barren rock.

Loam. Soil having approximately equal amounts of sand, silt, and clay. Loam contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

Marine sediment. Material reworked by the sea and later exposed.

Parent material. The unconsolidated mass of rock material (or peat) from which the soil profile develops.

Permeability. The readiness with which air, water, or plant roots penetrate into or pass through soil pores. The portion of the soil being discussed should be designated; for example, "the permeability of the A horizon" (*4*).

pH. A term used to indicate the acidity and alkalinity of soils. A pH of 7.0 indicates precise neutrality; large numbers (up to 14.0), alkalinity; and smaller ones (down to 0.0), acidity.

Phase, soil. That subdivision of a soil type having variations in characteristics not significant to the classification of the soil in its natural landscape but significant to the use and management of the soil. The variations are chiefly in such external characteristics as relief, stoniness, or erosion.

Plasticity index. The numerical difference between liquid limit and plastic limit. The range in moisture content within which a soil is in a plastic state.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Playas. Flat, generally dry, undrained basins that contain water for periods following rains.

Saline soil. A nonalkali soil containing sufficient soluble salts to impair its productivity (*4*).

Sand. Individual rock or mineral fragments having diameters ranging from 0.05 millimeter (0.002 in.) to 2.0 millimeters (0.079 in.). Sand grains consist chiefly of quartz, but they may be of any mineral composition.

Series, soil. A group of soils that, except for the texture of the surface soil, have horizons similar as to differentiating characteristics and arrangement in the soil profile, and that developed from a particular type of parent material. A series may include two or more soil types that differ from one another in the texture of the surface soil.

Silt. Individual mineral particles of soil that range in diameter between the upper size of clay, 0.002 millimeter and the lower size of very fine sand, 0.05 millimeter.

Soil. Soil is the collection of natural bodies occupying portions of the earth's surface that support plants and that have properties due to the integrated effect of climate and living matter, acting upon parent material, as conditioned by relief, over periods of time.

Solum. The upper part of the soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soils includes the A and B horizons.

Structure. The aggregation of primary soil particles into compound particles, or clusters of primary particles, which are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal types of soil structure are defined as follows:

Blocky.—Aggregates are shaped like blocks; they may have flat or rounded surfaces that join at sharp angles.

Block, subangular.—Aggregates have some rounded and some flat surfaces; upper sides are rounded.

Granular.—Roughly spherical, firm, small aggregates that may be either hard or soft but are generally more firm and less porous than crumb and without the distinct faces of blocky structure.

Prismatic.—Aggregates have flat, vertical surfaces, and their height is greater than their width.

Subsoil. The B horizons of soils with distinct profiles. In soils with weak profile development, the subsoil can be defined as the soil below the plowed soil (or its equivalent of surface soil), in which roots normally grow.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness.

Texture, soil. The relative proportions of the various size groups of individual soil grains in a mass of soil. Specifically, it refers to the proportions of sand, silt, and clay.

Type, soil. A group of soils, within a given soil series, that have the same texture in the surface soil; have the same arrangement of horizons; and have the same parent material. A soil type may be subdivided into several soil phases.

Volumetric change. The volume change for a given moisture content, expressed as a percentage of the dry volume of the soil mass, when the moisture content is reduced from the stipulated percentage to the shrinkage limit.

Literature Cited

(1) American Association of State Highway Officials.
1955. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 7, 2 v., illus.

(2) Bennett, Hugh Hammond.
1939. SOIL CONSERVATION. 993 pp., illus.

(3) Chepil, W. S., Woodruff, N. P., and Zingg, A. W.
1955. FIELD STUDY OF WIND EROSION IN WESTERN TEXAS. U.S. Dept. Agr. SCS–TP–125, 59 pp., illus.

(4) Committee on Terminology.
1956. REPORT OF DEFINITIONS APPROVED BY THE COMMITTEE ON TERMINOLOGY, SOIL SCIENCE SOCIETY OF AMERICA. Soil Sci. Soc. Amer. Proc. 20: 430–440, illus.

(5) Daniel, Harley A., and Langham, Wright H.
1936. The effect of wind erosion and cultivation on the total nitrogen and organic matter content of soils in the southern high plains. Amer. Soc. Agron. Jour. 28: 587–596, illus.

(6) Frye, John C., and Leonard, A. Byron.
1957. Studies of Cenozoic geology along eastern margin of Texas High Plains, Armstrong to Howard counties. Univ. Tex., Bur. Econ. Geol. Rept. 32: 60 pp., illus.

(7) Theis, Charles V.
1932. Report on the ground water in Curry and Roosevelt counties, New Mexico. Tenth Bien. Rpt. of State Engin. of N. Mex., 1930–1932, 63 pp., illus.

(8) United States Department of Agriculture.
1951. Soil survey manual. U.S. Dept. Agr. Handb. 18, 503 pp., illus.

(9) ———
1957. Soil. U.S. Dept. Agr. Ybk., 784 pp., illus.

(10) ———
1960. Soil survey, Dawson County, Tex. Series 1957, No. 6, 58 pp., illus.

(11) ———
1960. Soil survey, Hansford County, Tex. Series 1957, No. 3, 41 pp., illus.

(12) ———
1959. Soil survey, Lynn County, Tex. Series 1953, No. 3, 37 pp., illus.

(13) Waterways Experiment Station, Corps of Engineers.
1953. The unified soil classification system. Tech. Memo. No. 3–357, 3 v. Vicksburg, Miss.

GUIDE TO MAPPING UNITS, CAPABILITY UNITS, AND RANGE SITES

[See table 1, p. 7, for approximate acreage and proportionate extent of the soils, table 3, p. 33, for estimated average yields for cultivated soils under two levels of management, and table 4, pp. 35 and 36, for range sites]

Map symbol	Mapping unit	Page	Capability unit			Page	Range site
			Dryland	*Page*	*Irrigated*		
Ad	Active dunes	6	VIIIe-1	32	--------		
AfA	Amarillo fine sandy loam, 0 to 1 percent slopes	8	IIIe-2	28	IIe-2	28	Mixed Land.
AfB	Amarillo fine sandy loam, 1 to 3 percent slopes	8	IIIe-1	28	IIIe-1	28	Mixed Land.
AfC	Amarillo fine sandy loam, 3 to 5 percent slopes	8	IVe-3	31	IVe-3	31	Mixed Land.
AlA	Amarillo loam, 0 to 1 percent slopes	9	IIIce-1	27	IIe-1	27	Deep Hardland.
AlB	Amarillo loam, 1 to 3 percent slopes	9	IIIe-3	29	IIIe-3	29	Deep Hardland.
AmB	Amarillo loamy fine sand, 0 to 3 percent slopes	8	IVe-4	29	IIIe-4	29	Sandy Land.
An	Arch fine sandy loam	9	IVe-1	30	IIIe-6	30	High Lime.
Ao	Arch loam	9	IVe-1	30	IIIe-6	30	High Lime.
As	Arch loamy fine sand, overblown	10	VIe-2	31	IVe-7	31	Sandy Land.
AvA	Arvana fine sandy loam, 0 to 1 percent slopes	10	IIIe-2	28	IIe-2	28	Mixed Land.
AvB	Arvana fine sandy loam, 1 to 3 percent slopes	10	IIIe-1	28	IIIe-1	28	Mixed Land.
AxA	Arvana fine sandy loam, shallow, 0 to 1 percent slopes	11	IVe-5	30	IIIe-5	30	Mixed Land.
AxB	Arvana fine sandy loam, shallow, 1 to 3 percent slopes	10	IVe-5	30	IIIe-5	30	Mixed Land.
BeB	Berthoud fine sandy loam, 1 to 3 percent slopes	12	IIIe-1	28	IIIe-1	28	Mixed Land.
BeC	Berthoud fine sandy loam, 3 to 5 percent slopes	12	IVe-3	31	IVe-3	31	Mixed Land.
BeD	Berthoud fine sandy loam, 5 to 8 percent slopes	11	VIe-3	31	--------		Mixed Land.
BhB	Berthoud loam, 1 to 3 percent slopes	11	IIIe-3	29	IIIe-3	29	Deep Hardland.
BhC	Berthoud loam, 3 to 5 percent slopes	11	IVe-2	30	IVe-2	30	Deep Hardland.
Br	Brownfield fine sand, thick surface	12	VIe-2	31	IVe-7	31	Sandy Land.
Ch	Church clay loam	12	IVe-1	30	IIIe-6	30	High Lime.
DrB	Drake soils, 1 to 3 percent slopes	13	IVe-1	30	IIIe-6	30	High Lime.
DrC	Drake soils, 3 to 5 percent slopes	13	VIe-1	31	IVe-6	31	High Lime.
DrE	Drake soils, 5 to 20 percent slopes	13	VIe-5	31	--------		High Lime.
Km	Kimbrough soils	13	VIIs-1	32	--------		Shallow Land.
Le	Lea clay loam	13	IIIce-1	27	IIe-1	27	Deep Hardland.
Lk	Likes loamy fine sand, undulating	14	VIe-2	31	IVe-7	31	Sandy Land.
Lo	Lofton clay loam	14	IIIce-1	27	IIe-1	27	Deep Hardland.
Lu	Lubbock fine sandy loam	15	IIIe-2	28	IIe-2	28	Mixed Land.
MfA	Mansker fine sandy loam, 0 to 1 percent slopes	16	IVe-5	30	IIIe-5	30	Mixed Land.
MfB	Mansker fine sandy loam, 1 to 3 percent slopes	16	IVe-5	30	IIIe-5	30	Mixed Land.
MfC	Mansker fine sandy loam, 3 to 5 percent slopes	16	VIe-1	31	IVe-6	31	Mixed Land.
MfD	Mansker fine sandy loam, 5 to 8 percent slopes	16	VIe-3	31	--------		Mixed Land.
MkA	Mansker loam, 0 to 1 percent slopes	15	IVe-5	30	IIIe-5	30	Shallow Land.
MkB	Mansker loam, 1 to 3 percent slopes	15	IVe-5	30	IIIe-5	30	Shallow Land.
MkC	Mansker loam, 3 to 5 percent slopes	15	VIe-1	31	IVe-6	31	Shallow Land.
MkD	Mansker loam, 5 to 8 percent slopes	15	VIe-3	31	--------		Shallow Land.
OtA	Olton loam, 0 to 1 percent slopes	16	IIIce-1	27	IIe-1	27	Deep Hardland.
OtB	Olton loam, 1 to 2 percent slopes	16	IIIe-3	29	IIIe-3	29	Deep Hardland.
PfA	Portales fine sandy loam, 0 to 1 percent slopes	17	IIIe-2	28	IIe-2	28	Mixed Land.
PfB	Portales fine sandy loam, 1 to 3 percent slopes	18	IIIe-1	28	IIIe-1	28	Mixed Land.
PmA	Portales loam, 0 to 1 percent slopes	17	IIIce-1	27	IIe-1	27	Deep Hardland.
PmB	Portales loam, 1 to 3 percent slopes	17	IIIe-3	29	IIIe-3	29	Deep Hardland.
Pn	Portales loamy fine sand, overblown	18	VIe-2	31	IVe-7	31	Sandy Land.
PsC	Potter soils, 1 to 8 percent slopes	18	VIIs-1	32	--------		Shallow Land.
PsE	Potter soils, 8 to 30 percent slopes	18	VIIs-1	32	--------		Shallow Land.
Ra	Randall clay	19	VIw-1	31	VIw-1	31	
Rf	Randall fine sandy loam	19	IVw-1	31	IVw-1	31	
Sf	Springer fine sandy loam, undulating	19	IIIe-1	28	IIIe-1	28	Mixed Land.
Sg	Springer fine sandy loam, hummocky	19	IVe-3	31	IVe-3	31	Mixed Land.
Sh	Springer loamy fine sand, hummocky	20	VIe-2	31	IVe-7	31	Sandy Land.
Sp	Spur fine sandy loam	20	IIIe-2	28	IIe-2	28	Bottom Land.
Sr	Spur loam	20	IIIce-1	27	IIe-1	27	Bottom Land.
Tv	Tivoli fine sand	21	VIIe-1	31	--------		Sandy Land.
ZfA	Zita fine sandy loam, 0 to 1 percent slopes	21	IIIe-2	28	IIe-2	28	Mixed Land.
ZfB	Zita fine sandy loam, 1 to 3 percent slopes	21	IIIe-1	28	IIIe-1	28	Mixed Land.
ZmA	Zita loam, 0 to 1 percent slopes	21	IIIce-1	27	IIe-1	27	Deep Hardland.
ZmB	Zita loam, 1 to 2 percent slopes	21	IIIe-3	29	IIIe-3	29	Deep Hardland.
Zo	Zita loamy fine sand, overblown	22	IVe-4	29	IIIe-4	29	Sandy Land.

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