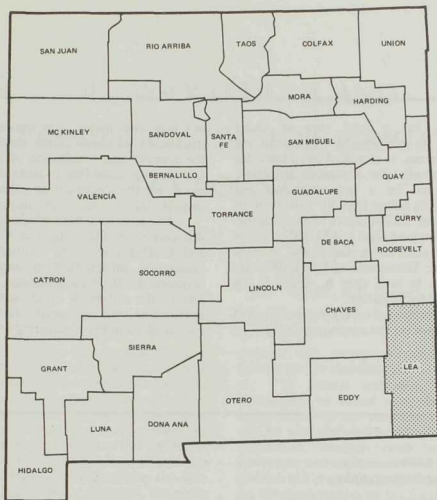


SOIL ASSOCIATIONS AND
LAND CLASSIFICATION FOR IRRIGATION
LEA COUNTY

*Agricultural Experiment Station
in cooperation with
Water Resources Research Institute
and
Soil Conservation Service*





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Summary

Lea County has a land area of about 2,812,200 acres. Approximately 44 percent, or about 1,230,000 acres, is classified as suitable for irrigation. The potential for expanding irrigation, therefore, is limited by a lack of water and economic restrictions rather than by a shortage of suitable soils. About 30,000 acres of the irrigable land are in irrigation land class 1; 420,000 acres are in class 2; 617,000 acres are in class 3; and 163,000 acres are in class 4. The remaining 1,582,000 acres in the county are in land class 6, which is not considered suitable for irrigation.

The data are presented on the basis of the soil associations as shown on the accompanying general

soil map (see figure 1 on the center pages). The irrigation land classification map (figure 2) shows the approximate distribution of the land classes in Lea County according to suitability for irrigation based on the dominant irrigable classes or non-irrigable class in each of the areas as outlined.

The soils have been classified according to the Association of State Highway Officials (AASHO) and Unified systems to facilitate use of the soil association information by engineers and others acquainted with these groupings. Information relative to the suitability of the soils for a variety of engineering uses and specific factors limiting their use are given in the engineering section.

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SOIL ASSOCIATIONS AND LAND CLASSIFICATION FOR IRRIGATION LEA COUNTY

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An essential criterion for planning the best possible use of land and water resources in New Mexico is information on the capability of soils for the numerous present and potential uses. One such land use is irrigated agriculture, and it is important that the many kinds of soil occurring within the state be evaluated for this land use. The interest in the expansion of irrigated land in New Mexico also adds to the importance of determining the suitability of the various soils for irrigation. The water required for the new irrigated land, if expansion should occur, would have to be developed locally, transferred from other sections of the state or brought in from distant sources.

The primary purpose of this report is to present information on the suitability of soils in Lea County for irrigation. The acreage, general location and relative capability of the soils for such use are given. This information can be used in appraising the value or suitability of large tracts of land for irrigation. For a satisfactory income to operators on irrigated land, it is essential that only soils capable of high productivity under sustained irrigation be developed for this use. Obviously, limited or expensive irrigation water should be used on soils that are the most productive and have the fewest limitations. The extent, location, and the relative suitability of land for irrigation in Lea County are presented on the irrigability land classification map (see figure 2 on the center pages of this report). The general soil map figure 1 and a

detailed soil survey provided the information needed for the classification for irrigation.

The general soil map is also useful in community or broad area planning. It provides information on soil resources of large tracts that can be used for preliminary planning for irrigated agriculture, forestry, range, urban, engineering, recreation and wildlife uses. For example, from the general soil map of Lea County, information can be obtained relative to the location of large tracts of land with soils suitable for the development of irrigated land. It will also show those areas with soils best suited to range, recreation, wildlife or other uses, as well as the general location of soils that will present problems in constructing roads or for building foundations.

The general soil map of Lea County does not replace the need for detailed soil maps for operational planning on individual farms and ranches or the planning of specific locations for houses, roads, parks and other items of this nature. General soil maps are suitable *only for general or broad area planning*. They can, however, serve a very useful purpose when available at the proper time in the planning process.

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A detailed soil survey and preliminary report made by the Soil Conservation Service³ provided the soils information used in this study, including soil descriptions and information on alternate uses of each soil.

The general soil map (figure 1) which is small scale showing general soil areas or soil associations, was prepared by grouping geographically associated soils shown on the detailed soil maps into 11 general soil areas. These 11 map units, which are referred to as "soil associations," are landscapes, or geographic areas, that have distinctive proportional patterns of soils. Inasmuch as individual kinds of soil normally occur in comparatively small rather than large areas, the map units on the general soil map of Lea County are generally made up of two or more kinds of soil. In addition, land types and a number of minor soils are commonly components of the map units in this county. The kinds of soil included in each of the soil associations are not necessarily similar. In fact, they are often contrasting in characteristics that influence their use and management.

After soil data were assembled, the major soils and miscellaneous land types within each soil association were placed into one of five classes of land depending upon their productive capacity under irrigated agriculture. The criteria used in the placement of soils in the irrigation land classes are those proposed at a 1967 conference organized by the Federal Water Resources Council⁴ as modified by a committee of this conference on January 12, 1968. These criteria were agreed upon by authorities from several organizations concerned with land classification, and appear to have a particularly high reliability. For uniform and consistent application of these criteria and standards, the New Mexico Soils Work Group has issued guidelines and clarifications as needed and appropriate. The classification system establishes four classes of irrigable land and one class of non-irrigable land. The limita-

tions for use under irrigation increase from class 1 through 4. For example, class 1 has few or no limitations for use as cropland under irrigation. It is land that is productive and well adapted to irrigation. High yields of most climatically adapted crops can be obtained on these lands with good management. Class 2 land, although well suited to irrigation, has slight to moderate limitations for sustained use under irrigation. These are moderately productive lands, or are lands that require more than average management to obtain high yields of climatically adapted crops. Class 3 land, which has moderate to severe limitations for sustained use under irrigation, is generally not as suitable for the production of as wide a range of the climatically adapted crops as land in classes 1 and 2. These lands also have a more limited productivity for many of the climatically adapted crops, or are lands that require a very high level of management to obtain moderate to high yields. Class 4 land has a very severe limitation for sustained use under irrigation. The lands included in this class are usually adapted only to a relatively few of the climatically adapted crops. In some cases these lands may be adapted or used for the production of specialized crops under a very high level of management. Class 6 land is not suitable for irrigation.

The lands in Lea County were placed in the various irrigation land classes on the basis of those soil properties and qualities that affect their suitability for continued use under irrigation. The availability, or the cost of pumping and conveying of irrigation water does not enter into the classification. Nor was the shape, size, and location of lands with respect to other lands to be developed for irrigation considered in this classification. The detailed criteria used in the placement of land in the various irrigation land classes are listed in table 1.

The major soil properties and qualities, and related land factors, that affected the placement of land in this county in the various irrigation land classes were soil texture, effective soil depth, available water-holding capacity, permeability, erosion, surface smoothness, slope, internal soil drainage and surface drainage.

³Turner, Millard T. Soil Survey of Lea County, New Mexico. U.S. Department of Agriculture. Unpublished. Copies of field sheets and interim report available for review at Lovington, New Mexico, office of Soil Conservation Service.

⁴Proceedings Water Resources Council, Irrigation Land Classification Seminar, Salt Lake City, Utah, July 1967.

Table 1. Land classification specifications for Pacific Southwest Basin irrigation land classes¹

Land Characteristics	Class 1	Class 2	Class 3	Class 4	Non-irrigable Class 6
Soils					
Texture (Surface 12") ²	LVFS-CL	LS-C Peat, Muck	MS-C	MS-C	All other lands not meeting criteria for arability
Moisture Retention (AWHC-48") ³	> 6.0'	4.5' 6.0'	3.0' 4.5'	2.5' 3.0'	
Effective Depth (inches)	> 40" ⁴	30- 40	20- 30	10- 20	
Salinity (EC _e x 10 ³ - equil.)	< 4	4- 8	8- 12	12- 16	
Sodic Conditions⁵					
Percent area affected	< 5	5- 15	15- 25	25- 35	
Severity of problem ⁶	Slight	Moderate	Moderate	Moderate	
Permeability (in place - in/hr)	0.2-5.0	0.05-5.0	0.05-10.0	Any	
Permissible coarse fragments (% by vol.)					
Gravel	15	35	55	70	
Cobbles	5	10	15 ⁷	35 ⁷	
Rock Outcrops (distance apart in feet)	200	100	50	30	
Soil Erosion (for all classes)	Severely eroded soils will be downgraded one class. Less severely eroded soils may be downgraded one class, depending on other conditions.				
Topography (or land development items)⁸					
Stone for Removal (cubic yards per acre)	10	25	50	70	
Slope (percent)					
Moderately to severely erodible	< 2	2- 5	5- 10	10- 20	
Slightly erodible	< 4	4- 10	10- 20	20- 25	
Surface Leveling or					
Tree Removal (amount of cover)	Light	Medium	Medium heavy	Medium heavy	
Irrigation Method					
Lands unsuited to gravity irrigation where land grading would permanently reduce soil fertility below arable limits or exceed permissible costs, or field pattern too complex, may be considered for sprinkler. Land must meet other requirements for arability. Designate by "S" - example, 3-S.					
Drainage					
Soil Wetness (depth to water table during growing season with or without drainage)					
Loam or finer	> 60"	40" - 60"	20" - 40"	10" - 20"	
Sandy	> 50"	30" - 50"	20" - 30"	10" - 20"	
Surface Drainage					
Depth to Drainage Barrier (in feet)	> 7	6- 7	5- 6	1.5- 5	
Air Drainage ⁹	No Problem	Minor	Restricted	Restricted	

¹Specifications are representative of conditions after land is developed for irrigation. Each individual factor represents a minimum requirement, and unless all other factors are near optimum two or more interacting deficiencies may result in land being placed in lower class or designated class 6 - non-irrigable.

²Finer textures may be required than those indicated for each class in areas subject to critical hot spells or wind; coarser textures may sometimes be permissible.

³In areas of very warm growing season 3" may be required for class 4 and in cold areas as little as 5" may be permitted for class 1.

⁴Depth of 60" or more is required for class 1 where deep-rooted crops are important.

⁵More extensive and severe sodic problems may be tolerated in areas of wide crop adaptability.

⁶Severity of problem: **Slight** - ESP less than 15% or less than 25% if dominated by nonswelling clays; **moderate** - ESP less than 20% or less than 30% if clay minerals favorable; **severe** - ESP less than 30%; with certain soil minerals may range above 50% as measured by usual techniques.

⁷May range above 50% in subsoil for certain crops if surface soil is favorable.

⁸Special crop and management practices may justify exceeding the limits for stone removal or slope in class 4; irregularity of slope may necessitate downgrading of class unless deficiency is compensated for by possibility of sprinkler irrigation.

⁹Air drainage is a consideration mainly in areas adapted to fruit or to early or late vegetables.

Abbreviations:

LVFS - loamy very fine sand

LS - loamy sand

MS - medium sand

CL - clay loam

C - clay

AWHC - available water holding capacity

ESP - exchangeable sodium percentage

Location and Topography

Lea County comprises an area of 2,812,200 acres in the extreme southeastern part of New Mexico. It is bordered on the north by Roosevelt County and on the west by Chaves and Eddy counties. The New Mexico-Texas state line forms the eastern and southern boundary.

The northern half of Lea County lies on the southwestern part of the Llano Estacado, or Staked Plains, which comprise the southern extension of the High Plains. The High Plains are remnants of a vast deposit of soil and rock debris laid down by eastward-flowing streams along the eastern front of the Rocky Mountains and the mountain ranges of central New Mexico. The High Plains area in Lea County is essentially an extensive plain in which the gently sloping, smooth-lying surface is broken only by a few drainage depressions and minor areas with undulating or dunelike topography. The undulating and hummocky areas occur dominantly in the extreme eastern and northern parts. Although there are no perennial streams, there are a number of slightly depressed drainageways that usually fade out within a few miles or terminate in depressions of roughly circular form which are locally known as playas. Elevations in this part of the county range from about 4,300 feet at the northwest boundary to about 3600 feet above sea level near the city of Hobbs in the southeastern part.

The southern half of the county consists of an extensive area of gently sloping sandy plains. This area, which generally slopes to the south is dominated by gently sloping to undulating and dunelike landscapes. With the exception of a narrow strip along the western boundary which

drains to the west, the natural drainage is also generally to the south and southeast. Monument Draw, which heads in the lower portions of the High Plains area north of the Monument community is the only extensive intermittent drainageway in the county. It drains southward into Texas near the southeast corner of the county. Elevations in this area range from about 4200 feet near the community of Maljamar in the northwestern part to slightly less than 3000 feet in the southeastern part near the Texas line.

Climate⁵

Lea County climate is semi-arid and continental, with warm summers, cool, dry winters, abundant sunshine, and a large range of daily and annual temperature. The land elevation increases northwestward from about 3000 feet in the southeast to about 4300 feet in the northwest corner. The upslope flow of moist air in the general southeasterly circulation from the Gulf of Mexico brings heavier amounts of precipitation to the north and west parts of the county. In summer, strong surface heating by solar radiation contributed to brief but heavy thunderstorms of the season. Average annual precipitation in the county ranges from near 12 inches in the south to near 16 inches in the north. Over 80 percent of the annual rainfall occurs during the growing season, April through October. Extreme annual precipitation totals in the county have been a high of 36.49 inches at Tatum in 1941, and a low of 2.46 inches at Ochoa in 1941.

⁵This section was prepared by Frank E. Houghton, ESSA, Weather Bureau State Climatologist.

Table 2. Monthly temperatures and precipitation, Hobbs, Lea County, New Mexico, 1913 to 1960

Item	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperatures (F°)												
Average daily maximum	56	61	68	76	84	93	94	92	86	76	65	57
Average daily minimum	27	31	36	45	54	63	66	65	58	48	35	27
Daily mean	41	46	52	61	69	78	80	79	72	62	50	42
Extreme maximum	83	87	93	98	107	110	110	107	109	98	88	84
Extreme minimum	-7	-1	1	17	27	37	47	45	34	12	9	1
Precipitation												
Average (inches)	.36	.31	.51	.86	1.81	1.94	1.90	2.45	2.37	1.91	.43	.53
Average days 0.10 inch or more (no.)	1	1	1	2	3	3	3	4	3	3	1	1
Average snowfall (inches)	1.6	0.5	1.1	0.2	0	0	0	0	0	T	0.4	1.3

T = Less than 0.05 inch

1956. The greatest monthly total was 13.67 inches at Tatum in May 1941, and 7.00 inches fell at Tatum in one day, July 30, 1925.

Average annual snowfall totals range from about 4 inches in the south to about 10 inches in the north. Although nearly half the winter months, on the average, go without snowfall, 18 inches of snow fell in one day at Tatum, February 20, 1961. Blizzards are rare, and most snow melts soon after falling. Ice storms occur in some years.

Table 2 shows the annual patterns of precipitation and temperature at Hobbs, and these are generally representative of other county locations, selected data of which are listed in table 3. Lea county is in one of the warmer sections of the state, and during the summer months temperatures of 90 degrees or higher occur two-thirds of the days. During winter months, freezing temperatures occur on about two-thirds of days, but seldom does the temperature go below zero, or fail to rise above freezing during the day. Extreme temperatures in the county have been 113 degrees at Maljamar, June 12 and other dates, 1946, and -32 degrees at Tatum, February 8, 1933. The growing

season averages nearly seven months, early April through October.

Surface winds predominate from the southwest during the winter half of the year, and from southeast in summer. Spring has the higher average wind speeds, near 15 miles per hour, while fall has the lower speeds, averaging 10 miles per hour. Winds in excess of 46 miles per hour are predominantly from the westerly quadrant, and occur an average of twice a year.

With dry soil and winds over 25 miles per hour, blowing dust may occur. An average of one to two tornadoes a year may occur, but usually no damage results as many tornadoes are over open land. Occasionally, hail accompanying a tornado or thunderstorm may cause extensive local crop damage. An annual average of near 75 percent of the possible sunshine, or 3300 hours, may be expected, and relative humidity averages from 45 to 50 percent, with spring having the lower value. Class A pan evaporation averages from 105 to 110 inches per year, with two-thirds of the evaporation during the growing season.

Table 3. Annual averages of selected climatological data, Lea County, New Mexico, for period of record through 1960 (except through 1938 for Carson Seep Ranger Station and through 1949 for Loving)

Station	Elevation feet	Temperature			Precipitation		Last 32° F or Lower in Spring	First 32° F or Lower in Fall	Time Between Dates days
		Mean maximum	Mean minimum	Yrs. of record	Mean annual	Yrs. of record			
		F°	F°	no.	in.	no.			
Hobbs	3615	76	46	40	15.38	43	Apr. 10	Nov. 4	208
Jal	3150	80	48	12	11.51	29	Apr. 5	Oct. 30	208
Lovington 1WNW	3990	76	44	27	15.42	29	Apr. 12	Nov. 1	203
Maljamar 2SE	4000	75	46	16	12.62	17	Apr. 9	Nov. 2	207
Pearl	3800	76	45	35	13.16	44	Apr. 9	Nov. 3	208
Tatum 1SSW	4100	75	42	34	15.88	40	Apr. 18	Oct. 26	191
Caprock 3WNW	4345				12.09	10			
Crossroads 2NE	4120				15.94	28			
Ochoa	3454				10.03	18			

Land Use

The land in Lea County has been grazed by livestock for many years. Ranching, which was the principal agricultural enterprise in this county when it was first organized in 1917 from parts of Eddy and Chaves counties, is still an important land use. In 1968, the county's farm and range lands supported about 65,000 cattle and 35,000 sheep.⁶

⁶New Mexico Agricultural Statistics, Vol. VI, Supplement II, 1969.

Dry-land farming is also practiced to a very limited extent in the northeastern part of the county. Only about 10,000 acres of dry cropland remains under cultivation.⁷ Farming without irrigation is hazardous under the prevailing climatic conditions in this county. Profitable dry-land crop

⁷New Mexico Soil and Water Conservation Needs Inventory, Statistical Report, Soil Conservation Service and other Federal and State agencies, 1970.

yields can be expected only when average or above-average precipitation is obtained. The development of irrigated land in this county has occurred primarily since the boundaries of a large area of shallow ground water were established by the State Engineer in 1931 to form the Lea County Shallow Water Basin. By 1932, some 5000 acres were under irrigation. Except for the period immediately following World War II, when there was a rapid expansion of irrigated land, the increase in acreage of irrigated cropland in this county has occurred gradually since 1930. The State Conservation Needs Committee estimates that about 113,500 acres were irrigated by ground water in 1967. The Shallow Water Basin, with the city of Lovington slightly to the west of its center, covers an area of some 25 miles east and west and 50 miles north and south. Cotton, grain sorghums, and alfalfa are the most extensively grown crops. Other include small grains, corn, forage sorghums and vegetable crops.

The present use of the land in each soil association is shown in the following list:

<i>Soil Map Symbol and Soil Association</i>	<i>Present Land Use</i>
1. Kimbrough	Range
2. Kimbrough-Lea-Stegall	Range, irrigated farming
3. Amarillo-Arvana	Range, irrigated farming, dry farming
4. Berino-Cacique	Range
5. Kermit-Maljamar	Range
6. Brownfield-Patricia-Tivoli	Range
7. Midessa-Wink	Range
8. Simona-Upton-Tonuco	Range
9. Largo-Pajarito	Range
10. Portales-Stegall-Lea	Range, irrigated farming
11. Arch-Portales	Range

A land use is shown only when it appears to apply to at least 1 percent of the association. Although much land is used for recreation, this use is not included because of the difficulty of accurately determining its extent.

Description of Soils

The 11 soil associations recognized in Lea County are shown by color and symbol on the accompanying small-scale soil map (figure 1). They are named for the major soil series occurring within each of the soil associations. Where the other soils included were not extensive, only one soil series name is used. Selected characteristics and qualities of the major soils are summarized in table 4. A description of each soil association follows:

1. Kimbrough association

This association encompasses an area of about 648,800 acres on the High Plains in the north-central and northwestern parts of the county. The soils, which are dominantly shallow, occur on nearly level to very gently sloping uplands. Although this general soil area is remarkably smooth, a number of swales or very slightly depressed drainageways occur locally and terminate in shallow depressions or playas.

The association supports a relatively dense cover of grass and under good management moderate yields of forage are obtained. The principal grasses are blue grama, sand dropseed, buffalograss, sidecoats grama, black grama, bush muhly, three-awns, New Mexico feathergrass and tobosa. In the swales and slightly depressed areas, tobosa grass often comprises a relatively high

percentage of the plant community. In addition to the grasses, a few mesquite shrubs, broom snake-weed, small soapweed, and various species of cacti commonly occur on the soils of this association.

Soil Characteristics: Kimbrough soils, the most extensive in the association, occur on nearly level to gently sloping uplands. The surface layer to an average depth of six to eight inches consists of a dark grayish brown non-calcareous to weakly calcareous gravelly loam. The pebbles, which are dominantly angular, hard caliche fragments, may comprise as much as 30 percent of the soil volume. These surface layers may range in thickness from 4 to 20 inches. Where the soils are deeper than the average depth of six to eight inches, the soil layer immediately above the caliche is commonly strongly calcareous and lighter colored. Indurated caliche occurs at depths ranging from 4 to 20 inches.

The Lea, Stegall, Portales, and Slaughter series are also common and occur in small depressional areas and swales throughout the association. Stegall soils have a dark grayish-brown noncalcareous loam surface layer and blocky mildly alkaline clay loam subsoil. The Lea soils differ principally from the Stegall soils in that they have coarser textured or loam subsoils that contain fine threads and filaments of carbonates. Both the Lea and Stegall soils

are commonly underlain by indurated caliche at depths ranging from about 20 to 40 inches. The Portales soils have a surface layer of grayish-brown strongly calcareous loam over a pale brown loam or light clay loam subsoil. They are typically underlain by a prominent lime zone or soft caliche at a depth of 20 to 40 inches. The Slaughter soils which are shallow are underlain by indurated caliche at depths of 10 to 20 inches.

Irrigation Potential: There is little or no potential for development of irrigated land in this association because it is dominated by the shallow soils of the Kimbrough series which are not suitable for such use. There are, however, included small bodies of arable soils suitable for use as cropland under irrigation. Their use for this purpose generally will not be feasible as they occur as small areas interspersed with large tracts of non-irrigable soils.

2. Kimbrough-Lea-Stegall association

Included in this association is an extensive area of about 433,200 acres in the east-central part of Lea County. It occupies broad, nearly level to very gently sloping landscapes that are characteristic of the Southern High Plains. The soils in general, are developing over indurated to strongly cemented caliche at shallow to moderate depths. It differs primarily from the Kimbrough association previously described in that it contains a much higher percentage of moderately deep soils suitable for irrigation. Although the underlying caliche restricts soil depth and plant roots, there are sufficient fractures in the caliche to permit deep percolation of excess soil moisture. It supports a good cover of grass with blue grama, hairy grama, sideoats grama, black grama, buffalograss, ring mulch and tobosa grass representing the more important species. In the swales and slightly depressed areas occupied by the soils of Stegall and Slaughter series, tobosa grass often comprises a relatively high percentage of the plant community. The more common shrubs on the soils of this unit include broom snakeweed, yucca, and a few scattered mesquite. Irrigated farming is also an important land use in this association. Cotton, grain sorghums, and forage sorghums are extensively grown.

Soil Characteristics: Kimbrough soils, the most extensive in the association, commonly occur on the ridges or slightly higher parts of the landscape in this association. The surface layer to an

average depth of six or eight inches consists of a dark grayish-brown noncalcareous to weakly calcareous gravelly loam. The pebbles, which are dominantly angular hard caliche fragments, may comprise as much as 30 percent of the soil volume. Where the soils are deeper than the average depth of six to eight inches, the soil layer immediately above the caliche is commonly strongly calcareous and lighter colored. Indurated caliche occurs at depths ranging from 4 to 20 inches.

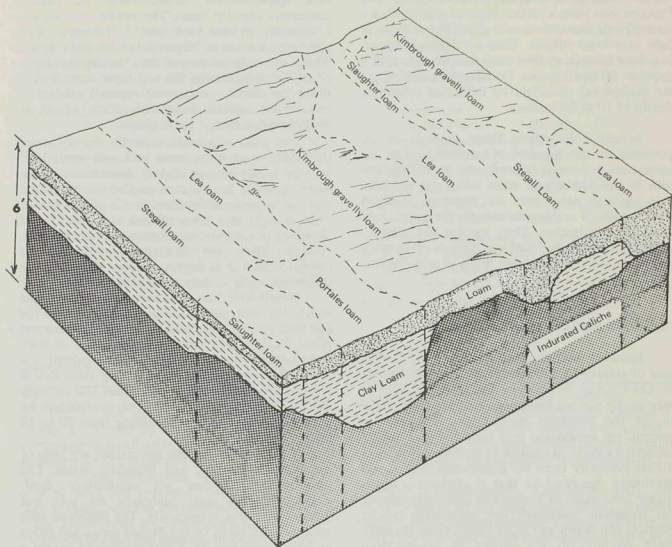
Lea soils, which are typically slightly lower than Kimbrough soils, occur on broad nearly level to very gently sloping slightly depressional areas. They typically have a dark grayish-brown surface layer of noncalcareous loam over a grayish-brown loam or light clay loam subsoil. Fine threads and filaments of calcium carbonate usually occur in the subsoil. They are commonly underlain by indurated caliche at depths of 20 to 40 inches, but it is occasionally as deep as 60 inches.

Stegall soils, the least extensive of the major soils in this unit, occur in close association with the Lea soils in weakly defined swales and depressional areas. They usually have a surface layer of dark grayish-brown to brown loam. Their subsoil is a brown heavy clay loam or silty clay loam that is weakly calcareous in the upper part and strongly calcareous in the lower part. This is underlain by indurated caliche at depths ranging from 20 to 40 inches.

Also included in this association are soils of the Portales, Arvana, and Slaughter series. The Portales and Arvana are moderately deep, medium-textured soils underlain by soft and indurated caliche, respectively. The Slaughter soils are similar to those of the Stegall series, but differ in being underlain by indurated caliche within a depth of 20 inches.

Irrigation Potential: Approximately 43 percent of the land in this association has been classified as suitable for irrigation. There is, therefore, some potential for expansion of irrigation. The Lea, Stegall, Portales, and Arvana soils account for most of 148,500 acres of land included in irrigation land class 2, which is well suited for use as irrigated cropland. This class 2 land, in association with minor acreages of class 3 and 4 land, will generally provide tracts of sufficient size to warrant consideration for irrigation. Although the interspersed non-irrigable lands in this association usually occur in tracts of sufficient size so that they can be conveniently excluded from areas planned for irrigation, there are some exceptions. Some potentially irrigable lands that remain after exclusion of the non-irrigable land will be in such

Fig. 3. Typical pattern of soils in the Kimbrough-Lea-Stegall association



small areas and irregular shapes that their use for irrigation will not be feasible.

3. Amarillo-Arvana association

This general soils area occurs in close association with the Brownfield-Tivoli-Amarillo association in the northern and northeastern parts of the county. It occurs on nearly level to very gently sloping and undulating landscapes, unlike the rolling and hummocky landscapes of the Brownfield-Tivoli-Amarillo association. The soils of this association are dominantly moderately deep and deep, and well-drained.

Approximately seven percent of the county, or about 192,600 acres, are included in this association.

It supports a good cover of native grass, with blue grama, hairy grama, black grama, little blue-stem, New Mexico feathergrass, sand muhly, three-awns, and sidecoats grama being the more important species. Although the dominant use is range, a limited acreage in this association is cultivated under irrigated and dry-cropland farming. Grain and forage sorghums and cotton are the main crops produced.

Soil Characteristics: Amarillo soils, the most extensive in the association, occur on nearly level to very gently undulating landscapes. They usually have a surface layer of brown to reddish-brown loamy fine sand or fine sandy loam that is leached free of lime. Their subsoil is a thick yellowish-red to reddish-brown sandy clay loam that is typically noncalcareous in the upper part. This is underlain

by a light reddish-brown sandy clay loam with a high lime content. The lime or calcium carbonate below an average depth of 40 inches is typically visible in the form of threads and small soft masses.

Arvana soils are mainly on nearly level to very gently sloping landscapes in this association. The surface layer is a brown to reddish-brown noncalcareous fine sandy loam or loamy fine sand. The subsoil is a moderately thick reddish-brown sandy clay loam that is typically neutral in reaction. This is underlain by indurated to strongly cemented caliche at depths ranging from 20 to 36 inches.

Soils of the Portales, Zita, Gomez, Sharvana, and Kimbrough series also comprise significant acreages in this association. The Portales and Zita soils are moderately deep over soft caliche, the Sharvana and Kimbrough soils are shallow over indurated caliche and the Gomez soils, which are sandy, and are underlain by soil layers high in lime at moderate depths.

Irrigation Potential: The major soils in this association have characteristics and properties favorable for their use as irrigated cropland. The Amarillo soils, which are in classes 1 and 2, are well suited to cropland use under irrigation. Their major limitation is a slight to moderate susceptibility to wind erosion. The Arvana soils, in addition to the wind erosion hazard, are of moderate depth and water-holding capacity. Due to these characteristics and properties, the Arvana soils were placed in irrigation land class 3. The Zita and Portales soils, because of their moderate depth and water-holding capacity, were included in irrigation land class 2. These soils, together with Amarillo loamy fine sand, account for most of the land of that class. The Sharvana, Kimbrough, and Gomez soils are not suitable for use as irrigated cropland because of their limited water-holding capacity, shallow depth or sandy textures. Approximately 36 percent of the land in this association is in land class 6. Non-irrigable lands are often interspersed with the lands suitable for irrigation and will tend to limit the size of the tracts that can be developed for irrigation.

4. Berino-Cacique association

This soil association occurs on gently sloping and undulating landscapes below the High Plains in the southern part of the county with associations 5, 8, and 9. Approximately 6 percent of the land in the county, or about 169,100 acres, are included in this general soil area. It is dominated by soils with sandy surface layers that are moderately susceptible to wind erosion. This has resulted in

much of the land in this association being affected by some degree of wind erosion. These soils, which are dominantly of moderate depth, are developing in sandy eolian and alluvial materials.

This general soil area is used for grazing of livestock, and under good management moderate yields of forage are obtained. Because of the moderate wind erosion hazard, good management is required to prevent depletion of vegetative cover and resulting soil deterioration by wind erosion. The vegetative cover consists dominantly of tall and mid grasses, mesquite, shinnery oak, and yucca. The more common grasses include sand bluestem, little bluestem, sand dropseed, sideoats grama, black grama, three-awns and switchgrass.

Soil Characteristics: Berino soils, one of the more extensive soils in this association, commonly occur on gently sloping and undulating landscapes. The eroded phases of the Berino soils, however, are usually hummocky. They have a thin surface layer of yellowish-red to reddish-brown noncalcareous loamy fine sand or fine sandy loam over thick reddish-brown sandy clay loam subsoils. The lower part of the subsoil, which is normally calcareous contains a few filaments and small soft masses of lime. This is underlain at depths of three to four feet by a pinkish-white sandy clay loam with a very high lime content.

The Cacique soils occupy the nearly level to gently sloping landscapes in this association. These soils, which are similar to those of the Berino series, have reddish-brown noncalcareous fine sandy loam or loamy fine sand surface layers over thick reddish-brown sandy clay loam subsoils. They differ from Berino soils mostly in that they are underlain by indurated caliche at depths of 20 to 36 inches.

Other soils of considerable importance and extent in this association include those of the Midessa, Wink, Tonuco, and Simona series. The Tonuco and Simona soils are underlain by white or pinkish-white strongly cemented caliche within a depth of 20 inches. The calcareous Midessa and Wink soils are typically underlain by soft caliche or materials very high in lime at depths of 20 to 40 inches. Also in this association are small areas of Maljamar, Pyote, Palomas, and Kermit soils. These deep sandy soils comprise less than 10 percent of this general soil area.

Irrigation Potential: Berino and Cacique soils, which have characteristics and properties favorable for their use as irrigated cropland, are in irrigation land classes 2 and 3, respectively, and account for 48 percent of the association. In addition to the

class 2 and 3 land, about 18 percent of the land in this association has been placed in irrigation land class 4, and 34 percent in non-irrigable land class 6. This area therefore offers some potential for development of irrigated land, particularly if the irrigable land is adjacent to other irrigable soils. The irrigable soils, however, do have some limitations for irrigation due to their sandy textures, moderate depth, and water-holding capacities. With the application of adequate erosion control measures and other accepted good farming practices, the major soils in this general soil area, however, should have sufficient productive capacity to support irrigation.

5. **Kermit-Maljamar association**

This association, the largest in the county, includes an area of about 777,400 acres in the southern and southwestern parts of the county. A characteristic feature of this general soil area is the undulating to gently rolling and dunny landscapes. The soils, which are generally deep, are developing in sandy eolian and alluvial materials. They typically have sandy surface layers that are highly susceptible to wind erosion, and as a result, only a few areas have not been affected by some degree of erosion. A few dunes, which are essentially barren of vegetation, actively erode during windy periods.

The soils of this association are used for grazing of livestock. A high level of management is essential to prevent depletion of vegetative cover and soil deterioration by wind erosion. Under good management, moderate yields of forage are obtained. The vegetative cover consists dominantly of tall and mid grasses, mesquite, shiny oak, and sand sage. The more common grasses include sand bluestem, little bluestem, sand dropseed, tall dropseed, sidecoats grama, three-awns, and switchgrass.

Soil Characteristics: Kermit soils occupy those parts of the landscape in this association that are gently rolling or have dunelike topography. They have surface layers of loose, noncalcareous yellowish-brown fine sand over thick deposits of fine sand.

Maljamar soils, the other major component of the association, occur on gently undulating and hummocky landscapes. They have a thick surface layer to yellowish-red fine sand over a subsoil of red to reddish-brown sandy clay loam. This, in turn, is underlain by a yellowish-red light sandy clay loam. A white fractured caliche layer is often present at depths between four and six feet.

Other relatively extensive soils in this association include those of the Pyote, Palomas, and

Berino series. The Pyote soils, like the Maljamar soils, occupy gently undulating to hummocky landscapes. They have a thick surface layer of light brown to yellowish-red noncalcareous fine sand or loamy sand. This is underlain by a reddish-yellow to reddish-brown fine sandy loam. A few fine threads and small soft masses of lime commonly occur below an average depth of 40 inches.

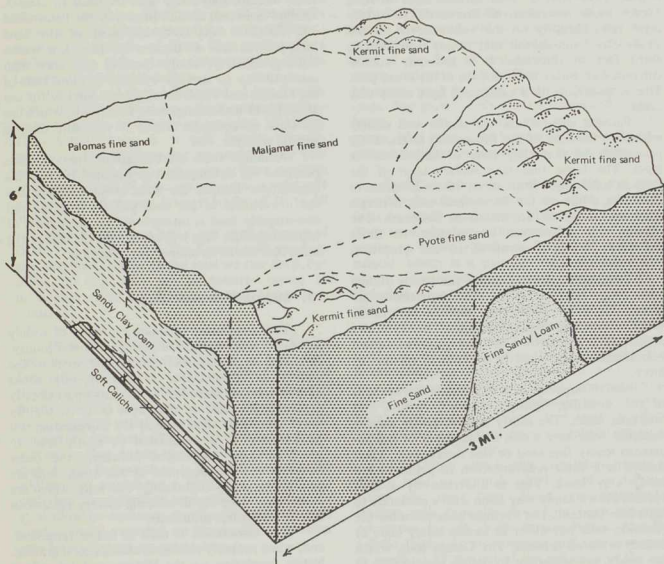
The Palomas soils, which are similar to those of the Maljamar series, differ essentially in thickness of the surface layer. The loose fine sand surface layer of the Palomas soils ranges from about 12 to 20 inches in thickness, while on the Maljamar soils it ranges from about 20 to 36 inches in thickness.

Berino soils occupy the nearly level to gently sloping areas between the undulating to gently rolling Kermit and Maljamar soils. The eroded parts of the Berino soils usually are hummocky. They have a thin surface layer of yellowish-red to reddish-brown noncalcareous loamy fine sand or fine sand over thick reddish-brown sandy clay loam subsoils. The lower part of the subsoil, which is normally calcareous, contains a few filaments and small soft masses of lime. This is underlain at depths of three to four feet by a pinkish-white sandy clay loam with a very high lime content or soft caliche.

Also in this association are small areas of active duneland, Cacique, Pajarito, Tonuco, and Wink soils. Active duneland includes the barren or nearly barren sand dunes that are actively eroding. The Cacique and Wink soils are moderately deep sandy soils underlain by indurated caliche and lacustrine materials, respectively. The Pajarito soils are deep sandy soils in depressions and drainages. The Tonuco soils are shallow noncalcareous sandy soils underlain by indurated caliche. These soils comprise about 17 percent of the association.

Irrigation Potential: The Berino, Maljamar, Pyote, and Palomas soils, where they occur in tracts of sufficient size, have properties suitable for use as irrigated cropland. These soils, however, have moderate to severe limitations because of their sandy textures, high water intake rates, and low to moderate water-holding capacities. Wind erosion is a moderate to severe hazard and careful management will be needed to minimize damage by wind. These soils, however, if provided with essential improvements of land leveling, soil conditioning or modification, and the application of adequate erosion control measures and other accepted good farming practices should have sufficient productive capacity to support irrigation. The Maljamar and Berino soils can also be improved for

Fig. 4. Kermit-Maljamjar association. This soil association is extensive in the southern part of the county



irrigation by deep plowing or mixing of the sandy surface layers with the underlying sandy clay loam subsoil.

Kermit soils, because of their extremely sandy nature, low water-holding capacity, and very high erosion hazard, are not recommended for irrigation.

6. Brownfield-Patricia-Tivoli association

This association, which includes an area of approximately 167,300 acres, occurs dominantly in the northern part of Lea County. A few areas along the east side of the county, adjoining Texas, are also included in this general soil area. A characteristic feature of this sandy soil area is the

gently undulating to rolling or dunny topography. The soils, which are generally deep, are developing in sandy eolian and alluvial sediments.

In this association, the native pasture areas that are in good condition support a fair to good cover of tall and mid grasses. However, a few dunes that are bare or nearly bare of vegetation are included. These areas actively erode during windy periods. The more common grasses on range in good condition are sand bluestem, little bluestem, switchgrass, sandreed, Indiangrass, sideoats grama, black grama, and sand dropseed. In addition to the grasses, these soils often support scattered to relatively dense stands of shrubs, including shinny oak, yucca, mesquite, sandsage, and various species of cacti.

Soil Characteristics: Brownfield soils, one of the more extensive soils in this association, usually occur on gently undulating and hummocky landscapes. They have a thick surface layer of light brown, loose, noncalcareous fine sand. The surface layer rests abruptly on the yellowish-red to red sandy clay loam subsoil that ranges from two to three feet in thickness. It is generally noncalcareous, but it may be calcareous in the lower part. This is underlain by a calcareous light sandy clay loam.

Patricia soils, which are similar and closely related to the soils of the Brownfield series, differ principally in that they have a thinner surface layer. The loose fine sand surface layer of the Patricia soils ranges from about 10 to 20 inches in thickness, while on the Brownfield soils it ranges from about 20 to 36 inches in thickness. The subsoil and substratum are similar to those described for the Brownfield in the preceding paragraph.

Tivoli soils, which occupy the gently rolling and dunny landscapes in this association, are characterized by their very rapidly permeable, loose, and extremely sandy profiles. They typically consist of a pale brown or light yellowish-brown noncalcareous fine sand to a depth of six feet or more.

Also of importance in this association are soils of the Amarillo, Springer, Gomez, Arvana, and Sharvana series. The nearly level to gently sloping Amarillo soils have a thin surface layer of noncalcareous loamy fine sand or fine sandy loam. Their subsoil is a thick reddish-brown to yellowish-red sandy clay loam. This is underlain by a light reddish-brown sandy clay loam with a moderate to high lime content. The Springer soils resemble the Amarillo soils but differ in having sandy loam or coarser-textured subsoils. The Gomez soils, which are sandy, are underlain by layers high in lime at moderate depths. The Arvana soils are underlain by indurated caliche at moderate depths and those of the Sharvana series at depths of 12 to 20 inches. In addition to these soils, the shallow Kimbrough soils and the moderately deep Lea soils occur to a very limited extent.

Irrigation Potential: The soils in this association that are suitable for irrigation are in irrigation land classes 3 and 4. These soils, therefore, do have moderate to severe limitations for use as cropland under irrigation. The Brownfield, Patricia, and Springer soils account for the majority of the land in class 3. These soils, which are characterized by sandy surface layers, are susceptible to wind erosion under cultivation, and management

practices will be needed to minimize damage by wind erosion. The Amarillo soils in this association are usually eroded and hummocky. Because of these factors they were also included in class 3. Shallow soils and eroded phases of the Brownfield and Patricia soils comprise most of the land included in class 4. Because of their low water-holding capacity, sandy texture, and very high susceptibility to damage by wind erosion, soils of the Gomez and Tivoli series are not suitable for use as cropland under irrigation. These soils, which are in class 6, comprise about 31 percent of this general soil area.

Although there are limitations, there is some potential for development of irrigated land in this association. Besides the wind erosion hazard and the unevenness of the land surface, irrigable and non-irrigable land is interspersed in many parts of this association. This will often limit the size of the areas that can be developed for irrigation.

7. Midessa-Wink association

This association includes a number of widely separated areas in the southern part of the county. It is one of the smaller general soil areas in the county as it comprises an area of only about 31,800 acres. It includes for the most part slightly depressional areas, or areas that occur at slightly lower elevations than that of the surrounding soil associations. It is dominated by nearly level to gently sloping landscapes. However, the outer fringes and those occupied by the sandy soils are commonly gently undulating. The soils, which are moderately deep are developing in very calcareous alluvial and eolian sediments.

This association is used as native rangeland, and, when properly managed, affords good grazing. Native vegetation on the Midessa and Jal soils is principally blue grama, black grama, vine mesquite, alkali sacaton, tobosa grass, three-awns, and burrograss. Sidecoats grama, little bluestem, sand dropseed, blue grama, black grama, and three-awns are dominant on the Wink and other sandy soils in this association.

Soil Characteristics: Midessa soils occur on the nearly level to very gently sloping slightly depressional areas and plains. They have a thin surface layer of dark grayish-brown to pale brown strongly calcareous clay loam. It commonly contains a few to many soft and hard concretions of lime. This grades into a light gray to pinkish-white clay loam or soft caliche substratum at depths ranging from 20 to 45 inches.

The associated gently sloping and undulating Wink soils have moderately thick surface layers of pale brown, calcareous fine sand or loamy fine sand. Their subsoil is a very pale brown to brown strongly calcareous fine sandy loam that usually contains a few fine concretions and small soft masses and threads of lime. This grades into a pinkish-white soft caliche substratum at depths ranging from 24 to 36 inches.

Jal soils, a minor component of this association, are characterized by a thick prominent lime layers beginning at a depth of less than 20 inches. The surface layer is a pale brown strongly calcareous loamy fine sand or sandy loam. This grades through a fine sandy loam or loam in which small soft masses of lime are common, to the soft caliche or a prominent lime at depths of 10 to 20 inches.

Also in this association are small acreages of Drake and Kermit soils. The Kermit soils are deep and extremely sandy. Drake soils are also deep, but differ in that they are moderately coarse to medium-textured and contain a much higher lime content.

Irrigation Potential: Although this association contains a relatively high percentage of land classified as irrigable, there is only a limited potential for expansion of irrigation because of the small acreage and the moderate to severe limitations for use as cropland under irrigation. Approximately 19 percent of the land in this unit is in class 3; 56 percent in class 4; and the remaining 25 percent in class 6. All the major soils of this association, in addition to containing a high lime content, are underlain by prominent lime zones or soft caliche at shallow to moderate depths. Moderate to high yields can be expected on these soils only when lime tolerant crops are produced.

8. Simona-Upton-Tonuco association

This general soil area includes a number of widely separated areas in the southern part of the county. The topography, which is quite varied, ranges from nearly level to gently sloping plains and mesa tops to moderately sloping and undulating uplands. A small acreage of steeply sloping lands on escarpments and breaks are also included. Although small and scattered areas of deep soils occur in this association, it is dominated by shallow soils underlain by fractured strongly cemented to indurated caliche. It comprises an area of approximately 205,400 acres, or about 7 percent of the county.

The entire association is used for grazing of livestock and wildlife. The soils, which are dominantly shallow and droughty, in general support only a fair cover of vegetation. Short, mid, and tall grasses with mesquite, creosotebush, broom snakeweed, and yucca comprise most of the vegetation. The more common grasses on the sandy soils of the Simona and Tonuco series are black grama, sideoats grama, Plains bristlegrass, little bluestem, sand dropseed, sandy muhly, and three-awns. The grass species on the Upton soils consist mainly of black grama, sideoats grama, hairy grama, blue grama, and burrograss. Creosotebush is often the dominant shrub on the Upton soils.

Soil Characteristics: Simona soils, the most extensive in the association, are mainly on nearly level to gently undulating plains and mesa tops. They typically have a thin surface layer of grayish-brown to brown calcareous fine sandy loam. The subsoil, which is a pale brown fine sandy loam, usually contains angular caliche fragments. This is underlain at a depth of less than 20 inches by white or pinkish-white strongly cemented caliche.

Tonuco soils occur on landscapes similar to those of the Simona series. They commonly occur in the part of the association that is adjacent to the Kermit-Maljamar-Berino general soil area. They have a thin surface layer of brown non-calcareous loamy fine sand. This is underlain by a reddish-brown noncalcareous loamy fine sand. A white layer of extremely hard fractured caliche occurs at a depth of 6 to 20 inches.

The Upton soils in this association occur on nearly level to strongly sloping and undulating plains and mesa tops. These very shallow to shallow soils typically have light brownish-gray, calcareous gravelly loam surface layers. Angular caliche fragments are common and may comprise as much as 35 percent of the soil mass in the soil layers immediately above the underlying indurated caliche. The depth to caliche, which is usually less than 10 inches, may range from 4 to 20 inches.

In addition to the three principal soils, miscellaneous land types and soils of minor extent comprise approximately 19 percent of the association. The land types include stony and rough broken land and gullied land. Mobeetie, Potter, and Kimbrough are the most extensive of the minor soils included in this unit. The Mobeetie soils have a surface layer of brown to grayish-brown fine sandy loam. This is underlain to a depth of five feet or more by weakly stratified loamy fine sand and fine sandy loam. It is calcareous throughout and usually contains fine threads and small soft masses of lime. The Potter and Kimbrough soils are

Table 4. Soil characteristics and qualities of major soils in each soil association, Lea County, New Mexico

Soil Map Symbol and Soil Association	Dominant Slope Range (percent)	Approximate Percent of Association	Pedologic Classification		Texture ¹
			Subgroup	Family	
1 Kimbrough					
Kimbrough gravelly loam	0 to 3	70	Aridic Petrocalcic Calcustoll	Loamy, mixed, thermic, shallow	g;loam
Other soils		30			
2 Kimbrough-Lea-Stegall					
Kimbrough gravelly loam	0 to 3	40	Aridic Petrocalcic Calcustoll	Loamy, mixed, thermic, shallow	g;loam
Lea loam	0 to 1	20	Aridic Petrocalcic Paleustoll	Fine-loamy, mixed, thermic, shallow	loam
Stegall loam	0 to 1	17	Aridic Petrocalcic Paleustoll	Fine, mixed, thermic	loam;slcl
Portales loam	0 to 3	6	Aridic Calcustoll	Fine-carbonatic, thermic	loam;fsl
Slaughter loam	0 to 1	3	Aridic Petrocalcic Paleustoll	Clayey, mixed, thermic, shallow	loam
Other soils		14			
3 Amarillo-Arvana					
Amarillo soils	0 to 3	40	Aridic Paleustalf	Fine-loamy, mixed, thermic	lfs;fsl,loam
Arvana fine sandy loam	0 to 3	15	Aridic Petrocalcic Paleustalf	Fine-loamy, mixed, thermic	fsl;lfs
Sharvana loamy fine sand	0 to 3	15	Petrocalcic Ustalfic Paleargid	Loamy, mixed, thermic, shallow	lfs;fsl
Gomez loamy fine sand	0 to 3	8	Typic Ustochrept	Coarse-loamy, mixed, thermic	lfs;fs;fsl
Other soils		22			
4 Berino-Cacique					
Berino loamy fine sand	0 to 3	24	Typic Haplargid	Fine-loamy, mixed, thermic	lfs;fsl;fs
Cacique loamy fine sand	0 to 3	24	Petrocalcic Paleargid	Fine-loamy, mixed, thermic	lfs;fsl;fs
Simona fine sandy loam	0 to 3	12	Typic Paleorthid	Loamy, mixed, thermic, shallow	fsl;lfs
Midessa fine sandy loam	0 to 3	9	Typic Ustochrept	Fine-carbonatic, thermic	fsl;loam
Wink fine sandy loam	0 to 3	9	Typic Calciorthid	Coarse-loamy, mixed, thermic	fs;lfs;fsl
Other soils		22			
5 Kermit-Maljamjar					
Kermit fine sand	0 to 5	25	Typic Torripsamment	Siliceous, thermic	fs
Maljamjar fine sand	0 to 3	32	Arenic Haplargid	Loamy, mixed, thermic	fs
Pyote fine sand	0 to 3	20	Arenic Ustalfic Haplargid	Loamy, mixed, thermic	fs;lfs
Berino loamy fine sand	0 to 3	2	Typic Haplargid	Fine-loamy, mixed, thermic	lfs;fsl;fs
Palomas fine sand	0 to 3	4	Typic Haplargid	Fine-loamy, mixed, thermic	fs
Other soils		17			
6 Brownfield-Patricia-Tivoli					
Brownfield fine sand	0 to 3	35	Arenic Aridic Paleustalf	Loamy, mixed, thermic	fs
Patricia fine sand	0 to 3	18	Aridic Paleustalf	Fine-loamy, mixed, thermic	fs
Tivoli fine sand	0 to 10	7	Typic Ustipsamment	Siliceous, thermic	fs
Amarillo loamy fine sand	0 to 3	6	Aridic Paleustalf	Fine-loamy, mixed, thermic	lfs;fsl
Springer loamy fine sand	0 to 3	6	Udic Paleustalf	Coarse-loamy, mixed, thermic	lfs;fs
Other		28			
7 Midessa-Wink					
Midessa fine sandy loam	0 to 3	45	Typic Ustochrept	Fine-carbonatic, thermic	fsl, loam
Wink fine sand	0 to 3	30	Typic Calciorthid	Coarse-loamy, mixed, thermic	fs;lfs;fsl
Jal sandy loam	0 to 1	15	Typic Calciorthid	Fine-carbonatic, thermic	sl;lfs
Other soils		10			

¹Abbreviations used for textural classes:

fs-fine sand
lfs-loamy fine sand
ls-loamy sand
fsl-fine sandy loam
sl-sandy loam
slcl-silty clay loam
gl-gravelly loam
sc-sandy clay loam
sil-silty loam
cl-clay loam

²Calc. -- calcareous³Permeability classes and approximate rates per hour:

Very slow - less than 0.20 inches
Slow - 0.20 to 0.63 inches
Moderate - 0.63 to 2.50 inches
Rapid - 2.50 to 6.30 inches
Very rapid - more than 6.30 inches

Surface Soil Features		Subsoil Features					Soil Depth ⁴ (inches)	AWHC ⁵ (inches)
Color	Carbonates ²	Texture ¹	Color	Permeability ³	Substratum			
Dark grayish-brown	Weakly calc.	gl;loam	Dark grayish-brown	Moderate	Indurated caliche	4 to 20	1 to 3	
Dark grayish-brown	Weakly calc.	gl;loam	Dark grayish-brown	Moderate	Indurated caliche	4 to 20	1 to 3	
Dark grayish-brown	Non-calc. to weakly calc.	loam	Grayish-brown	Moderate	Indurated caliche	20 to 40	4 to 6	
Dark grayish-brown to brown	Non-calc.	cl;sil	Brown to dark grayish-brown	Slow	Indurated caliche	20 to 40	4 to 6	
Grayish-brown	Strongly calc.	loam;cl	Pale brown	Moderate	Soft caliche	20 to 36	4 to 6	
Dark grayish-brown	Non-calc.	cl;sil	Brown to dark brown	Slow	Indurated caliche	10 to 20	2 to 3	
Brown to reddish-brown	Non-calc.	scl	Yellowish-red	Moderate	Calcareous loamy sediments	40 to 60	5 to 7	
Brown to reddish-brown	Non-calc.	scl	Reddish-brown	Moderate	Indurated caliche	20 to 36	3 to 5	
Brown to reddish-brown	Non-calc.	scl	Reddish-brown	Moderate	Indurated caliche	12 to 20	2 to 3	
Grayish-brown	Non calc. to weakly calc.	fs;ls	Pale brown to brown	Rapid	Soft caliche or strongly calc. lacustrine sediments	18 to 30	3 to 4	
Yellowish-red to reddish-brown	Non-calc.	scl	Reddish-brown to red	Moderate	Soft to weakly cemented caliche	30 to 50	4 to 6	
Reddish-brown	Non-calc.	scl	Reddish-brown to red	Moderate	Caliche; upper 1 to 2 feet indurated	20 to 36	3 to 5	
Grayish-brown to brown	Calc.	fs, ls, fs	Pale brown	Rapid	Caliche; platy and indurated in upper part	7 to 20	1 to 3	
Dark grayish-brown	Calc.	cl	Grayish-brown to pale brown	Moderate	Strongly calcareous eolian and alluvial sediments	20 to 45	3 to 5	
Pale brown to brown	Strongly calc.	fsl	Brown to very pale brown	Rapid	Soft caliche	24 to 36	2 to 3	
Pale brown to light yellowish-brown	Non-calc.	fs	Light yellowish-brown	Very rapid	Sandy eolian sediments	60 or more	3	
Yellowish - red	Non-calc.	ls over scl	Red to reddish-brown	Moderate	Sandy clay loam; some lime above 60 inches	48 to 60	5 to 6	
Light brown to yellowish-red	Non-calc.	fsl	Reddish-yellow to reddish-brown	Rapid	Sandy eolian and alluvial sediments	60 or more	4	
Yellowish-red to reddish-brown	Non-calc.	scl	Reddish-brown to red	Moderate	Soft to weakly cemented caliche	30 to 50	4 to 6	
Reddish-brown	Non-calc.	scl	Red to reddish-brown	Moderate	Calc. sandy sediments	60	5 to 6	
Light brown	Non-calc.	scl	Yellowish-red and red	Moderate	Sandy eolian sediments	60 or more	5	
Brown	Non-calc.	scl	Yellowish-red	Moderate	Sandy eolian sediments	60 or more	6	
Pale brown	Non-calc.	fs	Light yellowish-brown	Very rapid	Sandy eolian sediments	60 or more	3	
Reddish-brown to brown	Non-calc.	scl	Reddish-brown	Moderate	Calc. loamy sediments	40 to 60	6 to 7	
Brown	Non-calc.	fsl	Yellowish-red	Rapid	Sandy eolian sediments	60	4	
Dark grayish-brown	Strongly calc.	cl	Grayish-brown to pale brown	Moderate	Strongly calc. eolian and alluvial sediments	20 to 45	3 to 5	
Pale brown to brown	Strongly calc.	fsl	Brown to very pale brown	Rapid	Soft caliche	24 to 36	2 to 3	
Pale brown	Strongly calc.	fsl;loam	Pale brown	Moderate	Soft caliche	10 to 20	2 to 3	

⁴Thickness of effective soil for plant growth

⁵AWHC - Available water-holding capacity (estimated to a depth of 4 feet or for the effective soil depth if less than 4 feet)

Table 4. Continued

Soil Map Symbol and Soil Association	Dominant Slope Range (percent)	Approximate Percent of Association	Pedologic Classification		Texture ¹
			Subgroup	Family	
8 Simona-Upton-Tonuco					
Simona fine sandy loam	0 to 3	45	Typic Paleorthid	Loamy, mixed, thermic, shallow	fsl;ifs
Upton gravelly loam	0 to 3	15	Typic Paleorthid	Fine-carbonatic, thermic, shallow	gl;loam
Tonuco loamy fine sand	0 to 3	20	Typic Paleorthid	Sandy, mixed, thermic, shallow	ifs;ls
Mobeetic fine sandy loam	1 to 15	4	Typic Ustochrept	Coarse-loamy, mixed, thermic	fsl
Other soils		16			
9 Largo-Pajarito					
Largo loam	0 to 3	25	Typic Torriorthent	Fine-silty, mixed, calcareous, thermic	loam; sil
Pajarito loamy fine sand	0 to 3	21	Typic Camborthid	Coarse-loamy, mixed, thermic	ifs;fs
Badland and stony rolling land		15			
Reeves loam	0 to 3	3	Typic Calciorthid	Fine, gypsic, thermic	loam
Other soils		36			
10 Portales-Stegall-Lea					
Portales loam	0 to 3	38	Aridic Calcicustoll	Fine-carbonatic, thermic	loam;fsl
Stegall loam	0 to 1	20	Aridic Petrocalcic Paleustoll	Fine, mixed, thermic	loam;sicl
Lea loam	0 to 1	10	Aridic Petrocalcic Paleustoll	Fine-loamy, mixed, thermic	loam
Mansker loam	0 to 3	10	Aridic Calcicustoll	Fine-carbonatic, thermic	loam, fsl
Other soils		22			
11 Arch-Portales					
Arch loam	0 to 1	25	Ustochreptic Calciorthid	Fine-carbonatic, thermic	loam;fsl
Portales loam	0 to 3	25	Aridic Calcicustoll	Fine-carbonatic, thermic	loam;fsl
Drake loamy fine sand	0 to 5	20	Typic Ustorthent	Fine-carbonatic, thermic	ifs
Other soils		30			

¹Abbreviations used for textural classes:

fs-fine sand	gl-gravelly loam
ifs-loamy fine sand	scl-sandy clay loam
ls-loamy sand	sil-silty loam
fsl-fine sandy loam	cl-clay loam
sl-sandy loam	sicl-silty clay loam

²Calc. -- calcareous³Permeability classes and approximate rates per hour:

Very slow - less than 0.20 inches
Slow - 0.20 to 0.63 inches
Moderate - 0.63 to 2.50 inches
Rapid - 2.50 to 6.30 inches
Very rapid - more than 6.30 inches

Surface Soil Features		Subsoil Features				Soil Depth ⁴ (inches)	AWHC ⁵ (inches)
Color	Carbonates ²	Texture ¹	Color	Permeability ³	Substratum		
Grayish-brown to brown	Calc.	fsl;ls;ifs	Pale brown	Rapid	Caliche; platy and indurated in upper part	10 to 20	1 to 3
Light brownish-gray	Strongly calc.	gl;loam	Pale brown	Moderate	Caliche; platy and indurated in upper part	6 to 20	1 to 3
Brown	Non-calc.	lfs;ls	Reddish-brown	Rapid	Caliche; indurated in upper part	10 to 20	1 to 2
Brown to grayish-brown	Calc.	fsl;ifs	Light brown to brown	Rapid	Sandy calc. sediments	60 or more	4
Reddish-brown	Calc.	sl;slcl;loam	Reddish-brown	Moderate to slow	Loamy alluvium	60 or more	7
Yellowish-red	Weakly calc.	fsl	Yellowish-red	Rapid	Sandy alluvium	60 or more	4 to 5
Light brownish-gray	Strongly calc.	loam	Very pale brown	Moderate	Gypsiferous earth	10 to 36	3 to 5
Grayish-brown	Calc.	loam;cl	Pale brown	Moderate	Soft caliche	20 to 36	4 to 6
Dark grayish-brown to brown	Non-calc.	cl;slcl	Brown to dark grayish-brown	Slow	Indurated caliche	20 to 40	4 to 6
Dark grayish-brown	Weakly calc.	loam	Grayish-brown	Moderate	Indurated caliche	20 to 40	4 to 6
Grayish-brown	Strongly calc.	cl;loam	Light brown	Moderate	Soft caliche	12 to 26	3 to 4
Light brownish-gray	Strongly calc.	loam;cl	Light gray	Moderate	Soft caliche	10 to 20	3
Grayish-brown	Strongly calc.	loam;cl	Pale brown	Moderate	Soft caliche	20 to 36	4 to 6
Light brownish-gray	Strongly calc.	sl;slcl;loam	Light gray to pale brown	Moderate	Calc. eolian sediments	60 or more	5

⁴Thickness of effective soil for plant growth

⁵AWHC - Available water-holding capacity (estimated to a depth of 4 feet or for the effective soil depth if less than 4 feet)

- Land Classes 2 and 3
(72% class 2, 10% class 3; 9% class 4; 7% class 6; 2% class 1)
- Land Classes 3 and 6
(54% class 3, 42% class 6; 3% class 4; 1% class 2)
- Land Classes 4, 6, and 3
(54% class 4, 26% class 6; 21% class 3)
- Land Classes 6 and 2
(51% class 6; 34% class 2; 6% class 4; 5% class 3; 4% class 1)
- Land Classes 6, 2, and 3
(34% class 6; 24% class 2; 24% class 3; 18% class 4)
- Land Classes 6 and 3
(55% class 6; 45% class 3)
- Land Class 6
(91% class 6; 5% class 2; 4% class 4)

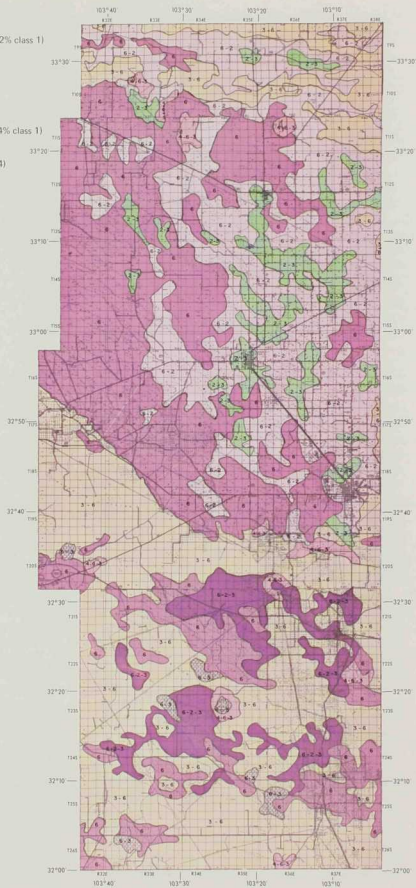


Fig. 2. Classification of land for irrigation in Lea County, New Mexico

shallow over soft and indurated caliche respectively.

Irrigation Potential: There is essentially no potential for the development of irrigated land in this association. Simona, Upton, Tonuco, Potter, and Kimbrough soils are all in irrigation land class 6. These soils, because of their shallow depth and other soil properties, are not suitable for irrigation. The deep sandy and strongly sloping soils of the Mobeetic series, which have been placed in irrigation land class 4, are suitable for irrigation. These soils, however, in addition to their limited extent in this association, commonly occur in small and irregularly shaped tracts intermingled with large areas of non-irrigable land. These factors, will generally tend to preclude their consideration for irrigation.

9. Largo-Pajarito association

This relatively inextensive unit of about 21,300 acres includes a number of small and widely separated areas in the southern part of the county. The major and more extensive soils in this association are forming in calcareous alluvium derived primarily from sandstones and shales of the redbed formation. Eolian sediments or sandy materials locally transported by wind, however, have contributed minor amounts to the parent materials. It is common for the soils of this general soil area to occur on gently to strongly sloping alluvial fans and plains below outcrops and escarpments of the redbed formations. They also occur on nearly level to gently sloping valley bottoms or flood plains of intermittent drainages.

This association supports a relatively wide variety of grasses and shrubs, and under good systems of management moderate forage yields are obtained. The principal grasses and shrubs on the Largo soils are black grama, blue grama, sideoats grama, tobosa, vine mesquite, creosotebush and a few mesquite. The vegetation on the Pajarito soils consists mainly of sand dropseed, sand bluestem, black grama, blue grama, mesquite, broom snake-weed, sand sage, and yucca.

Soil Characteristics: Largo soils commonly occupy the gently to strongly sloping landscapes. They have a thin surface layer of reddish-brown calcareous loam or silt loam. This is underlain to a depth of five feet or more by weakly stratified, reddish-brown calcareous silt loams and loams. These soils are susceptible to water erosion where the vegetative cover is depleted and there is a

concentration of runoff. A few deep gullies, particularly in the drainageways, are common.

Pajarito soils, which are also extensive in this association, occupy nearly level to gently sloping and hummocky landscapes. These soils usually have a thin surface layer of yellowish-red, weakly calcareous loamy fine sand or fine sand. The subsoil and substratum is a yellowish-red calcareous fine sandy loam extending to over 60 inches. They are susceptible to wind erosion in those areas where vegetative cover is seriously depleted.

Besides the two major soils in this association, active dunes, gullied land, stony land, and other miscellaneous land types and soils comprise a relatively high percentage of this association. Stony land, the most extensive of the inclusions, consists of a complex of very shallow soils and outcrops of thinly bedded, siltstones, shale, sandstone, limestone, and gypsiferous rocks. A thin mantle of stony or gravelly soil material commonly occurs between the exposures of bedrock. Reeves and Holloman soils, which are moderately deep and shallow, respectively, over gypsiferous earths also comprise a small acreage in this association.

Irrigation Potential: The Largo and Pajarito soils, which are suitable for use as cropland under irrigation, have been placed in irrigation land class 3. The irrigable land in this soil association, which is widely distributed throughout the southern part of the county, often occurs in relatively small tracts intermingled with areas of non-irrigable land. The development of these lands for irrigation may therefore be limited to the places where they occur adjacent to irrigable land in other soil associations, so that tracts of sufficient size can be obtained to warrant development for irrigation.

10. Portales-Stegall-Lea association

This association occupies nearly level to gently sloping landscapes on the High Plains in the north-central part of the county with associations 1 and 2. It consists essentially of the same soils as those in the two closely related soil associations, but differs in being dominated by moderately deep soils suitable for irrigation. The soils, in general, are developing over either soft or indurated caliche at moderate depths. Although the underlying caliche restricts plant roots and limits soil depth; it is sufficiently permeable to permit deep percolation of excess soil moisture. Approximately 148,600 acres, or about five percent of the county, is included in this association.

It supports a good cover of grass with blue grama, sideoats grama, black grama, buffalograss, ring muhly and tobosa grass being the more common species. In the swales and slightly depressed areas occupied by the soils of the Stegall and Slaughter series, tobosa grass often comprises a relatively high percentage of the plant community. The more common shrubs include broom snake-weed, yucca and a few scattered mesquite, and various species of cacti. A considerable part of the presently irrigated cropland occurs in this association, so irrigated farming is also an important land use. Cotton and sorghum are extensively grown.

Soil Characteristics: The Portales soils, the most extensive in the association, commonly occur on nearly level to very gently sloping slightly depressional areas and plains. They have a surface layer of grayish-brown strongly calcareous loam over a pale brown loam or light clay loam subsoil. They are typically underlain by a pinkish-white prominent lime zone, or soft caliche, at depths of 20 to 40 inches.

Stegall soils generally occupy the lowest part of the landscape in broad weakly defined swales and plains. These soils usually have a surface layer of dark grayish-brown to brown noncalcareous loam. Their subsoil is a brown heavy clay loam or silty clay loam that is mildly alkaline in the upper part and strongly calcareous in the lower part. This is underlain by indurated caliche at depths ranging from 20 to 40 inches.

Lea soils, the least extensive of the major soils in this unit, occur in close association with the Stegall soils on nearly level to very gently sloping landscapes. They have a surface layer of dark grayish-brown noncalcareous loam over a grayish-brown loam or light clay loam subsoil. Fine threads and filaments of calcium carbonate are usually present in the subsoil. They are generally underlain by indurated caliche at depths of 20 to 40 inches, but occasionally may be as deep as 60 inches.

Amarillo, Arvana, Mansker, Kimbrough, and Slaughter soils comprise the rest of this association. The Amarillo series consists of deep reddish-brown soils with fine sandy loam or loamy fine sand surface layers and sandy clay loam subsoils. The Arvana soils differ from those of the Amarillo series in that they are underlain by indurated caliche at moderate depths. The Mansker soils are shallow over soft caliche, and those of the Kimbrough and Slaughter series are shallow over indurated caliche.

Irrigation Potential: There is a relatively high potential for the development of irrigated land in

this association. The Portales, Stegall, Lea, and Arvana soils, which comprise about 72 percent of the association, are well-suited for use as cropland under irrigation. They account for the majority of the land in irrigation land class 2. The Amarillo soils, which are of minor extent, are in irrigation land class 1. In addition to the class 1 and 2 land, approximately 10 percent of the land in this unit is in irrigation land class 3, and 9 percent is in class 4. Although this land is not as well adapted to irrigation as that in land classes 1 and 2, it is nevertheless suitable. A limited water-holding capacity and shallow soil depth were the principal factors contributing to the placement of land in irrigation land classes 3 and 4. Approximately 7 percent of the land in this association is non-irrigable or in class 6. Although this intermingled class 6 land will place some restrictions on the size of the tracts that can be developed for irrigation, it is usually of sufficient size to permit excluding it from that planned for irrigation.

11. Arch-Portales association

This association includes four relatively small and widely separated areas in the north-central part of the county. They comprise a total acreage of approximately 16,700 acres, or slightly less than one percent of the county. Shallow depressional areas or basins are a common feature of this association. This unit also includes nearly level terraces and benches that surround the basin areas, as well as the gently to strongly sloping sideslopes. The soils, which are usually strongly calcareous, are developing in alluvial and eolian sediments.

It is used as rangeland, and when properly managed, moderate forage yields are obtained. Native vegetation includes blue grama, vine mesquite, buffalograss, black grama, ring muhly, and three-awns. In addition to these grasses, sand dropseed, sideoats grama, and little bluestem often grow on the Drake loamy fine sand component of this association.

Soil Characteristics: Arch soils commonly occur on the nearly level terraces and low lying areas adjacent to playas and basins. The surface layer is light brownish-gray or pale brown calcareous loam and is about six inches thick. This grades through pale brown strongly calcareous loam subsoil to white soft caliche which is encountered at a depth ranging from 10 to 12 inches.

Portales soils, the other major component of this association, occupy nearly level to very gently

sloping depressional areas and plains. They have a surface layer of grayish-brown strongly calcareous fine sandy loam over a pale brown loam or light clay loam subsoil. This is underlain by a pinkish-white prominent lime zone or soft caliche, at depths of 20 to 40 inches.

Also in this association are the Drake soils, which are deep and limy, and the moderately deep Reeves and Gomez soils. The Drake soils are developing in strongly calcareous sediments on the lee side of playas or enclosed basins. They occupy those parts of the association that have a undulating or dunny topography. These soils have a thin surface layer of light brownish-gray calcareous loam. It is underlain to a depth of five feet or more by a light gray to pale brown loam that has a high lime content. The Gomez soils, which are sandy, are underlain by soft caliche or layers very high in lime at moderate depths. The Reeves soils, which

are shallow to moderately deep, are underlain by gypiferous earth at depths of 10 to 36 inches.

Irrigation Potential: Although this association contains a relatively high percentage of land classified as irrigable, the lands so classified are in land class 4 with lesser amounts in class 3. These lands therefore have moderate to severe limitations for use as cropland under irrigation. The Drake soils, for example, in addition to occurring on undulating or dunny topography contain a high percentage of lime. Moderate to high yields can be expected on these soils only when lime tolerant crops are produced. The Portales, Gomez, and Reeves soils, which are moderately deep, have a low to moderate water-holding capacity. Approximately 24 percent of the land in this association was classified as non-irrigable. Arch soils and associated playas or basins comprise the majority of land so classified.

Interpretation of Soils for Irrigation

The acreage of irrigable land in each of the 11 soil associations in Lea County is shown in table 5. The extent of land in each of the five land classes was determined on the basis of the kinds of soils occurring in the soil associations and from the detailed soil survey. The acreage and irrigation land class, by mapping unit from the detailed soil survey, are shown in table 6.

The approximate distribution of the various land classes in Lea County is shown on the irrigation land class map (figure 2). In the construction of this map, the data on acreages in each of the land classes listed in table 5 were used as a guide. The land class or classes shown indicate that they comprise more than 75 percent of the delineated area. No land class was shown that did not comprise at least 10 percent of the area identified on the map. Where more than one land class is shown, the dominant or the most extensive class is indicated first, followed in order by those of lesser extent. The small scale of the irrigation land class map precludes the possibility of showing small areas of land with different capabilities for irrigation. For example, the large and extensive areas of class 6 land may, and often do, contain small tracts of land suitable for irrigation. Because of the limitation of map scale, these small tracts that differ in capability for irrigation are not shown.

Irrigation Land Classes

The irrigation land classes provide a relative rating of the suitability of land for irrigation. The limitations for use of land under irrigation increase from class 1 land through class 4. For example, class 1 land has few or no limitations for irrigation, class 4 land has very severe limitations, and class 6 land is non-irrigable. An analysis of the irrigation land classification data, as shown on table 5, indicates that the potential for expansion of irrigated land in Lea County occurs principally in the following six soil associations:

10. Portales-Stegall-Lea association
2. Kimbrough-Lea-Stegall association
3. Amarillo-Arvana association
4. Berino-Cacique association
5. Kermit-Maljamar association
6. Brownfield-Patricia-Tivoli association

These six soil associations (figure 1) contain slightly more than 1,107,000 acres, or about 90 percent of the 1,205,000 acres of Lea County land classified as irrigable.

The Portales-Stegall-Lea association (No. 10) offers the best potential for expansion of irrigation in this county. Approximately 93 percent, or about 137,550 acres of land in this association are

suitable for irrigation. In general, the land so classified is well adapted for use as cropland under irrigation. This suitability for irrigation is reflected in the irrigation land classification as about 72 percent is in class 2, 10 percent class 3, 9 percent class 4, 2 percent class 1 and 7 percent class 6. The lands in this association occur on nearly level to very gently sloping landscapes, and they will require but a minimum amount of land leveling and conditioning in preparation for irrigation. Although the intermingled class 6 land will place some restrictions on the size of tracts that can be developed for irrigation, it is usually of sufficient size to permit excluding it from that planned for irrigation.

The Kimbrough-Lea-Stegall association was combined with Amarillo-Arvana association on the irrigation land classification map (figure 2) as they contained approximately the same percentage of land in the dominant land classes. These two soil associations contain about 51 percent class 6 land; 34 percent class 2; 6 percent class 4; 5 percent class 3; and 4 percent class 1. Although slightly more than one half of this land is non-irrigable, there is a sizeable acreage (216,352 acres) of class 2 land. Lea, Stegall, Portales, and Arvana loams, which are of moderate depth and water-holding capacity, account for most of the land included in irrigation land class 2. Amarillo loamy fine sand was also included in class 2, primarily because of its coarse-textured surface layers and high susceptibility to wind erosion. There are approximately 27,000 acres of class 1 land. This class 1 and 2 land, together with minor acreages of class 3 and 4 land, would provide tracts of sufficient size to warrant consideration for irrigation. There are, however, some exceptions; in some places the irrigable and non-irrigable land occurs in such a complex pattern that it would be extremely difficult to exclude the non-irrigable land from the tracts planned for irrigation. In other places, the irrigable land that remains after exclusion of the non-irrigable land would be in such small areas and irregular shapes that its use for irrigation would not be feasible. Regardless of these limitations, there is a significant potential for expansion of irrigation on the lands comprising these two associations because of the relatively large acreage of class 1 and 2 land.

It is estimated that about 112,000 acres in the Berino-Cacique association (No. 4) are suitable for irrigation. Berino and Cacique soils, because of their sandy surface layers, moderate depths and water-holding capacities are included in irrigation land class 2 and 3 respectively. The Cacique soils which are underlain by indurated caliche at 20 to 36 inches are shallower than the Berino soils. The

calcareous and sandy soils of the Midessa and Wink series account for most of the land included in class 4. There is therefore some potential for development of irrigated land in this association as 24 percent is in land class 2, 24 percent in class 3 and 18 percent in class 4. Although these lands do have some limitations, they should, with the application of erosion control measures and other accepted good farming practices, have sufficient productive capacity to support irrigation.

The Kermit-Maljamar and the Brownfield-Patricia-Tivoli associations were also combined on the irrigation land classification map (figure 2), because of similarity in the percentages of land in each of the land classes. Although 58 percent of the land in these two soil associations has been classified as suitable for irrigation, it is not as well adapted to this use as the land classified as suitable for irrigation in the four previously discussed soil associations. Due to the moderate to severe limitations of the soils for use under irrigation, they are dominantly in class 3 with small amounts in class 4 and 2. The surface of these lands is generally uneven, hummocky, or so sloping that they will require considerable land leveling and land preparation before they can be profitably used for irrigation. In addition to the hummocky and uneven topography, the soils of this association have a low to moderate moisture retention capacity, and a moderate to severe wind erosion hazard. The extremely sandy soils of the Kermit and Tivoli series are in land class 6 because of their low moisture retention capacity and high wind erosion hazard. They are commonly interspersed with the lands suitable for irrigation, hence will tend, in some cases, to limit the size of tracts that can be developed for irrigation.

In the remaining four soil associations, the opportunity for any significant expansion of irrigated land is extremely limited or non-existent. The Midessa-Wink association (No. 7) and the Arch-Portales association (No. 11), which were also combined on the irrigation land classification map (figure 2), comprise a total land area of only about 48,500 acres. These soil associations also have a relatively high percentage of land with a low capacity for irrigation. Approximately 54 percent of the land in these two soil associations in class 4, 21 percent in class 3 and the remaining 25 percent is non-irrigable.

The Largo-Pajarito association, which is widely distributed throughout the southern part of the county, contains about 9,485 acres of class 3 land. The remaining 55 percent of the land in this inextensive soil association is non-irrigable. Unless these small and widely distributed tracts of land

Table 5. Estimated acreage and percentage of land in each irrigation land class by soil association, Lea County, New Mexico

Soil Map Symbol and Soil Association	Class 1		Class 2		Class 3	
	Acres	Percent	Acres	Percent	Acres	Percent
1 Kimbrough						
Kimbrough gravelly loam						
Kimbrough-Lea complex			45,200			
Total			45,200	7		
2 Kimbrough-Lea-Stegall						
Kimbrough gravelly loam						
Kimbrough loam						
Kimbrough-Lea complex						
Lea loam			27,597			
Lea fine sandy loam					2,970	
Arvana-Lea soils			16,076			
Portales and Stegall loams			56,363			
Stegall loam			30,214			
Stegall silty clay loam			1,968			
Stegall and Slaughter soils			12,875			
Other soils and land types			3,409		1,101	
Total			148,502	34	4,071	1
3 Amarillo-Arvana						
Amarillo loam	3,865					
Amarillo fine sandy loam	14,831					
Amarillo loamy fine sand			31,845			
Amarillo-Arvana fine sandy loam	8,388				4,516	
Amarillo-Arvana loamy fine sand			15,287		12,507	
Arvana fine sandy loam					8,069	
Sharvana loamy fine sand						
Kimbrough-Sharvana complex						
Other soils			20,718			
Total	27,084	14	67,850	35	25,092	13
4 Berino-Cacique						
Berino-Cacique loamy fine sand			13,061		31,050	
Berino-Cacique fine sandy loam			9,198		9,198	
Midessa and Wink fine sandy loam						
Simona fine sandy loam						
Tonuco loamy fine sand						
Other soils						
Total			40,259	24	40,248	24
5 Kermit-Maljamar						
Kermit-Palomas fine sand					19,247	
Kermit soils and duneland						
Kermit-Wink complex						
Maljamar and Palomas fine sand					16,182	
Pyote and Maljamar fine sand					333,858	
Pyote soils and duneland						
Pyote loamy fine sand					36,954	
Berino-Cacique loamy fine sand			12,050		12,050	
Other soils						
Total			12,050	2	418,291	54
6 Brownfield-Patricia-Tivoli						
Brownfield and Patricia fine sand					52,060	
Brownfield-Springer soils					29,696	
Tivoli-Brownfield fine sand						
Tivoli soils and duneland						
Amarillo-Gomez fine sand						
Amarillo loamy fine sand, eroded					4,663	
Amarillo-Arvana soils, eroded					1,355	
Arvana loamy fine sand					6,932	
Other soils						
Total					94,706	57
7 Midessa-Wink						
Midessa-Wink fine sandy loams						
Midessa loam					5,994	
Other soils and land types						
Total					5,994	19

*AWHC is abbreviation for available water-holding capacity

**Less than 1 percent

Class 4		Classes 1 to 4 Total		Class 6		Grand Total		Principal Limiting Factor(s)*
Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	
				196,577		196,577		Depth; AWHC
22,600		67,800		384,423		452,223		Depth; AWHC
22,600	3	67,800	10	581,000	90	648,800	23	
				38,813		38,813		Depth; AWHC
11,302		11,302		14,728		26,030		Depth; AWHC
				179,339		179,339		Depth; AWHC
		27,597				27,597		Depth; AWHC
		2,970				2,970		Depth; AWHC
		16,076				16,076		Depth; AWHC
		56,363				56,363		AWHC; depth
		30,214				30,214		AWHC; depth
		1,968				1,968		AWHC; depth
12,874		25,749				25,749		AWHC; depth
8,450		12,960		15,121		28,081		
32,626	8	185,199	43	248,001	57	433,200	15	
		3,865				3,865		
		14,831				14,831		
		31,845				31,845		Soil texture
		12,904				12,904		AWHC; depth
		27,794				27,794		Soil texture; depth
		8,069				8,069		AWHC; depth
				29,974		29,974		Depth; AWHC
2,603		23,321		23,406		23,406		Depth; AWHC
2,603	2	122,629	64	16,591	36	39,912	7	
				69,971		192,600		
		62,111				62,111		Soil texture; depth
31,586		18,396				18,396		Depth; AWHC
		31,586				31,586		Depth; AWHC
				20,000		20,000		Depth; AWHC
				13,326		13,326		Depth; AWHC
				23,681		23,681		
31,586	18	112,093	66	57,007	34	169,100	6	
		19,247		57,738		76,985		AWHC; soil texture
				127,159		127,159		AWHC; erosion; soil texture
				6,659		6,659		AWHC; erosion; soil texture
		16,182				16,182		AWHC; soil texture
		333,858				333,858		AWHC; soil texture
				78,707		78,707		AWHC; erosion; soil texture
4,170		36,954				36,954		AWHC; soil texture
		28,270				28,270		Soil texture; depth
				72,626		72,626		
4,170	**	434,511	56	342,889	44	777,400	28	
8,419		60,479				60,479		AWHC; soil texture; erosion
1,453		31,149				31,149		AWHC; soil texture; erosion
				17,248		17,248		AWHC; soil texture; erosion
				5,828		5,828		AWHC; soil texture; erosion
				9,124		9,124		AWHC; soil texture; erosion
		4,663				4,663		Erosion; soil texture; depth
		1,355				1,355		Erosion; soil texture; depth
1,535		8,467				8,467		AWHC; soil depth
9,619		9,619		19,368		28,987		
21,026	12	115,732	69	51,568	31	167,300	6	
						17,873		Soil depth; AWHC; limy
17,873		17,873				5,994		Soil depth; AWHC
		5,994				7,933		
				7,933		7,933		
17,873	56	23,867	75	7,933	25	31,800	1	

Table 5. Continued

Soil Map Symbol and Soil Association	Class 1		Class 2		Class 3	
	Acres	Percent	Acres	Percent	Acres	Percent
8 Simona-Upton-Tonuco						
Simona fine sandy loam					8,770	
Simona-Upton soils					715	
Tonuco loamy fine sand						
Other soils and land types						
Total						
9 Largo-Pajarito						
Largo-Pajarito complex						
Reeves loam						
Stony rolling land						
Badland						
Other soils						
Total					9,485	45
10 Portales-Stegall-Lea						
Portales loam			56,074			
Stegall loam			30,200			
Lea loam			9,536			
Arvana-Lea soils			10,000			
Amarillo fine sandy loam	3,425					
Mansker loam					14,757	
Other soils						
Total	3,425	2	105,810	72	14,757	10
11 Arch-Portales						
Arch loam						
Arch-Drake soils					3,573	
Portales-Gomez fine sandy loams						
Other soils					693	
Total					4,266	26
Grand total	30,509	1	419,671	15	616,910	22

*AWHC is abbreviation for available water-holding capacity

**Less than 1 percent

Class 4		Classes 1 to 4 Total		Class 6		Grand Total		Principal
Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Principal Limiting Factor(s)*
				60,357		60,357		Soil depth; AWHC
				65,106		65,106		Soil depth; AWHC
				40,754		40,754		Soil depth; AWHC
8,565		8,565		30,618		39,183		
8,565	4	8,565	4	196,835	96	205,900	7	
		8,770		974		9,744		Erosion; slope; AWHC
		715				715		Soil depth; salinity
				2,777		2,777		Soil depth; slope
				798		798		Slope; soil
				7,266		7,266		
		9,485	45	11,815	55	21,300	1	
		56,074				56,074		AWHC; soil depth
		30,200				30,200		AWHC; soil depth
		9,536				9,536		Soil depth; AWHC
		10,000				10,000		Soil depth; AWHC
		3,425				3,425		
		14,757				14,757		Soil depth; AWHC
13,558		13,558		11,050		24,608		
13,558	9	137,550	93	11,050	7	148,600	5	
				483		483		Soil depth; AWHC
		3,573		3,572		7,145		Slope; AWHC; soil depth
8,379		8,379				8,379		AWHC; soil texture; depth
		693				693		
8,379	50	12,645	76	4,055	24	16,700	1	
162,986	6	1,230,076	44	1,582,124	56	2,812,200	100	

Table 6. Irrigation land class, approximate acreage, and proportionate extent of soils in Lea County¹

Soil Mapping Unit	Irrigation			Soil Mapping Unit	Irrigation		
	Land Class	Acres	Percent		Land Class	Acres	Percent
Active duneland	6	6,985	0.25	Kimbrough-Sharvana complex	6	26,828	0.95
Amarillo loamy fine sand, 0 to 3 percent slopes	2	31,845	1.13	Kermit-Palomas fine sand			
Amarillo loamy sand, 0 to 3 percent slopes, eroded	3	4,663	0.17	Kermit	6	57,738	2.05
Amarillo fine sandy loam, 0 to 1 percent slopes	1	14,950	0.53	Palomas	3	19,247	0.68
Amarillo fine sandy loam, 1 to 3 percent slopes	1	3,306	0.18	Kermit-Wink complex, 0 to 3 percent slopes	6	6,659	0.24
Amarillo loam, 0 to 1 percent slopes	1	3,865	0.14	Kermit soils and duneland	6	127,159	4.52
Amarillo-Gomez fine sands	6	9,124	0.32	Largo-Pajarito complex	3,6	9,744	0.35
Amarillo-Arvana loamy fine sand association	2	15,287	0.54	Lea fine sandy loam	3	2,970	0.11
Amarillo	3	12,507	0.44	Lea loam	2	37,132	1.32
Amarillo-Arvana fine sandy loam association				Maljamar and Palomas fine sands, 0 to 3 percent slopes	3	16,182	0.57
Amarillo	1	8,388	0.30	Mansker loam, 0 to 1 percent slopes	3	9,416	0.33
Arvana	3	4,516	0.16	Mansker loam, 1 to 3 percent slopes	3	5,341	0.19
Amarillo-Arvana association, eroded	3	1,355	0.05	Mansker loam, 0 to 3 percent slopes	3	693	0.03
Arch loam	6	483	0.20	Midessa loam	3	5,994	0.21
Arch-Drake association				Midessa and Wink fine sandy loams	4	49,459	1.76
Arch	6	3,572	0.13	Mixed alluvial land	6	4,690	0.17
Drake	3	3,573	0.13	Mobeetie-Potter association, 1 to 15 percent slopes			
Arvana loamy fine sand, 0 to 3 percent slopes	3	6,932	0.25	Mobeetie	4	8,565	0.30
Arvana loamy fine sand, 0 to 3 percent slopes, eroded	4	1,535	0.05	Potter	6	2,856	0.10
Arvana-Lea association	2	26,076	0.93	Portales fine sandy loam, 0 to 1 percent slopes	2	8,953	0.32
Arvana fine sandy loam, 0 to 1 percent slopes	3	7,472	0.27	Portales fine sandy loam, 1 to 3 percent slopes	2	2,053	0.07
Arvana fine sandy loam, 1 to 3 percent slopes	3	597	0.02	Portales loam, 0 to 1 percent slopes	2	28,321	1.01
Arvana loam, 0 to 1 percent slopes	2	3,409	0.12	Portales loam, 1 to 3 percent slopes	2	1,273	0.04
Badland	6	798	0.03	Portales loam, 0 to 3 percent slopes	2	26,480	0.94
Berino-Cacique loamy fine sand association				Portales and Gomez fine sandy loams	4	17,998	0.64
Berino	2	43,111	1.53	Portales and Stegall loams	2	56,363	2.00
Cacique	3	43,100	1.53	Pyote loamy fine sand	3	36,954	1.31
Berino-Cacique fine sandy loam association				Pyote and Maljamar fine sands	3	333,858	11.87
Berino	2	9,198	0.33	Pyote soils and duneland	6	78,707	2.80
Cacique	3	9,198	0.33	Reeves loam	3	715	0.03
Berino-Cacique association, hummocky	4	4,170	0.15	Reeves-Holloman association	6	2,211	0.08
Brownfield and Patricia fine sands	3	52,060	1.85	Sharvana loamy fine sand	6	29,974	1.07
Brownfield and Patricia sands, eroded	4	8,419	0.30	Sharvana fine sandy loam	6	15,121	0.54
Brownfield-Springer association	3	29,696	1.06	Simona fine sandy loam	6	80,357	2.86
Brownfield-Springer association, hummocky				Simona-Upton association	6	65,106	2.31
Drake loamy fine sand	4	1,453	0.05	Slaughter loam	4	13,975	0.50
Gomez fine sand	6	5,343	0.19	Stegall loam	2	60,414	2.15
Gomez loamy fine sand	6	7,823	0.28	Stegall silty clay loam	2	1,968	0.07
Gomez fine sandy loam	4	2,603	0.09	Stegall and Slaughter soils			
Jal association	6	7,933	0.28	Stegall	2	12,875	0.46
Kimbrough loam, 0 to 1 percent slopes	4	19,335	0.69	Slaughter	4	12,874	0.46
Kimbrough loam, 1 to 3 percent slopes	6	2,741	0.10	Stony rolling land	6	2,777	0.10
Kimbrough loam, 0 to 3 percent slopes	6	11,987	0.43	Tivoli soils and duneland	6	5,828	0.21
Kimbrough gravelly loam, 0 to 3 percent slopes	6	246,441	8.76	Tivoli-Brownfield fine sands	6	17,248	0.61
Kimbrough-Lea complex	6, 2, 3	733,931	26.00	Tonuco fine sand, hummocky	6	7,762	0.28
				Tonuco loamy fine sand	6	54,080	1.92
				Wink fine sand	6	15,140	0.54
				Wink loamy fine sand	6	8,624	0.31
				Zita fine sandy loam	2	1,237	0.04
				Zita loam	2	8,475	0.30
				Miscellaneous (caliche pits, playas, etc.)	6	2,924	0.10
				Grand total		2,812,200	100.00

¹The acreages and percentages are taken from the detailed "Soil Survey of Lea County."

suitable for irrigation can be developed with adjacent lands, the difficulty and expense of transporting irrigation water to these areas will undoubtedly tend to preclude their use for this purpose.

The Kimbrough (No. 1) and Simona-Upton-Tonuco (No. 3) associations, although extensive, offer little or no opportunity for expansion of irrigated land in this county. These soil associations are dominated by shallow soils that are not suitable for irrigation. The small acreage of land classified as suitable for irrigation commonly occurs in small and irregularly shaped tracts intermingled with

extensive areas of non-irrigable land. These factors will generally tend to preclude their consideration for irrigation.

Although approximately 56 percent of the land in this county has been classified as non-irrigable, there is a sizeable acreage of land with a relatively high capability for irrigation. Of the 1,230,076 of land classified as suitable for irrigation, about 3 percent is class 1, 34 percent is class 2, 50 percent is class 3 and 13 percent is class 4. The potential for expansion of irrigable land in Lea County therefore is large insofar as the suitability of soils is concerned.

Interpretation of Soils for Engineering and Related Uses

In this section, information is provided on engineering properties and uses of soils as construction material and as a support for various kinds of structures. The information is provided in tabular form and in accordance with the soil associations shown on the soil map (figure 1). Selected engineering properties, engineering classifications, and estimates on the suitability of soils for specified engineering uses are indicated for the major soils in each soil association. This correlation of engineering data and soil properties according to soil associations, or general soil areas, can be useful in estimating the suitability of certain areas for engineering purposes. The information on general soil problems, limitations and hazards can also be helpful in the selection of areas for various engineering structures or practices.

That data presented here will not eliminate the need for on-site sampling and testing of sites for design and construction of specific engineering works and uses. This is particularly true at those sites of specific engineering works involving heavy loads or where excavations are deeper than the depths of the soil layers herein reported. The general soil map does not delineate or show the individual kinds of soil.

The general soil map is useful, however, for planning more detailed investigations and for suggesting the kinds of problems that may be expected in each of the soil associations.

Engineering Soil Groups and Estimated Soil Properties

Estimates of selected soil properties of importance in engineering are given in table 7.

Information taken from the detailed soil survey, knowledge of the individual soils of the county, and a limited amount of laboratory test data were used as a basis for making these estimates.

A brief explanation of some of the terms used in table 7 follows:

The "USDA texture" is determined by the relative proportions of sand, silt, and clay in the soil mass. It is the standard procedure used by the U.S. Department of Agriculture to classify soils according to texture.

Two systems of classifying soils, the AASHO and the Unified, are in general use among engineers.

Highway engineers generally classify soil materials in accordance with the system approved by the American Association of State Highway Officials.⁸ In this system (AASHO) classification is based on the gradation, liquid limit, and plasticity index of the soil. Highway performance has been related to this system of classification. All soil materials are classified in seven principal groups. The groups range from A-1 (gravely soils of high bearing capacity, the best soils for subgrades) to A-7 (clay soils having low strength when wet, the poorest soils for subgrades).

Some engineers prefer to use the Unified soil classification system established by the Waterways Experiment Station, Corps of Engineers.⁹ This

⁸American Association of State Highway Officials, 1955 Standard Specifications for Highway Materials and Methods of Sampling and Testing, Ed. 7, part 1, 257 pp., illus.

⁹Waterways Experiment Station Corps of Engineers, 1953. The Unified Soil Classification System, Tech. Memo 3-337, 2V, and Appendix.

Table 7. Engineering soil groups and estimated soil properties, Lea County, New Mexico

Soil Map Symbol and Soil Association	Depth from Surface in.	USDA texture	Classification Unified	AASHTO	Percentage Passing Sieve--		Range in Permeability in/hr	Shrink-swell Potential	
					No. 4 (4.7mm)	No. 10 No. 200 (0.075mm)			
1 Kimbrough									
Kimbrough	0-6	Gravelly loam	ML	A-2 or A-4	75-85	70-85	20-45	0.63-5.00	Low
Kimbrough	6 ⁺	Indurated caliche							
2 Kimbrough-Lea-Stegall									
Lea	0-10	Loam	ML-CL	A-4	100	100	55-70	0.63-2.50	Low
Lea	10-26	Heavy loam	CL	A-4	100	100	60-75	0.63-2.50	Low to moderate
Lea	26 ⁺	Indurated caliche							
Stegall	0-9	Loam	ML or CL	A-4	100	100	60-80	0.63-2.50	Low
Stegall	9-30	Heavy clay loam	CL	A-6	100	100	65-80	0.20-0.63	Moderate
Stegall	30 ⁺	Indurated caliche							
Portales	0-12	Loam	ML-CL	A-4	100	100	55-70	0.63-2.50	Low
Portales	12-26	Sandy clay loam	CL	A-6	100	100	55-70	0.63-2.50	Low to moderate
Portales	26 ⁺	Soft caliche							
Slaughter	0-5	Loam	ML-CL	A-4	100	100	60-75	0.63-2.50	Low
Slaughter	5-15	Heavy clay loam	CL	A-6	100	100	65-80	0.20-0.63	Moderate
Slaughter	15	Indurated caliche							
3 Amarillo-Arvana									
Amarillo	0-10	Loamy fine sand	SM	A-2	100	100	15-25	2.50-6.30	Low
Amarillo	10-36	Sandy clay loam	SC	A-4 or A-6	100	100	40-55	0.63-2.50	Low to moderate
Amarillo	36-50	Sandy clay loam	SC	A-4 or A-6	100	100	40-50	0.63-2.50	Low
Arvana	0-6	Fine sandy loam	SM	A-4	100	100	40-55	2.50-6.30	Low
Arvana	6-28	Sandy clay loam	SC	A-6	100	100	45-60	0.63-2.50	Low to moderate
Arvana	28 ⁺	Indurated caliche							
Brownfield	0-22	Fine sand	SM	A-2	100	100	10-20	> 6.30	Low
Brownfield	22-40	Sandy clay loam	SC	A-6	100	100	35-50	0.63-2.50	Low to moderate
Brownfield	40-50	Sandy clay loam	SC	A-6	100	100	15-25	2.50-6.30	Low
Sharvana	0-5	Loamy fine sand	SM	A-2	100	100	40-55	0.63-2.50	Low to moderate
Sharvana	5-16	Sandy clay loam	SC	A-6	100	100	40-55	0.63-2.50	Low to moderate
Sharvana	16 ⁺	Indurated caliche							
Gomez	0-15	Loamy fine sand	SM	A-2	100	100	15-25	> 6.30	Low
Gomez	15-22	Fine sandy loam	SM-SC	A-4	100	100	30-50	2.50-6.30	Low
Gomez	22-36	Sandy clay loam	CL	A-6	100	100	50-65	0.63-2.50	Moderate
4 Berino-Cacique									
Berino	0-12	Loamy fine sand	SM	A-2	100	100	10-20	2.50-6.30	Low
Berino	12-40	Sandy clay loam	SC	A-6	100	100	35-45	0.63-2.50	Low to moderate
Berino	40-50	Sandy clay loam	SC	A-6	100	100	35-45	2.50-6.30	Low
Cacique	0-12	Loamy fine sand	SM	A-2	100	100	15-25	2.50-6.30	Low
Cacique	12-28	Sandy clay loam	SC	A-6	100	100	35-50	0.63-2.50	Low to moderate
Cacique	28 ⁺	Indurated caliche							
Simona	0-8	Fine sandy loam	SM	A-4	100	100	35-55	2.50-6.30	Low
Simona	8-16	Fine sandy loam	SM	A-4	100	100	35-55	2.50-6.30	Low
Simona	16 ⁺	Indurated caliche							
Middesa	0-8	Fine sandy loam	SM	A-4	100	100	40-55	2.50-6.30	Low
Middesa	8-22	Clay loam	CL	A-6	100	100	75-85	0.63-2.50	Moderate
Middesa	22-36	Sandy clay loam	SC	A-6	100	100	35-45	2.50-6.30	Low
Wink	0-8	Fine sandy loam	SM	A-4	100	100	95-100	2.50-6.30	Low
Wink	8-23	Loamy fine sand	SM	A-2	100	100	40-50	2.50-6.30	Low
Wink	23-50	Soft caliche (sandy)	SC	A-4	100	100	80-95	0.63-2.50	Low

5	Kermit-Muljamar-Berino	0-60	Fine sand	SP-SM or SM	A-3	100	100	5-15	> 6.30	Low
	Kermit	0-24	Fine sand	SM	A-2	100	100	10-20	> 6.30	Low
	Muljamar	24-50	Sandy clay loam	SC	A-6	100	100	35-50	0.63-2.50	Low to moderate
	Berino	(See association 4)								
	Pyote	0-30	Fine sand	SP-SM or SM	A-3	95-100	95-100	5-15	> 6.30	Low
	Palomas	30-60	Fine sandy loam	SM	A-4	95-100	95-100	35-45	2.50-6.30	Low
		0-16	Fine sand	SP-SM or SM	A-3	95-100	95-100	5-15	> 6.30	Low
		16-60	Sandy clay loam	SC	A-6	95-100	95-100	35-50	0.63-2.50	Low to moderate
6	Brownfield-Tivoli-Amarillo	(See association 3)								
	Brownfield	0-60*	Fine sand	SP or SM-SP	A-3	100	100	5-15	> 6.30	Low
	Tivoli	(See association 3)								
	Amarillo	0-16	Fine sand	SM	A-2	100	100	10-20	> 6.30	Low
	Patricia	16-58	Sandy clay loam	SC	A-6	100	100	0.63-2.50	Low to moderate	
	Springer	0-14	Loamy fine sand	SM	A-2	100	100	15-25	2.50-6.30	Low
		14-60	Fine sandy loam	SM	A-4	100	95-100	35-50	2.50-6.30	Low
7	Midessa-Wink-Jal	0-8	Fine sandy loam	SM	A-4	100	100	40-55	2.50-6.30	Low
	Midessa	8-22	Clay loam	CL	A-6	100	100	75-85	0.63-2.50	Moderate
	Wink	0-12	Fine sand	SM	A-2	100	100	10-25	> 6.30	Low
		12-23	Loamy fine sand	SM	A-2	100	95-100	20-50	2.50-6.30	Low
		23-50	Soft caliche (sandy)	SC	A-4	100	80-85	40-55	0.63-2.50	Low
	Jal	0-12	Sandy loam	SM	A-2-4	100	100	35-50	2.50-6.30	Low
		12-30	Limy loam	ML or CL	A-4 or A-6	95-100	90-100	45-60	0.63-2.50	Low
8	Simona-Upton-Tonuco	0-8	Fine sandy loam	SM	A-4	100	100	35-55	2.50-6.30	Low
	Simona	8-16	Fine sandy loam	SM	A-4	90-100	80-90	35-55	2.50-6.30	Low
	Tonuco	16*	Indurated caliche	SM	A-4	75-85	60-85	25-45	2.50-6.30	Low
	Upton	0-8	Gravelly loam	SM	A-4	95-100	95-100	15-25	2.50-6.30	Low
		8*	Indurated	SM	A-2	95-100	95-100	15-25	2.50-6.30	Low
	Tonuco	0-17	Loamy fine sand	SM	A-4	100	100	60-70	0.20-2.50	Low to moderate
9	Lagro-Pajarito	0-65	Loam and silt loam (stratified)	ML-CL	A-4	100	100	60-70	0.20-2.50	Low to moderate
	Lagro	0-16	Loamy fine sand	SM	A-2	95-100	95-100	15-30	2.50-6.30	Low
	Pajarito	16-60	Fine sandy loam	SM	A-4	95-100	95-100	35-45	2.50-6.30	Low
10	Portales-Stegall-Lea	(See association 2)								
	Portales	(See association 2)								
	Stegall	(See association 2)								
	Lea	0-10	Loam	ML-CL	A-4	100	100	50-65	0.63-2.50	Low
	Manaker	10-19	Clay loam	CL	A-6	100	100	65-75	0.63-2.50	Moderate
		19*	Soft caliche	ML-CL	A-4	100	100	55-70	0.63-2.50	Low
11	Arch-Portales	0-10	Loam	CL	A-6	100	100	55-75	0.63-2.50	Low to moderate
	Arch	10-16	Heavy loam	CL	A-6	100	100	55-75	0.63-2.50	Low to moderate
	Portales	16*	Soft caliche	SM	A-2	100	100	20-35	2.50-6.30	Low
	Drake	0-9	Sandy fine sand	SM or SC	A-4 or A-6	100	100	35-50	0.63-2.50	Low
		9-60	Loamy fine sand and sandy clay loam							

Table 8. Interpretation of soil properties for engineering uses, Lea County, New Mexico

Soil Map Symbol and Soil Association	Suitability as a Source of --		Degree of Limitation for Septic Tank Filter Fields	Corrosion Potential (untreated steel pipe)
	Topsail	Road fill		
1 Kimbrough Kimbrough gravelly loam	Poor; excessive caliche fragments	Fair; material very limited	Severe; indurated caliche at 4 to 20 inches	Moderate
2 Kimbrough-Lea Kimbrough gravelly loam	(See association 1)			
Lea loam	Upper 8 to 10 inches good	Fair	Severe; indurated caliche at 20 to 40 inches	Moderate
Stegall loam	Upper 6 to 10 inches good	Poor; moderate shrink-swell	Severe; indurated caliche at 20 to 40 inches	Moderate
Portales loam	Fair; strongly calcareous	Fair	Moderate; moderate permeability	Moderate
Slaughter loam	Good to a depth of 4 to 5 inches	Poor; moderate shrink-swell; material very limited	Severe; indurated caliche at 10 to 20 inches	Moderate
3 Amarillo-Arvana Amarillo loamy fine sand	Poor; sandy and erodible	Good to depth of 10 inches; fair below	Slight to moderate; moderately permeable	Moderate
Arvana fine sandy loam	Fair; moderately sandy and erodible	Fair	Severe; indurated caliche at depth less than 3 feet	Moderate
Brownfield fine sand	Poor; very sandy and erodible	Good to a depth of 2 feet; fair below	Moderate; moderately permeable substratum	Moderate
Sharvana loamy fine sand	Poor; sandy and erodible	Fair; material very limited	Severe; indurated caliche at 12 to 20 inches	Moderate
Gomez loamy fine sand	Poor; sandy and erodible	Good to a depth of 2 feet; fair below	Moderate; soft caliche below 2 feet	Moderate
4 Berino-Cacique Berino loamy fine sand	Poor; sandy and erodible	Surface layers good; fair to a depth of 40 inches when mixed	Moderate; moderately permeable	Moderate
Cacique loamy fine sand	Poor; sandy and erodible	Fair	Severe; indurated caliche at depths of less than 3 feet	Moderate
Simona fine sandy loam	Poor; sandy and erodible; caliche fragments	Good; caliche may require crushing	Severe; indurated caliche at 7 to 20 inches	Moderate
Midessa fine sandy loam	Fair to a depth of 8 to 10 inches; strongly calcareous	Poor	Moderate; caliche substratum with slow permeability	Moderate
Wink fine sandy loam	Poor; strongly calcareous; erodible	Fair	Slight to moderate caliche may restrict permeability	Moderate

Soil Features Affecting --				
Foundation support	Highway location	Farm ponds		Terraces, diversions, contour furrows, and pitting
		Reservoir area	Embankment	
Good; indurated caliche at 4 to 20 inches	Indurated caliche at 4 to 20 inches; limited borrow material	*	*	*
Indurated caliche at 20 to 36 inches; material above caliche has fair bearing capacity and shear strength	Indurated caliche at 2 to 3 feet	Moderately permeable subject to seepage if indurated caliche exposed	Fair to good stability; limited amount of borrow material	Borrow materials limited by depth to caliche
Indurated caliche at 20 to 40 inches; material above caliche has fair bearing capacity and shear strength	Indurated caliche at 20 to 40 inches; moderate shrink-swell	Slow permeability; subject to seepage if caliche is exposed	Fair to good stability; limited amount of borrow material	Borrow materials limited by depth to caliche
Fair bearing capacity and shear strength; low to moderate shrink-swell	Soil features favorable	Moderately permeable; may require compaction	Fair stability if compacted	Exposed limy materials erodible and difficult to vegetate
Indurated caliche at depths of 10 to 20 inches	Indurated caliche below 10 to 20 inches	*	*	*
Good bearing capacity and shear strength	Surface layers erodible; slight to moderately plastic subsoil	Subject to seepage; requires compaction	Surface layer sandy and permeable; subsoil material has fair stability if compacted	*
Indurated caliche at 20 to 36 inches	Indurated caliche at depth of less than 3 feet	Moderately permeable; subject to seepage if caliche is exposed	Fair stability if compacted; material limited	Exposed caliche erodible and difficult to vegetate
Good bearing capacity and shear strength; surface layers erodible	Erodible when exposed on embankments; some drifting sand	Surface layers very sandy; subject to seepage	Sandy material; erodible	Sandy materials subject to wind erosion
Good bearing capacity and shear strength; indurated caliche at 12 to 20 inches	Layers of indurated caliche at depths of 12 to 20 inches	*	*	*
Fair bearing capacity and shear strength below an average depth of 2 feet	Surface layers erodible; soft caliche below a depth of 2 feet	Permeable and subject to seepage	Erodible and very permeable	*
Good bearing capacity and shear strength	Erodible on exposed embankments; other features favorable	Moderately permeable; requires compaction	Erodible; fair stability when mixed and compacted	Surface layers erodible; fair stability when mixed with subsoil and compacted
Good bearing capacity and shear strength; indurated caliche at 20 to 36 inches	Indurated caliche at less than 3 feet	Moderately permeable; subject to seepage if caliche is exposed	Fair stability if compacted; material limited	Exposed caliche erodible and difficult to vegetate
Indurated caliche at 7 to 20 inches	Sandy surface layers erodible; indurated caliche at less than 2 feet	*	*	*
Fair bearing capacity and shear strength; moderate shrink-swell	Soil features favorable	Soft caliche at 2 to 3 feet; requires compaction	Fair stability if compacted	Exposed limy materials erodible and difficult to vegetate
Good bearing capacity; fair to good shear strength	Erodible on embankments; other soil features favorable	Rapid to moderate permeability; subject to seepage	Erodible surface layers; porous	Exposed limy materials erodible and difficult to vegetate

*Unsuitable or practice not applicable

Table 8. Continued

Soil Map Symbol and Soil Association	Suitability as a Source of --		Degree of Limitation for Septic Tank Filter Fields	Corrosion Potential untreated steel pipe
	Topsoil	Road fill		
5 Kermit-Maljamar-Berino Kermit fine sand	Poor; very sandy and erodible	Good if soil binder added	Slight	Low
Maljamar fine sand	Poor; very sandy and erodible	Good to 24 inches; fair 24 to 60 inches	Moderate; moderately permeable below 2 feet	Low
Berino loamy fine sand	Poor; sandy and erodible	Surface layers good; fair to a depth of 40 inches when mixed	Moderate; moderately permeable	Moderate
Pyote fine sand	Poor; very sandy and erodible	Good if material is mixed to a depth of 4 to 5 feet	Slight	Low
Palomas fine sand	Poor; very sandy and erodible	Good in upper 12 to 20 inches; fair below	Moderate; moderately permeable below 12 to 20 inches	Moderate
6 Brownfield-Tivoli-Amarillo Brownfield fine sand	Poor; very sandy and erodible	Good to a depth of 2 feet; fair below	Moderate; moderately permeable substratum	Moderate
Tivoli fine sand	Poor; very sandy and erodible	Good if soil binder added	Slight	Low
Amarillo loamy fine sand	Poor; sandy and erodible	Good to depth of 10 inches; fair below	Slight to moderate; moderately permeable	Moderate
Patricia fine sand	Poor; very sandy and erodible	Good in upper 12 to 20 inches; fair below 20 inches	Moderate; moderately permeable below 20 inches	Moderate
Springer loamy fine sand	Poor; sandy and erodible	Good in upper 12 to 24 inches; fair below	Slight	Low
7 Midessa-Wink-Jal Midessa fine sandy loam	Fair to a depth of 8 to 10 inches; strongly calcareous	Poor	Moderate; caliche substratum with slow permeability	Moderate
Wink fine sand	Poor; calcareous; sandy and erodible	Good in upper 2 feet; fair below	Slight to moderate; caliche may restrict permeability	Moderate
Jal sandy loam	Fair to a depth of 5 to 10 inches; calcareous and sandy	Poor	Severe	Moderate
8 Simona-Upton-Tomuco Simona fine sandy loam	Poor; sandy and erodible; caliche fragments	Good; caliche may require crushing	Severe; indurated caliche at 7 to 20 inches	Moderate
Upton gravelly loam	Poor; calcareous and gravelly	Good; caliche at depth of 4 to 20 inches may require crushing	Severe; shallow to indurated caliche	Moderate
Tomuco loamy fine sand	Poor; sandy and erodible	Good; caliche below 6 to 20 inches may require crushing	Severe; shallow to indurated caliche	Moderate

Soil Features Affecting --				
Foundation support	Highway location	Farm ponds		Terraces, diversions, contour furrows, and pitting
		Reservoir area	Embankment	
Good if confined	Erodible sand; hummocky; blowing and drifting sand hampers movement of equipment	*	Porous material; erodible and unstable	*
Good bearing capacity and shear strength; may be necessary to confine surface layers	Surface layers to a depth of 2 feet erodible	Very permeable to 2 feet; moderately permeable 24 to 60 inches; subject to seepage	Erodible and unstable material; porous	*
Good bearing capacity and shear strength	Erodible on exposed embankments; other features favorable	Moderately permeable; requires compaction	Erodible; fair stability when mixed and compacted	Surface layers erodible; fair stability when mixed with subsoil and compacted
Good bearing capacity and shear strength; may be necessary to confine surface layers	Erodible; some loose and drifting sands	*	*	*
Good bearing capacity and shear strength; surface layers erodible	Erodible; some loose and drifting sands	Very permeable 12 to 20 inches; moderately permeable below 20 inches; subject to seepage	Sandy material; erodible	*
Good bearing capacity and shear strength; surface layers erodible	Erodible when exposed on embankments; some drifting sand	Surface layers very sandy; subject to seepage	Sandy material; erodible	Sandy materials subject to wind erosion
Good if confined	Erodible; hummocky; blowing and drifting sand	Very permeable*	Porous; erodible and unstable*	*
Good bearing capacity and shear strength	Surface layers erodible; slight to moderately plastic subsoil	Subject to seepage; requires compaction	Surface layer sandy and permeable; subsoil material has fair stability if compacted	*
Good bearing capacity and shear strength; surface layers erodible	Erodible; some loose and drifting sand	Subject to seepage; moderately permeable below 12 to 20 inches	Sandy material; erodible	*
Good bearing capacity and shear strength; low shrink-swell	Sandy materials subject to wind erosion	Subject to seepage; rapidly permeable	Sandy material; erodible	*
Fair bearing capacity and shear strength; moderate shrink-swell	Soil features favorable	Soft caliche at 2 to 3 feet; requires compaction	Fair stability if compacted	Exposed limy materials erodible and difficult to vegetate
Good bearing capacity; fair to good shear strength; may be necessary to confine surface layers	Erodible; some loose and drifting sand	Rapid to moderately permeable; subject to seepage	Erodible surface layers; porous	*
Fair bearing capacity and shear strength	Soft caliche at 12 to 20 inches; erodible when exposed on embankments	Subject to seepage	Limy material; erodible; difficult to vegetate	*
Indurated caliche at 7 to 20 inches	Sandy surface layers erodible; indurated caliche at less than 2 feet	*	*	*
Good bearing capacity	Indurated caliche at depth of 4 to 20 inches	*	*	*
Indurated caliche at 6 to 20 inches; may be necessary to confine sandy surface materials	Erodible surface layers; shallow to indurated caliche	*	*	*

*Unsuitable or practice not applicable

Table 8. Continued

Soil Map Symbol and Soil Association	Suitability as a Source of --		Degree of Limitation for Septic Tank Filter Fields	Corrosion Potential (untreated steel pipe)
	Topsoil	Road fill		
9 Largo-Pajarito Largo loam	Poor to fair; silty and erodible	Fair	Moderate to severe; occasional overflow; slow permeability	Moderate
Pajarito loamy fine sand	Poor; sandy and erodible	Good to fair	Slight	Low
10 Portales-Lea-Stegal Portales loam	Fair; strongly calcareous	Fair	Moderate; moderate permeability	Moderate
Lea loam	Upper 8 to 10 inches good	Fair	Severe; indurated caliche at 20 to 40 inches	Moderate
Stegall loam	Upper 6 to 10 inches good	Poor; moderate shrink-swell	Severe; indurated caliche at 20 to 40 inches	Moderate
Mansker loam	Fair to a depth of 6 to 8 inches; Fair erodible and limy		Moderate; lime zone with moderately slow permeability	Moderate
11 Arch-Portales Arch loam	Fair to a depth of 6 to 8 inches; Fair limy and erodible		Severe; lime zone restricts permeability	High
Portales loam	(See association 10)			
Drake loamy fine sand	Poor; sandy and limy	Fair to good	Moderate	Moderate

*Unsuitable or practices not applicable

Soil Features Affecting --				
Foundation support	Highway location	Farm ponds		Terraces, diversions, contour furrows, and pitting
		Reservoir area	Embankment	
Fair to poor bearing capacity and shear strength	Highly erosive when exposed on embankments; subject to occasional flooding	Moderately slow permeability; requires compaction	Erodible; unstable material; difficult to vegetate	Unstable embankments; channels subject to siltation; piping hazard
Good bearing capacity; fair shear strength may be necessary to confine surface layers	Erodible when exposed on embankments; some drifting sand	Porous and permeable material	Sandy and porous material; erodible	*
Fair bearing capacity and shear strength; low to moderate shrink-swell	Soil features favorable	Moderately permeable; may require compaction	Fair stability if compacted	Exposed limy materials erodible and difficult to vegetate
Indurated caliche at 20 to 36 inches; indurated caliche at 2 to 3 feet bearing capacity and shear strength	Indurated caliche at 20 to 40 inches; moderate shrink-swell	Moderately permeable; subject to seepage if indurated caliche is exposed	Fair to good stability; limited amount of borrow material	Borrow materials limited by depth to caliche
Indurated caliche at 20 to 40 inches; material above caliche has fair bearing capacity and shear strength	Indurated caliche at 20 to 40 inches; moderate shrink-swell	Slow permeability; subject to seepage if caliche is exposed	Fair to good stability; limited amount of borrow material	Borrow materials limited by depth to caliche
Fair bearing capacity and shear strength	Shallow to soft caliche; erodible when exposed on embankments	Shallow to soft caliche; moderately permeable	Limy material; erodible and difficult to vegetate	Exposed limy materials erodible; difficult to vegetate
Fair bearing capacity and shear strength	Shallow to soft caliche; erodible when exposed on embankments	Shallow to soft caliche; moderately permeable	Limy material; erodible and difficult to vegetate	Exposed limy materials erodible and difficult to vegetate
Good bearing capacity; fair to good shear strength; low shrink-swell	Moderately sloping and undulating; high lime content; erodible on embankments	Sloping; subject to seepage	Limy material; erodible and difficult to vegetate	*

system is based on identification of soils according to their texture and plasticity and their performance as engineering construction materials. Soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic.

The estimated percentage of soil material passing sieves No. 4, No. 10, and No. 200 are in the columns headed by these sieve numbers. These percentages reflect the normal range for the soil series and most soils within a series will fall within that range indicated. The grain size of some soils may vary, and not all samples of a specific soil will fall within the range as shown.

Permeability as indicated in table 7 relates to the rate water moves through undisturbed and uncompacted soil. The estimates are based on the texture, structure and porosity of the soil.

Shrink-swell potential is an indication of the volume change to be expected of the soil material with changes in moisture content. Shrinking and swelling of soils cause much damage to building foundations, roads and other structures. A high shrink-swell potential indicates hazards to the maintenance of structures constructed in, on, or with such materials.

Engineering Interpretations

Table 8 contains selected information useful to engineers and others who plan to use soils as a support for various structures, or as soil material in the construction of highways, farm facilities, sewage disposal systems and other engineering structures.

Although limiting or undesirable soil features are emphasized, favorable soil features may also be listed. The ratings and other interpretations in this table are based on estimated soil properties for engineering uses as listed in table 7, on available test data, and on field experience.

Topsoil is a term used to designate a fertile soil or soil material of favorable texture, structure and organic matter content, which can be used as a topdressing for lawns, roadbanks, and various other engineering structures. The ratings of poor, fair, or good indicate the general suitability of the surface soil layers for such use.

Suitability ratings of poor, fair, or good for road fill are given for the major soils in each soil association. The ratings are based on the performance of the soil material when excavated and used as borrow for highway subgrade. Generally, the best soil material for subgrade and subbase are

coarse-grained soils. The suitability of fine-grained soils ranges from fair to very poor.

Sewage filter fields are affected mainly by permeability, depth to water table, depth to bedrock or indurated caliche and susceptibility to flooding. The degree of limitations and principal reasons for assigning moderate to severe limitations are given.

A corrosion potential of low, moderate, or high is indicated for the major soils in each soil association. Corrosivity, as used here, indicates the potential danger of uncoated steel pipe to corrode or become weakened through chemical action. Among the features considered in rating corrosion potential are, soil drainage, presence of soluble salts and frequency of wetting and drying. The texture, structure, and porosity of the soil are also important because of their effect on aeration, moisture-holding capacity and movement of water.

Foundations for low buildings are affected chiefly by features of the undisturbed soil that influence its capacity to support low buildings that have normal foundation loads. Although specific values of bearing capacity and shear strength are not assigned, general values are indicated.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features, considered and of importance in Lea County are topography, thickness of soil material over soft or indurated caliche, erodibility, stability, susceptibility to overflow, stability, and plasticity. The more common soil features affecting highway construction and maintenance are listed in the column headed highway location. For example, the very sandy materials of the Kermit series when exposed on embankments and cuts are easily eroded by wind and water.

Farm pond reservoir areas are affected mainly by seepage loss of water, and the soil features listed are those that influence such seepage.

Farm pond embankments serve as dams. The soil features, of both subsoil and substratum, considered in this grading are those that influence suitability of the soil materials for constructing embankments.

Terraces and diversions are low structures designed to retain or direct water. Pitting, chiseling and contour furrowing serve to loosen the soil and retain water from rainfall and snow melt. The intake rate, permeability, stability of clods, and the use of the soil material for embankments are the soil features considered.

