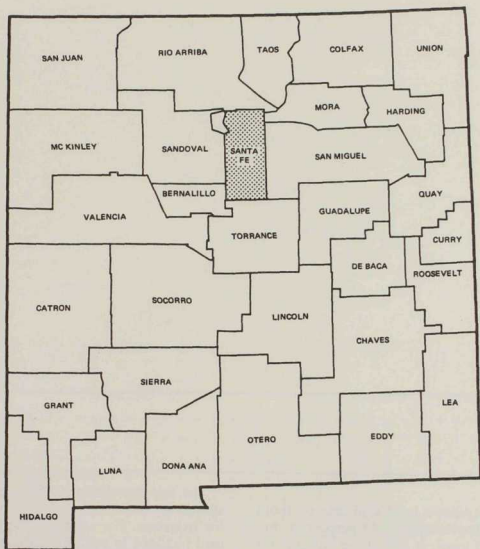


SOIL ASSOCIATIONS AND  
LAND CLASSIFICATION FOR IRRIGATION  
SANTA FE COUNTY

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



AGRICULTURAL EXPERIMENT STATION RESEARCH REPORT 185



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## Summary

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Santa Fe County has a total land area of about 1,221,800 acres. Approximately 43 percent of this, or about 520,000 acres, is considered suitable for irrigation. Of this total estimated acreage of irrigable land, about 12,800 acres are now irrigated. Therefore, a large acreage that is suitable for irrigation remains unirrigated. The potential for expanding irrigation is limited by a lack of water and by economic restrictions rather than by a shortage of suitable soils. Of the land classified as suitable for irrigation, 2,643 acres are in irrigation land class 1; 295,069 in class 2; 165,683 in class 3; and 57,095 acres in land class 4. The remaining 701,310 acres in the county are in land class 6, which is not suitable for irrigation.

The data are presented on the basis of the 13 soil associations shown on the general soil map of Santa Fe County (figure 1). The irrigation land classification map (figure 2) shows the approximate distribution of irrigation land classes. Only the dominant classes in each outlined area are shown.

The soil associations differ significantly in suitability for other uses just as they do in suitability for irrigation. For example, the high mountainous land included in soil associations 12 and 13 is well suited to many uses, including forestry, recreation, range, and wildlife. These associations include the principal timber-producing soils in the county and provide a good habitat for many species of wildlife and offer many recreational opportunities. In contrast, the deep, moderately permeable soil of association 5 is well suited to range use and irrigated agriculture but offers only limited recreational opportunities and wildlife habitats.

Information is given on characteristics and capabilities of the soils, which are also classified according to the Unified and the American Association of State Highway Officials (AASHO) systems to facilitate use of the soil association information by engineers and others acquainted with these systems. 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 SANTA FE 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 Santa Fe 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 relative suitability of land for irrigation in Santa Fe County are presented in the map showing land classification for irrigation (see figure 2 on the center pages of this report). The general soils map

(figure 1) and a detailed soil survey provided the information needed for the classification for irrigation.

The general soil map, which indicates soil resources of large tracts, is also useful in community or broad area planning. It provides information that can be used in preliminary planning for irrigated agriculture, forestry, range, urban, engineering, recreation, and wildlife uses. For example, from the general soil map of Santa Fe County, information can be obtained relative to the location of large tracts of land with soils suitable for the development of irrigated land. It also shows the 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 the construction of roads or building foundations.

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

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## Procedures

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A detailed soil survey and preliminary report made by the Soil Conservation Service<sup>3</sup> provided the soils information used in this study, including soil descriptions, information about soil, and recommendations for the best use of each soil.

The general soil map (figure 1), which is small-scale and shows only general soil areas or soil associations, was prepared by grouping geographically associated soils shown on the unpublished detailed soil maps into 13 general soil areas. These 13 map units, which are referred to as "soil associations" are landscapes, or geographic areas, that have a distinctive proportional pattern of soils. Inasmuch as each kind of soil normally occurs in comparatively small areas, the map units on the general soil map of Santa Fe 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 soil association are not necessarily similar. In fact, they often are of contrasting characteristics that influence their use and management.

When the soil data were assembled, the major soils and miscellaneous land types within each soil association were classified according to their productive capacity under irrigated agriculture (table 5). The criteria used in the placement of soils in the five irrigation land classes are those proposed at the 1967 conference organized by the Federal Water Resources Council<sup>4</sup> and 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 limitations for use under irrigation increases from class 1 through 4. 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. Some of 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 Santa Fe County were placed in the various irrigation land classes on the basis of soil properties and qualities that affect their suitability for continued use under irrigation. Neither the availability nor the cost of pumping and conveying irrigation water enters into the classification. Nor were 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 the various irrigation land classes were: soil texture including gravel and stone content, effective soil depth, available water-holding capacity, permeability, erosion, surface smoothness, slope, internal soil drainage, and surface drainage. For example, the Nambe soils, which are of moderate water-holding capacity, were placed in land class 6 primarily because of steep slopes and unevenness of the land surface. The Bluewing soils were placed in class 4 primarily because of low water-holding capacity and coarse and gravelly textures.

<sup>3</sup>Folks, James J., Soil Survey of Santa Fe Area, New Mexico, Soil Conservation Service, U.S. Dept. of Agriculture, Unpublished. Copies of field sheets and interim report available for review at Santa Fe, New Mexico, Office of Soil Conservation Service.

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

Table 1. Land classification specifications for Pacific Southwest Basin irrigation land classes<sup>1</sup>

Land Characteristics	Class 1	Class 2	Class 3	Class 4	Non-irrigable Class 6
<b>Soils</b>					
Texture (Surface 12") <sup>2</sup>	LVFS-CL	LS-C Peat, Muck	MS-C	MS-C	All other lands not meeting criteria for arability
Moisture Retention (AWHC-48") <sup>3</sup>	> 6.0'	4.5' 6.0'	3.0' 4.5'	2.5' 3.0'	
Effective Depth (inches)	> 40 <sup>4</sup>	30-40	20-30	10-20	
Salinity (EC <sub>e</sub> × 10 <sup>3</sup> - equil.)	< 4	4-8	8-12	12-16	
<b>Sodic Conditions<sup>5</sup></b>					
Percent area affected	< 5	5-15	15-25	25-35	
Severity of problem <sup>6</sup>	Slight	Moderate	Moderate	Moderate	
Permeability (in place - in/hr)	0 2-5.0	0.05-5.0	0.05-10.0	Any	
<b>Permissible coarse fragments (% by vol.)</b>					
Gravel	15	35	55	70	
Cobbles	5	10	15 <sup>7</sup>	35 <sup>7</sup>	
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.				
<b>Topography (or land development items)<sup>8</sup></b>					
Stone for Removal (cubic yards per acre)	10	25	50	70	
<b>Slope (percent)</b>					
Moderately to severely erodible	< 2	2-5	5-10	10-20	
Slightly erodible	< 4	4-10	10-20	20-25	
<b>Surface Leveling or Tree Removal (amount of cover)</b>					
Tree Removal (amount of cover)	Light	Medium	Medium heavy	Medium heavy	
<b>Irrigation Method</b>					
	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.				
<b>Drainage</b>					
<b>Soil Wetness (depth to water table during growing season with or without drainage)</b>					
Loam or finer	> 60"	40"-60"	20"-40"	10"-20"	
Sandy	> 50"	30"-50"	20"-30"	10"-20"	
Surface Drainage	Good	Good	Restricted	Restricted	
Depth to Drainage Barrier (in feet)	> 7	6-7	5-6	1-5-5	
Air Drainage <sup>9</sup>	No Problem	Minor	Restricted	Restricted	

<sup>1</sup>Specifications 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.

<sup>2</sup>Finer 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.

<sup>3</sup>In 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.

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

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

<sup>6</sup>Severity 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.

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

<sup>8</sup>Special 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.

<sup>9</sup>Air 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

Santa Fe County comprises an area of 1,221,800 acres in north-central New Mexico. Its northern boundary is 68 to 70 miles south of New Mexico-Colorado state line.

The topography varies within the county. The northeastern part, which includes the Sangre de Cristo Mountains, is a high mountainous and wooded area. Although elevations range from about 7,000 feet at the base of mountains to 12,629 on Santa Fe Baldy Peak, elevations in much of this mountainous area range between 8,000 and 11,500 feet. Drainage patterns are well defined, with most of the drainage being into the Rio Grande. The eastern slopes of the mountains drain into the Pecos River drainage system. Slopes in this part of the county are generally steep or very steep.

The northwestern part of the county is characterized by basalt-capped mesas and old lava flows with a poorly defined drainage pattern. Slopes are dominantly gently to strongly sloping, but range from nearly level to moderately steep. This sloping topography is interrupted by the sides of basalt-capped mesas and fronts of lava flows that are steep to very steep. Another characteristic feature is the volcanic plugs and cinder cones that dot the area. These are commonly 100 to 500 feet above the surrounding landscapes. Elevations in this part of the county range from about 6,000 to 6,500 feet.

The southern part of the county, which includes a northern extension of the well-known Estancia basin, consists mostly of a broad, gently sloping plain surrounded by gently to strongly sloping piedmont slopes that extend from the mountain fronts. Elevations range from about 6,200 feet on the basin floor to about 7,000 feet near the base of the mountains. Drainage is into playas located in the central part of the Estancia basin of Torrance County.

The north-central and central parts of the county comprising the area between the Sangre de Cristo Mountains on the east and the basalt areas on the west consist essentially of alluvial plains and piedmont slopes. Slopes are generally moderately steep adjacent to the mountains and gradually lessen as distance increases away from the mountains. Drainage is well defined, especially where the major streams from the mountains enter the alluvial plain. In the northern half, undulating to rolling and hilly landscapes dissected by numerous

intermittent drainages and arroyos are common. In the southern half, erosion has been less active, and the major streams, especially the Santa Fe River, have well developed river terraces. Elevations range from about 6,000 feet to 7,000 feet.

A relatively large upland area is found to the east and northeast of the Estancia basin. This upland area, which is essentially the southern extension of Glorieta Mesa, is characterized by rolling hills in the northern and central parts and by small shallow basins in the southern segment. The most prominent of the basins is White Lake. At the extreme northern edge of this upland area are the very steep, north-facing scarps of the Glorieta Mesa. Drainage in the northern and central part is well defined and is generally into Galisteo Creek, but the southern part of this area has poorly defined drainage patterns, and runoff is into small basins. Elevations in this part of the county range from about 6,600 to 7,000 feet.

### Climate<sup>5</sup>

The climate of Santa Fe County depends greatly upon the elevation, which varies from 6,000 feet to more than 12,000 feet. Several rivers flow westward from the mountains into the Rio Grande, which is just west of the county and forms part of its boundary in the northwest. There are many arroyos and small mountain canyons which affect local climate.

Except in the high mountains, the climate is semi-arid continental, with relatively high elevation causing mild summer temperatures and quite cold winters. Summer is the rainy season, when moist air from over the Gulf of Mexico reaches Santa Fe in the general southeasterly to southerly air circulation. Mountains to the northeast shield the county from some of the colder air intrusions in winter. Winter precipitation is much lighter, because much of the moisture in the eastward-moving Pacific Ocean storms falls on the mountain ranges to the west of New Mexico. There is a large diurnal temperature change, averaging from 30 to 40 degrees.

Table 2 shows the patterns of monthly temperatures and precipitation at Santa Fe. These are generally representative of county areas below about 8,000 feet. In the valleys of the south, however, diurnal temperature change is greater, and extreme low temperatures are about 10 de-

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

Table 2. Monthly temperatures and precipitation, Santa Fe, New Mexico, for period ending 1960

Item	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Temperatures (F°)												
Average daily maximum	40	44	51	60	69	79	82	80	74	63	50	42
Average daily minimum	19	23	28	35	43	52	57	56	49	39	28	21
Daily mean	30	33	39	47	56	66	69	68	62	51	39	31
Extreme maximum	76	75	82	84	89	98	98	97	93	85	77	65
Extreme minimum	-13	-15	-2	3	20	33	42	40	21	13	-11	-13
Precipitation												
Average (inches)	.68	.74	.80	.95	1.30	1.08	2.34	2.27	1.44	1.14	.66	.72
Average days 0.10 inch or more (no.)	2	2	3	2	3	3	6	6	3	3	2	2
Average snowfall (inches)	6.3	6.5	5.1	3.0	T	3.0	0	0	0.1	0.7	3.3	6.2
T = Trace, less than 0.05 inch												
Years of record: Temperatures, 82; average precipitation, 99; average days 0.10 inch or more, 7; and average snowfall, 73												

grees lower than those at Santa Fe. The mean annual temperature of this area below 8,000 feet is close to 50 degrees. At higher elevations, the temperature may be expected to average about 3 degrees lower for each 1,000-foot increase in elevation. Extremes of temperature in the non-mountainous part of the county have been 99 degrees and 28 degrees below zero. An average of only 11 days a year reach 90 degrees at Santa Fe, a few in each summer month. Most days in November through March have freezing temperatures, but only rarely in the winter does the temperature fall to zero. On a few days in each winter month, the temperature may fail to reach

above freezing. The average freeze-free season of areas at elevations of 6,000 to 7,200 feet ranges from about 4½ to 6 months. Mean annual precipitation below 8,000 feet ranges from 10 to 14 inches over most of the county, generally greater at higher elevations. In the mountains, precipitation increases more rapidly with elevation, and reaches over 33 inches at Santa Fe Lake, 11,600 feet. Precipitation is included with other selected climatological data in table 3, for comparison of climate at several county localities.

Some county extremes of precipitation include an annual total of 24.80 inches at Santa Fe in 1855, and of 52.93 inches at Santa Fe Lake in

Table 3. Annual averages of selected climatological data, Santa Fe County, New Mexico, for the period of record through 1960, except as indicated

Station	Elevation feet	Temperatures			Precipitation		Last 32°F or Lower in Spring	First 32°F or Lower in Fall	Time Between Dates
		Mean maximum	Mean minimum	Yrs. of record	Mean annual	Yrs. of record			
		F°	F°	no.	in.	no.			
Galisteo	6,074	67	37	9	12.61	9	April 23	Oct. 17	177
Otto Airport	6,226	66	32	19	11.64	42	May 15	Oct. 4	142
Santa Fe	7,200	61	37	81	14.12	99	May 5	Oct. 15	163
Santa Fe Airport	6,314	65	37	17	9.78	17	April 29	Oct. 17	171
Stanley (1 mi. NNE)	6,380	66	32	6	10.80	6	May 18	Sept. 27	132
Cundiyo	6,889				9.19	15			
Edgewood	6,800				12.61	15			
Glorieta	7,520				14.56	14			
Golden	6,700				11.01	15			
Nambe No. 1	6,050				9.88	20			
Nambe No. 2	6,000				9.66	8			
Santa Fe Canyon	8,100				17.69	11			
Turquoise	6,225				11.86	8			
*Big Tesuque	9,800				23.49	10			
*Elk Cabin	8,500				20.05	19			
*Santa Fe Lake	11,600				33.54	9			

\*Storage gages

Period of record: Galisteo, through 1903; Otto Airport, through 1952; Santa Fe Airport, through 1957; Cundiyo, through 1923; Edgewood, through 1959; Nambe No. 2, through 1950; Santa Fe Canyon, through 1928; Big Tesuque, through June 1965; Elk Cabin, through June 1965; and Santa Fe Lake, through June 1964

1957. The least annual amount of 5.03 fell in Santa Fe in 1917. The great variability of precipitation may also be seen in monthly totals, 7.89 inches at Santa Fe in August 1855 and only 0.36 inch in August 1899. The greatest 24-hour precipitation at Santa Fe was 2.82, July 30, 1953. During the growing season, May through October, nearly 70 percent of the annual average precipitation falls, except in the mountains, where the percentage is about 10 percent less. Much of the summer precipitation is from brief, but often heavy, thundershowers. This area has an annual average of nearly 50 thunderstorms.

Annual snowfall averages are more variable than total precipitation at similar elevations. Snowfall totals range from 10 to 35 inches at elevations below 8,000 feet. The higher mountains may receive more than 100 inches of snowfall during an average season. The main season for snowfall is November through April.

Evaporation in two-thirds of the years at Santa Fe, as measured by a Class A pan, may be expected to range from 62 to 72 inches. During the average

growing season, May through October, nearly three-fourths of the annual evaporation occurs.

The daily range of relative humidity in winter averages from 70 percent in the early morning to 45 percent in the afternoons. In summer, the range averages from 65 percent in the early morning to 25 percent in the afternoons. Average relative humidity is lowest in spring with 48 percent and highest in winter with 62 percent. Average wind speed, as measured at Santa Fe Airport, is 12 miles per hour, with stronger winds in the spring and lighter winds in summer. Winds of 25 miles per hour or greater occur in 5 percent of the hours. The winds are predominantly from the west-southwest in spring, and north-northeast the rest of the year. The orientation of the Rio Grande Valley in the vicinity of Santa Fe influences the wind direction. At Otto Airport, and probably in the mountains, winds predominate from the west and southwest in all seasons.

Sunshine is plentiful in all seasons, averaging near 3300 hours a year, or 74 percent of the possible time.

## Land Use

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Much of the early history on the use and settlement of land of Santa Fe County centers around the Indian Pueblos, the city of Santa Fe, and early mining in the Cerrillos, Madrid, and Golden areas.

For centuries, the Santa Fe area has been a desirable place in which to live, because of its climate and water supply for crops and domestic use.

Rodriguez, one of the earliest Spanish explorers, reported four Indian pueblos along the Santa Fe River in his account of an expedition to northern New Mexico in 1581-82. Other Spanish explorers passed through the area until 1610, when a new settlement, La Villa Real de la Santa Fe de San Francisco de Assisi, became the capital of the province of Nuevo Mexico. It was a small community: in 1617, the total Spanish population consisted of 48 soldiers and colonists. These colonists probably built the first irrigation ditches in the area.

Irrigated agriculture, therefore, is an old industry in Santa Fe County. Records indicate that in 1967 approximately 12,830 acres of land were irrigated.<sup>6</sup> Of this irrigated acreage, approximately

7,000 acres are irrigated by water from wells. This pump-irrigated land is in the southern part of the county, in that part of the Estancia basin that is within the county. Pump irrigation is a comparatively recent development as most of this land was placed under irrigation between 1940 and 1947. Although the water level has declined some, the water is of satisfactory quality for domestic as well as irrigation use.

The remaining irrigated land, slightly less than 6,000 acres, is surface irrigated. It is located in valleys adjacent to streams in the northern part of the county. There are eight or nine small streams from which water is diverted directly to the land. Most of these streams run intermittently, causing the supply of irrigation water to be uncertain. There is usually an adequate supply in the spring from snow melt and again in July and August, when thunderstorm activity is the greatest. Santa Cruz reservoir is the only storage for irrigation water in the county.

Although a wide variety of crops is grown in the county, many are of extremely limited acreage. Alfalfa, corn, and small grains, which are the principal crops, are grown on 50 to 75 percent of the irrigated land. About one-tenth, or slightly more than 500 acres of irrigated land, is planted to fruit trees, principally apples.

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<sup>6</sup>New Mexico Soil and Water Conservation Needs Inventory, Statistical Report, Soil Conservation Service and other Federal and State Agencies, 1970.

In addition to irrigated agriculture, livestock grazing is an important land use. According to the United States Census of Agriculture for 1964, there are approximately 986,000 acres of land in this county in farms. Most of this acreage is range used for beef cattle production. In 1969, approximately 22,000 head of cattle were grazed on the county's rangeland.<sup>7</sup>

Dryland farming, which once was rather extensive in the extreme southern part of the county, has declined so that little land is used for this purpose now. According to the 1967 Conservation Needs Inventory report, slightly more than 21,000 acres were used as dry cropland in Santa Fe County in 1967. Most of this acreage, however, was in conservation use or had been reseeded to grass.

The use of land for wildlife and recreation is also important in Santa Fe County. The high mountainous parts of this county and the adjacent foothills provide good habitat for many species of wildlife.

This county is easily accessible and offers many opportunities for outdoor recreation. Many thousands of visits are made to the area each year by sightseers, picnickers, campers, hunters, hikers, horseback riders, and others in search of recreation. Santa Cruz Lake, which is fished heavily all during the season, is a major attraction at the lower

elevation. Several small mountain lakes furnish fishing during the summer. Hyde State Park is a favorite camping, picnicking, and hiking area. The Santa Fe Ski Basin hosts thousands of skiers each season.

The present use of the land in each soil association is shown in the following list. Only the land uses that apply to at least 1 percent of an association are shown. Although much land is used for recreation, this is not included because of the difficulty of accurately determining its extent.

<i>Soil Map Symbol and Soil Association</i>	<i>Present Land Use</i>
1. El Rancho-Fruitland	Irrigated farming
2. Pojoaque-Rough broken land	Range
3. Las Lucas-Galisteo	Range, urban
4. Panky-Pojoaque-Harvey	Range, urban
5. Witt-Harvey-Clovis	Range, irrigated farming, dry farming
6. Harvey-Dean-Tapia	Range
7. Majada-Calasas-Apache	Range
8. Travessilla-Rockland-Bernal	Range
9. Willard-LeBrier	Range
10. Laporte-Witt	Range
11. Rednun-Pena-Stony land	Range
12. Chimayo-Mirabel-Supervisor	Forestry, range
13. Nambe-Cundiyo	Forestry, range

## *Description of Soils*

Thirteen soil associations are shown in figure 1. Each of these 13 general soil areas or soil associations includes soils that are geographically associated and comprise recognizable landscapes. The soil associations are named for the major soil series and land types that occur within them. In addition to the named soils, the associations often contain soils of other series. Selected soil characteristics and qualities of major soils in each soil association are summarized in table 4. A description of each soil association follows:

### **1. El Rancho-Fruitland association**

This association, which consists of a number of small, widely separated areas in the northern part of the county, includes approximately 15,780 acres of nearly level to gently sloping soils in the valleys of Rio Tesuque, Rio Cienega, Rio Nambe, and the Pojoaque and Santa Cruz rivers. Although nearly level to gently sloping landscapes are

characteristic of this association, some moderately steep rough broken lands are included. The soils, which are forming in stratified alluvium of mixed origin, are dominantly deep and moderately coarse to medium textured.

Approximately one-half of the irrigated cropland in Santa Fe County is in this association. It includes essentially all the surface-irrigated land. Alfalfa and orchards are the crops most commonly grown under irrigation. The soils not irrigated or in built-up areas provide limited grazing for livestock and wildlife. Native vegetation includes blue grama, sand dropseed, Indian ricegrass, galleta, alkali sacaton, rabbitbrush and snakeweed. Cottonwood trees and some willows occur on the soils of the immediate flood plains of the major streams.

*Soil Characteristics.* El Rancho soils, the most extensive, are generally on the more sloping part of this association, away from the flood plains. These soils typically occupy gently sloping terraces and coalescing alluvial fans with slope gradients that are usually less than five percent. These soils have a surface layer of light reddish-brown calcareous

<sup>7</sup>New Mexico Agricultural Statistics, Vol VI-Supplement III, 1970.

sandy clay loam. This is underlain to a depth of five feet or more by light reddish-brown and light brown calcareous sandy clay loam. In the northern part of the area, small acreages of El Rancho soils are underlain by sand and gravel at moderate depths.

Fruitland soils occur on landscapes and slopes similar to those of the El Rancho soils but differ in that they occupy those parts of the association close to the drainage channels and have coarser textured subsurface layers. These soils have a surface layer of light brown calcareous sandy clay loam or sandy loam. The underlying material to a depth of five feet or more may be weakly stratified, but it consists dominantly of a light brown calcareous sandy loam.

Other soils of importance in this association include those of the Ancho, Bluewing, and Pojoaque series. The Ancho soils, which are deep and slightly calcareous have a brown clay loam surface layer and pinkish-gray clay loam subsurface layers. Approximately one-half of the Ancho soils are inadequately drained or are affected by a fluctuating water table and are locally slightly to moderately saline. The Bluewing soils are deep gravelly soils. They typically have gravelly sandy loam or loamy sand surface layers over very gravelly loamy sand and very gravelly sand subsurface layers. The Pojoaque soils in this association are intermingled with the steep and dissected rough broken lands. They have calcareous sandy clay loam surface layers and gravelly medium to moderately coarse subsurface layers.

Miscellaneous land types such as riverwash, drainage bottoms, and rough broken land comprise the remaining parts of this association. The rough broken land includes the steep and highly dissected lands in this association. It consists of a complex of shallow gravelly soils and exposures to sedimentary deposits.

*Irrigation Potential.* El Rancho and Fruitland soils are well suited for use as cropland under irrigation. These two soils account for practically all the land included in irrigation land classes 1 and 2. Bluewing soils, also extensive in this association, have a lower capability for irrigation. These soils were placed in irrigation land class 4 because of their gravelly and sandy characteristics and low water-holding capacity.

Although the major soils in this association are irrigable, there is little opportunity for expansion of irrigation because the acreage is small and most of the irrigable land is either already irrigated or in built-up areas. The rough broken lands, the arroyo bottoms, and the immediate flood plains of the

major drainages, which account for nearly 50 percent of the land in this unit, were placed in land class 6.

## 2. Pojoaque-Rough broken land

This association, which consists of about 143,370 acres, is located northwest of the city of Santa Fe in the north-central part of the county. It is characterized by rolling and hilly uplands that are dissected by numerous intermittent drainages and arroyos. In addition to this prevailing type of topography, steep slopes are common on the breaks and side slopes of ridges in the severely dissected areas. A few nearly level to gently sloping valley bottoms and flood plains adjacent to intermittent streams are also included.

Most of the soils are forming in unconsolidated old alluvium which is dominantly coarse to medium-textured and gravelly. They are usually calcareous and have sandy clay loam, sandy loam, or gravelly sandy loam surface layers. A thin mantle of scattered gravel and cobble is common over much of the land surface.

The association supports a sparse to fair stand of native vegetation, including a thin overstory of pinon and juniper trees. The more common grasses and shrubs are blue grama, sideoats grama, black grama, Indian ricegrass, ring muhly, sand dropseed, three-awns, snakeweed, rabbitbrush, chamiza, and yucca.

*Soil Characteristics.* Pojoaque soils, the major series in this association, occur mainly on ridge tops and the more stable landscapes between the drainageways. They are on gently sloping to moderately steep and rolling landscapes that are intermingled with the steep and dissected rough broken lands. These soils have a surface layer of light reddish-brown calcareous sandy clay loam, that usually contains a few rounded igneous gravels. The underlying material to depths of five feet or more consists of weakly stratified gravelly sandy loam, gravelly loam, or gravelly sandy clay loam. The content of coarse fragments, which ranges from about 15 to 35 percent, is mainly gravel, but small amounts are of cobble size. A few small pinkish-white masses of segregated lime also occur in these subsurface layers. Strata of sand and gravel are common below a depth of about 40 inches.

Rough broken land, a miscellaneous land type, is also an important component in this association. It consists of a complex of shallow soils and exposures of unconsolidated to weakly consolidated sedimentary deposits. This alluvial material, which is quite variable, is dominated by moder-

ately coarse-textured and gravelly materials. A thin mantle of soil commonly occurs on the ridge tops and between the outcrops of the sedimentary materials of the Santa Fe formation. A surface layer of gravel also occurs on the upper part of some of the ridges. The areas occupied by this unit are generally steep and highly dissected. They are commonly broken by numerous v-shaped intermittent drainage channels and sharp ridges. Geologic erosion is active and vegetation is sparse. Where medium-textured or finer materials predominate, the ridges are sharper and the slopes steeper than in areas of gravel deposits.

Also in this association are small areas of the deep medium-textured soils of the El Rancho series, the deep moderately coarse-textured soils of the Fruitland series, and the deep gravelly soils of the Bluewing series. Of still lesser extent are soils of the Panky and Ancho series. The Panky soils, which have fine sandy loam surface layers and clay loam subsoils, are underlain by soft caliche at moderate depths. The Ancho soils are deep clay loam soils. The remaining parts of this association consist of small acreages of other miscellaneous land types including riverwash, alluvial land, gullied land, and arroyo bottoms.

*Irrigation Potential.* The association offers little or no potential for development of irrigation because of unfavorable soil properties and the rough broken, steep, and highly dissected landscapes. Although the small areas of El Rancho, Fruitland, and Bluewing soils included in this association are suitable for irrigation, they commonly occur as small and widely distributed tracts intermingled with extensive areas of non-irrigable land. The small size and isolation of these irrigable lands will generally preclude their use for irrigation.

### 3. Las Lucas-Galisteo association

Included in this association are soils forming on gently to strongly sloping and undulating uplands in the south-central and western parts of the county. It consists of two widely separated areas, totaling about 53,235 acres, or slightly more than four percent of the county. The soils, which are moderately deep or deep, are forming dominantly in materials weathered residually from shale or in alluvium of similar origin. They are moderately to highly susceptible to water erosion, and, as a result, gullies are common in the valleys and depressional areas where runoff tends to concentrate. This of particularly true in those areas of the Galisteo soils, where deep, vertical-walled gullies and headcuts are

common.

These soils are used mainly for grazing of livestock and wildlife. Under good management, they produce fair to moderate yields of forage. Vegetation on the Las Lucas soils consists of alkali sacaton, western wheatgrass, blue grama, galleta, ring muhly, and broom snakeweed. In addition to this vegetation, chamiza, shadscale, mat muhly, and vine mesquite are commonly found on the Galisteo soils. Thin and scattered stands of pinyon and juniper also occur on the uplands in this association. In addition to range use, a few small and scattered tracts of irrigated land occur on the Galisteo soils. Alfalfa and pasture are the principal crops produced.

*Soil Characteristics.* The Las Lucas soils occur on gently to strongly sloping undulating uplands. They typically have a surface layer of pale brown to brown calcareous loam or light clay loam. Their subsoil consists of a yellowish-brown strongly calcareous clay loam with a few threads and small soft masses of lime. This grades through a light yellowish-brown clay loam or silty clay loam to the underlying shale which commonly occurs at depths between 40 and 60 inches.

Galisteo soils, which are also moderately extensive in this association, are located on gently sloping alluvial fans and valley bottoms. They have a surface layer of reddish-brown calcareous loam or clay loam. This is underlain to a depth of five feet or more by a light reddish-brown or reddish-brown calcareous silty clay or silty clay loam.

Gullied land occurs in close association with Galisteo soils. It consists of deep vertical-walled gullies or series of gullies and headcuts, with only small patches of the Galisteo soils between the gullies. Also in this association are saline alluvial land, shale and sandstone rockland, and soils of Bernal, Travessilla, and Persayo series. Saline alluvial land, which occurs in the Galisteo drainage, consists of saline highly stratified materials ranging in texture from loamy sand to silty clay loam. Shale and sandstone rockland includes the outcrop shale and sandstone that occur as a complex with shallow and highly variable soils on steep slopes, breaks, and escarpments. Bernal and Travessilla soils, which are shallow, are underlain by sandstone. The Persayo soils are also shallow, but differ in being finer textured and in forming in materials weathered from shale and are underlain by shale at shallow depths.

*Irrigation Potential.* Although approximately 68 percent of the land in this association has been classified as suitable for irrigation, the majority of

the land so classified has a relatively low capability for such use. The Las Lucas soils, which are underlain by shale, are in irrigation land class 4. The underlying shale will tend to restrict the free movement of water through these soils, and, as a result, localized salinity and drainage problems can be expected to develop. The gently to strongly sloping and undulating topography also contributed to their placement in irrigation land class 4. The Galisteo soils that were not severely dissected by gullies were placed in irrigation class 2 because of their low position, fine texture, and flooding hazard. This class 2 land, however, usually occurs as small and irregular-shaped tracts, which would undoubtedly severely restrict its use for irrigation.

#### 4. Panky-Pojoaque-Harvey association

This association includes gently to strongly sloping and undulating uplands in the west-central part of the county and the dissected areas and slopes bordering the drainageways which are commonly moderately steep and rolling. It comprises an area of about 175,705 acres. The soils, which are developing in old alluvium of mixed origin, generally have light-colored and moderately coarse to medium-textured surface layers. Erosion hazard is slight except for the dissected areas along the drainageways, which are very susceptible to water erosion. A fair cover of native vegetation includes blue grama, galleta, western wheatgrass, sand dropseed, Indian ricegrass, three-awn, and broom snakeweed. Thin and scattered stands of

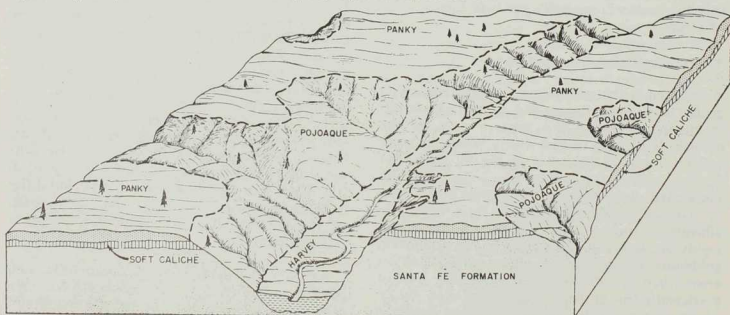
pinyon and juniper trees also occur on the moderately steep and rolling rough broken lands.

*Soil Characteristics.* Panky soils occupy the broad, nearly level to gently sloping areas between drainageways. These soils have a thin surface layer of light brown noncalcareous fine sandy loam. The subsoil is a reddish-brown heavy clay loam about 18 to 24 inches thick. This is underlain by pinkish-white soft caliche at depths ranging from about 20 to 40 inches.

The Pojoaque soils occur on the moderately steep and rolling breaks bordering the drainageways. These soils have a surface layer of light reddish-brown calcareous sandy clay loam that usually contains a few rounded igneous gravels. This is underlain to a depth of five feet or more by weakly stratified gravelly sandy loam, gravelly loam, or gravelly sandy clay loam. The coarse fragments, which make up about 15 to 35 percent of the soil, are mainly gravel but also include small amounts of cobble. A few small pinkish-white masses of segregated lime usually occur in these subsurface layers. Strata of sand and gravel are common below a depth of about 40 inches.

Harvey soils occur on gently to strongly sloping alluvial fans and side slopes of the drainageways. They typically have a light-brown or grayish-brown calcareous loam surface layer. The subsoil is similar except that it contains more lime and is slightly lighter colored. This layer grades to a pinkish-white very limy loam that begins at a depth of about 16 to 20 inches. The lime content usually decreases

Fig. 3. Typical pattern of soils in the Panky-Pojoaque-Harvey association



slightly below a depth of 30 to 36 inches.

Soils of minor extent in this association include those of Cerrillos, Calabasas, Five Mile, Silver, and Agua Fria series. The Cerrillos soils are underlain by pinkish-white soft caliche at depths of 10 to 20 inches. The Five Mile soils are deep and medium-textured, the Calabasas soils are deep and moderately fine-textured, and those of the Silver series are deep and fine-textured. Agua Fria soils occur on nearly level to gently sloping upland landscapes in the vicinity of the city of Santa Fe and on the lower slopes extending from the Ortiz Mountains. These soils have a surface layer of brown noncalcareous fine sandy loam over a light reddish-brown clay loam subsoil. This is underlain by gravel and cobble embedded in a pinkish-white high lime zone at depths of 18 to 36 inches. Miscellaneous land types, such as rough broken land, rockland, and riverwash comprise the remaining parts of this association.

*Irrigation Potential.* Approximately 94 percent of the land in this association has been classified as suitable for irrigation. A part of this potential irrigated land, however, is being used for roads or built-up areas, which places some restrictions on the amount of land available for expansion of irrigation. The Panky soils, which account for a high percentage of the land placed in irrigation land class 2, are well suited for irrigation. A moderate soil depth and water-holding capacity were the principal factors contributing to their placement in irrigation land class 2. The Agua Fria, Harvey, and Cerrillos soils, although suitable for use as cropland under irrigation, are not as well adapted to this use as the Panky soils. The limitations of the soils for irrigation are relatively severe due to shallow depth over a high lime zone, moderately low water-holding capacity, and high lime content. These soils are in irrigation land class 3. The Pojoaque soils that occur as a complex with rough broken land on steep slopes were placed in class 6 because of the high erosion hazard, moderately steep slopes, dissected topography, and unevenness of the land surface.

#### 5. Witt-Harvey-Clovis association

This association is located in the southern part of the county where it joins more extensive areas of this association in Torrance County. It comprises an area of approximately 123,585 acres, or about 10 percent of the county. It is dominated by deep, moderately to slowly permeable soils developing on piedmont slopes and plains east of the Sandia and Ortiz mountains. These nearly level

to strongly sloping soils are forming in old valley filling sediments of mixed origin.

This unit was formerly a major area for dryland farming, but, due to frequent crop failures resulting from the unfavorable climate, the majority of the dry cropland has now returned to range use. Approximately 6,000 acres of land in this association are irrigated by water obtained from wells. Irrigated crops are corn, alfalfa, small grain, and potatoes. The remainder of the land in this association is used for grazing and, in general, supports a good cover of short and mid grasses. The more common grasses include blue grama, hairy grama, sideoats grama, New Mexico feathergrass, galleta grass, little bluestem, and needle and thread grass. Thin and scattered stands of pinyon and juniper trees also occur in the western part of this association that borders the mountain foothills.

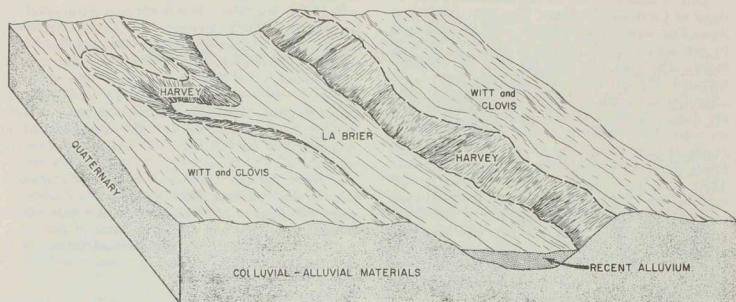
*Soil Characteristics.* Witt soils, the most extensive, are mainly on the broad gently sloping plains or piedmont slopes between the drainageways. They have a thin surface layer of light brown noncalcareous loam over a thick subsoil of reddish-brown clay loam that is noncalcareous in the upper part. A few threads and small soft masses of lime are common in the lower part of the subsoil. This is underlain by a pinkish-white very limy loam at depths of 40 to 50 inches.

The Harvey soils occur dominantly on gently to strongly sloping areas that slope towards drainageways. They typically have light brown or grayish-brown calcareous loam surface layers. The subsoil is similar except that it contains more lime and is slightly lighter colored. This layer grades to a pinkish-white very limy loam that begins at a depth of about 16 to 20 inches. The lime content decreases slightly below a depth of 30 to 36 inches.

Clovis soils, like the Witt soils, occupy broad, gently sloping plains or piedmont slopes between the drainageways. These soils, which differ principally from those of the Witt series in depth to the prominent lime zone, have a brown noncalcareous surface layer of loam or fine sandy loam. Their subsoil is a light brown to brown clay loam or sandy clay loam that contains a few small soft masses and streaks of lime in the lower part. A substratum of pinkish-white, very limy loam occurs at an average depth of about 30 inches.

Other soils of lesser extent in this association include those of the LaBrier, Penistaja, Dean, and Pastura series. The LaBrier soils occur mainly in swales and depressional areas adjacent to intermittent drainages. They have a surface layer, about nine inches thick, of a grayish-brown to dark

Fig. 4. Typical pattern of soils in the Witt-Harvey-Clovis association



brown noncalcareous loam over a thick grayish-brown heavy clay loam subsoil. This is underlain to a depth of five feet or more by a light clay loam that usually contains a few specks and threads of lime. The Penistaja soils are similar to those of the Witt series, but differ primarily in that they are coarser-textured and lack the strong lime layer. They typically have light brown fine sandy loam surface layers and sandy clay loam subsoils. The Dean and Pastura soils, which are shallow, are underlain by soft and indurated caliche, respectively.

*Irrigation Potential.* This association, like the Panky-Pojoaque-Harvey association, has a high potential for expansion of irrigated land. Most of the land in this association has been classified as suitable for irrigation. Approximately 70 percent is in irrigation land class 2, 29 percent in class 3, and 1 percent in class 6. The Witt, Clovis, and LaBrier soils, which account for a high percentage of the land placed in irrigation class 2, are well suited for irrigation. The Witt soils were placed in irrigation land class 2 primarily because of slope and unevenness of the land surface. A moderate soil depth and water-holding capacity, together with slope contributed to the classification of Clovis soils in land class 2. The LaBrier soils were placed in class 2 because of their low position and flooding hazard.

The Harvey soils, although suitable for use as cropland under irrigation, have a lower capability

for such use. The limitations for irrigation are moderately severe due to their shallow depth to a high lime zone, moderately low water-holding capacity, and slope.

#### 6. Harvey-Dean-Tapia association

Included in this association is an area of approximately 118,235 acres in the extreme southeastern part of the county. It consists dominantly of shallow to moderately deep soils underlain by caliche. Surface relief is gently to strongly sloping and undulating with slopes seldom exceeding 10 percent.

It is used mainly as native range and under good management moderate forage yields are obtained. Blue grama, galleta, sand dropseed, western wheatgrass, Indian ricegrass, sideoats grama, ring muhly, and three-awn are the principal grasses. A few scattered juniper and traces of broom snakeweed and cactus also occur.

*Soil Characteristics.* Harvey soils, the the most extensive, occupy gently to strongly sloping landscapes that occur adjacent to and slope toward drainageways. These soils have a surface layer of light brown or grayish-brown calcareous loam. The subsoil is similar, except that it contains more lime and is slightly lighter colored. This layer grades to a pinkish-white very limy loam that begins at a depth of about 16 to 20 inches. The lime content decreases slightly below a depth of 30 to 36 inches.

The shallow Dean soils occur mainly on the crests of undulating uplands. They normally have a thin surface layer of light brownish-gray calcareous loam. This is underlain at a depth of 6 to 15 inches by a light gray gravelly loam that is usually weakly cemented with lime in the upper part. This prominent lime layer grades to a less limy substratum of very pale brown loam at depths of two to three feet.

Tapia soils occur on the broad smooth and gently sloping areas between the drainageways and depressions. These moderately deep soils have a thin surface layer of brown noncalcareous loam. Their subsoil is a light brown to brown clay loam that usually contains a few indurated caliche pebbles. This is underlain at a depth ranging from 20 to 35 inches by pinkish-white caliche that commonly consists of about 35 percent of indurated caliche fragments or gravel. The caliche fragments are usually weakly cemented together in the upper few inches.

In addition to these three principal soils, other soils in this association include Clovis, Penistaja, LaBrier, Hagerman, Palma, Otero, Pastura, and Travessilla. The Clovis soils are similar to those of the Tapia series, but differ in that the underlying caliche layer lacks the indurated caliche fragments and is not cemented. The Penistaja soils, which are deep, have sandy loam surface layers and sandy clay loam subsoils. The LaBrier soils, which occur mainly in swales and depressional areas, have grayish-brown surface layers over thick grayish-brown to dark brown subsoils. The Otero and Palma soils are deep sandy loams. The Otero soils differ from those of the Palma series in that they are lighter colored and contain a higher content of lime. The Hagerman soils, which have brown fine sandy loam surface layers and sandy clay loam subsoils, are underlain by sandstone at moderate depths. The Travessilla and Pastura soils, which are shallow, are underlain by sandstone and indurated caliche, respectively. A small acreage of miscellaneous land types, such as rockland, intermittent lakes, and arroyo bottoms comprise the remaining parts of this association.

*Irrigation Potential.* Although class 6 land is relatively extensive, approximately 13 percent of the land in this association is in class 2 and 29 percent in class 3. There is, therefore, some opportunity for expansion of irrigated land in the areas occupied by this association. The Clovis, Penistaja, and LaBrier soils are in irrigation land class 2, which is well suited for use as cropland under irrigation. The Harvey, Otero, and Palma soils account for most of the land in irrigation land class

3. These soils, although suitable for irrigation, have a lower capability for such use than those included in land class 2. The Otero and Palma soils have moderate to severe limitations for use as cropland under irrigation because of their sandy loam textures, limited water-holding capacity, and a moderate to high wind erosion hazard. The Harvey soils also have a moderately severe limitation for irrigation due to their shallow depth to a prominent lime zone, moderately low water-holding capacity, and slope. These class 3 lands will require above-average management practices to insure satisfactory yields of adapted crops under irrigation.

The shallow soils of the Dean, Pastura, and Travessilla series were placed in land class 6, which is not recommended for irrigation.

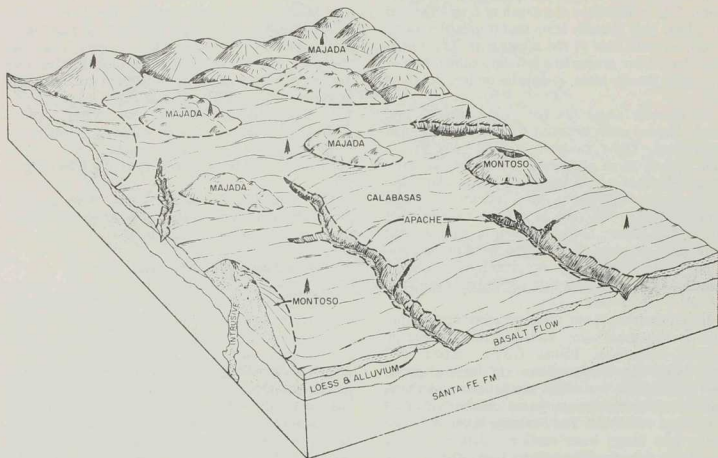
### 7. Majada-Calabazas-Apache association

Included in this association are soils forming in materials of volcanic or basic igneous origin on old lava flows, cinder cones, and basaltic mesas in the northwestern part of the county. It consists of an area of about 105,830 acres, or approximately nine percent of the county. A characteristic feature of this unit is the stony and rocky nature of many of the included soils. Although the soils range from shallow to deep, those that are stony and rocky are generally shallow. The land surface on the mesa tops and lava flows is dominantly gently to strongly sloping, but may range from nearly level to moderately steep. The sides of basalt-capped mesas and fronts of lava flows are steep to very steep.

It is dominated by grass vegetation, including blue grama, galleta, sand dropseed, western wheatgrass, sideoats grama, little bluestem, and poverty three-awn. The more common shrubs and woody species are snakeweed, chamiza, cholla, and scattered pinyon and juniper trees.

*Soil Characteristics.* The Majada soils occupy the moderately steep to steep and hilly landscapes in this association. These soils typically have a surface layer of grayish-brown noncalcareous cobbly fine sandy loam. There are small areas free of cobbles or that contain only a few cobble and stones in the surface layer. The subsoil is a dark grayish-brown and brown very cobbly sand clay loam that usually contains 35 to 50 percent cobble and a few stones. It ranges from noncalcareous in the upper part to slightly calcareous in the lower part. This grades through a pale brown strongly calcareous very cobbly sandy clay loam to a white and light gray cobbly loam at depths ranging from 20 to 40

Fig. 5. Typical pattern of soils in the northwestern part of Santa Fe County. These soils occur mainly in the Majada-Calabasas-Apache association



inches. The degree of cementation in this lime layer ranges from weak to strong. Cindery material is common below an average depth of 30 to 40 inches.

Calabasas soils, which are deep, occur dominantly on nearly level to strongly sloping broad swales and plains around the hills occupied by the Majada soils. Although these soils commonly occur on slopes of less than 10 percent, a few small areas occur on moderately steep slopes. They have a noncalcareous to weakly calcareous brown very fine sandy loam or loam surface layer over a thick brown calcareous heavy loam to light silty clay loam subsoil. This is underlain by a strongly calcareous pinkish-gray gravelly loam or loam substratum. The depth to the strong lime zone, which is weakly to strongly cemented in the upper part, ranges from about 40 to 60 inches.

Apache soils, which are also extensive in this association, usually occur on gently sloping to moderately steep landscapes adjacent to drainageways and on fronts of basalt flows. These soils

which are typically stony and shallow are forming over basalt. The brown granular surface layers contain variable amounts of angular and semi-rounded fragments of basalt. They are commonly calcareous and of a loam or sandy clay loam texture. Basalt fragments increase with depth, and unweathered basalt is usually encountered within a depth of 8 to 20 inches. Rockland, a miscellaneous land type, is also an extensive component of this association. It commonly occurs on the steep to very steep fronts of lava flows and sides of basalt-capped mesas. It consists of a complex of outcrops of igneous rocks and very stony and rocky soils.

Other soils of importance in this association include those of the Silver, Montoso, Los Alamos, and Guaje series. Silver soils, which are deep, occur on nearly level to gently sloping broad swales or slightly depressed areas on mesa tops and between shallow soils forming over basalt. They have a surface layer of brown noncalcareous loam over a thick clay subsoil. This is underlain by a pinkish-gray gravelly loam substratum. The Montoso soils,

which are developing on strongly sloping to steep cinder cones, are underlain by cinders at depths ranging from about 20 to 40 inches. They have gravelly silt loam surface layers and gravelly to very gravelly silty clay loam subsoils. The Los Alamos soils occupy gently to strongly sloping landscapes in this association. They have a light brown sandy loam surface layer and a light brown to brown clay loam subsoil. This grades through a very pale brown gravelly sandy clay loam to a horizon that consists of 80 to 90 percent pumice. The depth to the underlying pumice varies from 20 to 50 inches. The Guaje soils, like the Los Alamos soils, are forming in materials weathered from pumice and other volcanic materials. They differ from Los Alamos soils in that they occur on steeper slopes and are shallow. The depth to the underlying pumice ranges from 8 to 20 inches.

*Irrigation Potential.* The potential for development of irrigation in this association is very limited. The soils of the Silver, Calabasas, and Los Alamos series, which are the only soils in this association with characteristics suitable for irrigation, occur on mesa tops, where they are commonly surrounded by extensive areas of class 6 land. The location and relatively small size of many of these tracts of irrigable land will need to be considered in determining the feasibility of developing these lands.

## 8. Travessilla-Rockland-Bernal association

This association includes an area of about 202,795 acres in the south-central and east-central parts of the county. A characteristic feature of this association is the nearly level to strongly sloping mesa tops that are separated by steep canyon walls and escarpments. The alluvial fans and valley floors below the canyon walls and escarpments are nearly level to gently sloping. The soils in the valley bottoms, which are usually deep, are forming in alluvium principally of sandstone and shale origin, with lesser amounts from other sedimentary rocks. The soils on the upland summits and mesa tops are dominantly forming residually in materials of sandstone origin. Elevations range from about 6,400 to 6,800 feet.

This association supports a fair to good cover of native grass and shrubs, including scattered stands of pinyon and juniper. Blue grama, sideoats grama, sand dropseed, galleta, western wheatgrass, Indian ricegrass, ring muhly, alkali sacaton, and three-awn are the principal grasses. Sagebrush, snakeweed, chamiza, rabbitbrush, and various species of cactus also occur to a limited extent.

*Soil Characteristics.* Travessilla soils, the most extensive, occur on gently sloping to moderately steep ridges and outer fringes of the mesa tops. They have a thin surface layer of light brown to light reddish-brown weakly calcareous fine sandy loam or loam. This grades through a light brown fine sandy loam to the underlying sandstone bedrock at depths ranging from 6 to 18 inches. In addition to sandstone outcrops that occasionally occur, a few angular fragments of sandstone are common in the layers immediately above the bedrock.

Rockland, a miscellaneous land type, is also an extensive component of this association. It occurs for the most part on the steep to very steep mesa fronts and escarpments. It is a complex of shallow soils and outcrops of sandstone, shales, and other types of sedimentary rocks.

Bernal soils occur on nearly level to gently sloping upland plains or mesa tops. They have a thin brown to reddish-brown noncalcareous fine sandy loam surface layer. The subsoil is a reddish-brown sandy clay loam or clay loam that is free of lime. This is usually underlain by sandstone bedrock within a depth of 20 inches.

Other less extensive soils include those of the Rednun, Prewitt, Moriarty, Penistaja, Wilcoxson, Ortiz, and Cueva series. Of these, the deep Rednun soils are by far the most extensive. These soils, which occur on gently sloping uplands, have a moderately thick surface layer of reddish-brown noncalcareous loam over a brown heavy clay loam subsoil. The Moriarty and Prewitt soils occur mainly in swales and depressional areas that are nearly level to gently sloping. The Moriarty soils are deep and fine-textured and Prewitt soils are deep and moderately fine-textured. The Penistaja soils, which are also deep, have sandy loam surface layers and sandy clay loam subsoils. The Wilcoxson soils, which typically support a cover of trees, occur at the higher elevations in this association. These soils, which have sandy loam or loam surface layers and clay subsoils, are underlain by weathered granite and schists at depths of about 30 to 40 inches. The Cueva soils are underlain by interbedded shales and sandstone at depths of 20 to 48 inches. They have dusky red stony clay surface layers and clay subsoils. The Ortiz soils have reddish-brown gravelly loam surface layers and light reddish-brown clay loam subsoils. The depth to the underlying shale varies from 20 to 50 inches.

*Irrigation Potential.* The potential for development of irrigated land in this association is extremely limited. Approximately 72 percent is in class 6, 24 percent in class 2, and the remaining 4

percent is in class 4. The class 2 land, consisting of Loma, Prewitt, Penistaja, and Moriarty soils, is well suited for use as cropland under irrigation where the tracts are large enough to permit economical development. However, much of this class 2 land occurs as small and irregular tracts intermingled with extensive areas of class 6, which will tend to preclude its use for irrigation.

#### 9. Willard-LaBrier association

This association, consisting of about 4,865 acres, is the smallest in the county. Included is the northern extension of the Estancia basin in the southern part of the county adjacent to the county boundary, where it joins a more extensive area of this association in Torrance County. The soils, which occupy nearly level to gently sloping and undulating landscapes, are forming in alluvium, including lacustrine sediments.

The association supports a fair to good cover of perennial grasses, including alkali sacaton, western wheatgrass, vine mesquite, blue grama, galleta, three-awn, and dropseeds. The more common shrubs are chamiza, winterfat, and rabbitbrush.

*Soil Characteristics.* Willard soils, the most extensive, have a moderately thick surface layer of light brownish-gray calcareous clay loam. This is underlain by a very limy, light yellowish-brown loam or clay loam. Lacustrine sediments that are usually high in gypsum and other salts normally begin at a depth of about two feet, but the depth may range from 15 to 36 inches.

The LaBrier soils occupy nearly level to gently sloping flood plains of intermittent streams that drain into the lake depression. They have a surface layer, about nine inches thick, of grayish-brown to dark brown noncalcareous loam over a thick grayish-brown clay loam subsoil. This is underlain to a depth of five feet or more by a light clay loam that usually contains a few specks and threads of lime.

Also in this association are small acreages of saline alluvial land and soils of the Harvey and Penistaja series. The saline alluvial land includes the strongly saline draws and depressions occupying low parts of this association. The shallow to moderately deep, limy soils of the Harvey series occur to a very limited extent on the side slopes of drainages near the outer fringes of this unit. The Penistaja soils also occur on the outer fringes of this association. They have light brown fine sandy loam surface layers and sandy clay loam subsoils.

*Irrigation Potential.* Although this association is

small, it offers some opportunity for expansion of irrigation, particularly where the land can be developed in conjunction with adjacent associations. Approximately 48 percent is in class 3, 33 percent in class 2, and the remaining 19 percent is non-irrigable or class 6 land. The Willard soils, which are in irrigation land class 3, have moderate limitations for use as cropland under irrigation. These soils have a moderate water-holding capacity and limited depth of effective soil over saline lacustrine sediments. They will, therefore, require above-average management practices for satisfactory yields of adapted crops under irrigation. The LaBrier soils, which account for the majority of the land in class 2, are well suited for irrigation. The low position of this soil and its susceptibility to flooding or receiving runoff from higher lying lands are the major limitations.

The saline alluvial land which includes the saline depressions and draws is not recommended for irrigation.

#### 10. Laporte-Witt association

This association includes an area of about 10,140 acres in the extreme southwestern part of the county. It consists mainly of rolling to steep mountain foothills and intermingled gently to strongly sloping valleys. The soils, like the topography, are quite varied. The soils on the low foothills, which are dominantly shallow, are developing residually in materials weathered from limestone. In the valleys, the soils are forming in alluvium and are generally deep.

Vegetation on the shallow soils of the foothills and upland ridges consists of an overstory of pinyon and juniper trees with understory of grasses and shrubs. The more common grasses and shrubs include blue grama, galleta, sand dropseed, sideoats grama, three-awn, sagebrush, and broom snake-weed. The soils in the valleys generally support a fair to good grass cover, consisting of blue grama, sideoats grama, New Mexico feathergrass, galleta, sand dropseed, western wheatgrass, Indian rice-grass, ring muhly, and three-awn.

*Soil Characteristics.* Soils of the Laporte series are dominant on the strongly sloping and rolling to steep low hills and ridges. They have a grayish-brown, calcareous stony loam or loam surface layer. This grades through a pale brown or brown strongly calcareous stony or cobbly loam to the underlying limestone bedrock at a depth of 8 to 20 inches.

Witt soils are mainly on the gently to strongly sloping valley filling side slopes which extend from

the base of the low hills and ridges that are occupied by the Laporte soils. They have a thin surface layer of light brown noncalcareous loam over a thick subsoil of reddish-brown clay loam that is noncalcareous in the upper part. A few threads and small soft masses of lime are common in the lower part of the subsoil. This is underlain by a pinkish-white very limy loam at depths of 40 to 50 inches.

Limestone rockland, a miscellaneous land type, also occurs in this unit in close association with the Laporte soils. It consists of a complex of very shallow soils and exposures or outcrops of limestone bedrock. It commonly occurs on moderately steep to steep slopes. The thin mantle of soil that occupies the areas between the outcrops of bedrock is usually gravelly and stony.

The remaining parts of this association consist of small areas of Encierro, Clovis, and Harvey soils. The Encierro soils, which are shallow, are underlain by sandstone within a depth of 20 inches. The Clovis soils are similar to the Witt soils, but differ in that they are underlain by soft caliche or a very prominent lime zone within a depth of 20 to 40 inches. Harvey soils, which occur on gently to strongly sloping alluvial fans and side slopes of drainageways, have light brown calcareous surface layers. The subsoil is similar except that it contains more lime and is lighter colored. This layer grades to a pinkish-white and is very limy at a depth of about 16 to 20 inches.

*Irrigation Potential.* There is little or no potential for development of irrigated land in this association due to the prevalence of shallow soils and rough broken and hilly landscapes. A small acreage of Witt soils is in irrigation land class 2. The soils with properties and characteristics suitable for irrigation occur as small and widely distributed tracts intermingled with extensive areas of non-irrigable land. This will generally tend to preclude their development for irrigation.

#### 11. Rednun-Pena-Stony Land association

This association occurs in the southwestern part of Santa Fe County, where it includes the foothills of the Ortiz Mountains and adjacent alluvial fans and piedmont slopes extending from the base of these mountains. It consists of an area of approximately 49,930 acres. Landscapes are varied, ranging from gently sloping and undulating uplands on the lower piedmont slopes to the steep and very steep mountain footslopes. Although small areas of soils are included that are developing residually in materials from the underlying bedrock, the major-

ity of the soils in this association are forming in alluvium of mixed origin. Many of the steeply sloping soils and land types are gravelly and stony.

This association supports a fair cover of vegetation that is dominated by an overstory of pinyon and juniper trees with an understory of grasses and shrubs. The more common grasses are blue grama, galleta, sand dropseed, sideoats grama, Indian ricegrass, ring muhly, and three-awn.

*Soil Characteristics.* Rednun soils, the most extensive, occupy the more gently sloping landscapes in this association. The upland areas that they occupy are on the lower parts of the piedmont slopes which dominantly have gradients of less than five percent. These soils have a moderately thick surface layer of reddish-brown noncalcareous loam. The subsoil is a brown heavy clay loam about 16 inches thick. This is underlain by brown clay loam or sandy clay loam that contains threads and small soft masses of calcium carbonate. Sandstone bedrock may occur occasionally below a depth of 40 inches.

Pena soils occur on moderately steep piedmont slopes along mountain fronts.

They have a four- to five-inch surface layer of dark reddish-brown noncalcareous stony clay loam. This grades through a calcareous very gravelly clay loam to a weakly cemented lime zone at depths of 15 to 30 inches. The lime layer contains about 70 to 90 percent gravel, cobbles, and stones.

Stony rockland, a miscellaneous land type, is also a moderately extensive component in this association. It is dominantly in the upper part of the association in the steep to very steep foothill areas. In addition to the steep slopes, it is characterized by outcrops of sedimentary and igneous rocks and a stony and rocky surface. Approximately 30 to 90 percent of the land surface is covered with cobbles and stones. A thin mantle of soil material commonly occurs between the outcrop of bedrock. Although this land type is dominated by thin stony and rocky soils, it contains a few small areas or pockets of deep soils.

Other soils of lesser extent in this association include those of Panky, Cerrillos, and Travessilla series. The Cerrillos and Travessilla soils, which are shallow, are underlain by soft caliche and sandstone, respectively. The Panky soils, which are moderately deep, are underlain by soft caliche at depths ranging from 20 to 40 inches. Alluvial land and arroyo bottoms and other miscellaneous lands also comprise small acreages in this association.

*Irrigation Potential.* Although this association contains a relatively high percentage of non-

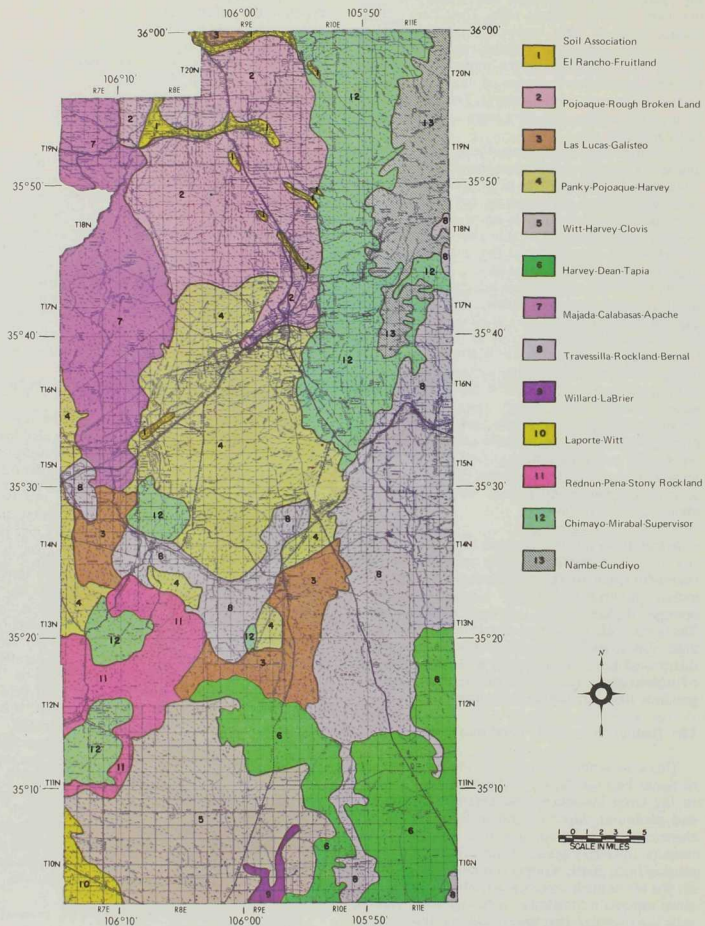


Fig. 1. General soil map of Santa Fe County, New Mexico

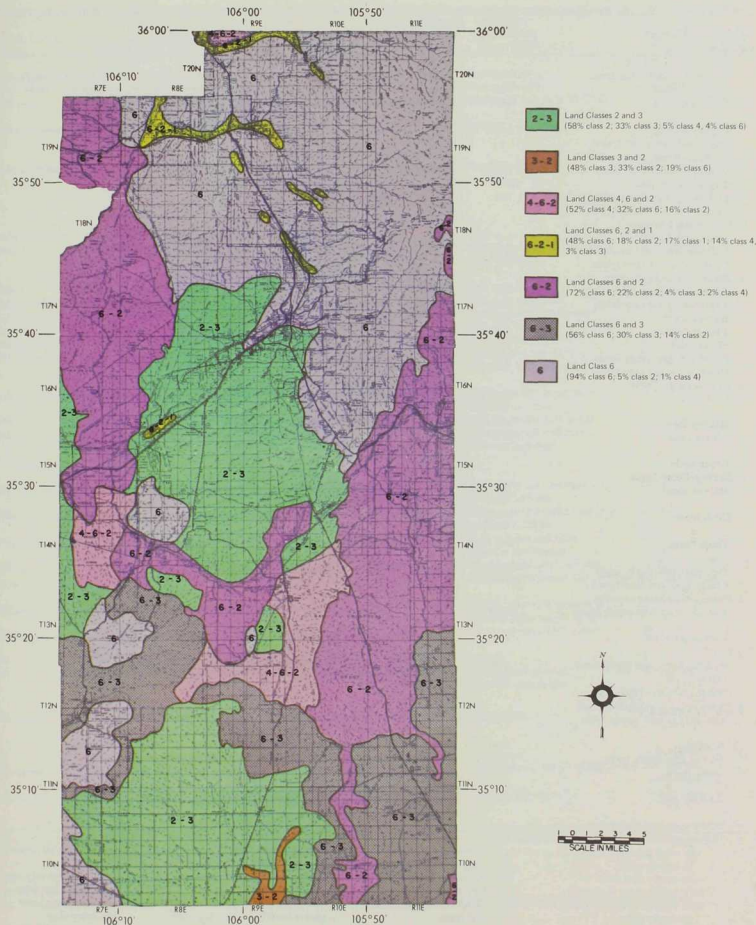


Fig. 2. Classification of land for irrigation Santa Fe County, New Mexico

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

Soil Map Symbol and Soil Association	Dominant Slope Range (percent)	Approximate Percent of Association	Pedologic Classification		Texture
			Subgroup	Family	
1 El Rancho-Fruitland					
El Rancho sandy clay loam	0-5	24	Ustic Torriorthent	Fine-loamy, mixed, calcareous, mesic	scl
Fruitland soils	0-5	10	Typic Torriorthent	Coarse-loamy, mixed, calcareous, mesic	sl;slcl
Bluewinging soils	0-5	14	Typic Torriorthent	Sandy-skeletal, mixed, mesic	gst;ls
Pojoaque soils	1-25	15	Typic Torriorthent	Fine-loamy, mixed, calcareous, mesic	scl;s
Other soils and land types		37			
2 Pojoaque-Rough Broken Land					
Pojoaque sandy clay loam	1-25	36	Typic Torriorthent	Fine-loamy, mixed, calcareous, mesic	scl;sl
Rough broken land	20-35	45	A miscellaneous land type		
El Rancho-Fruitland complex	3-5	13	(See association no. 1)		
Other soils and land types		6			
3 Las Lucas-Galisteo					
Las Lucas loam	1-9	51	Ustollic Camborthid	Fine-silty, mixed, mesic	loam;c
Galisteo loam and gullied land	0-3	19	Ustic Torriorthent	Fine, mixed, calcareous, mesic	loam;c
Other soils and land types		30			
4 Panky-Pojoaque-Harvey					
Panky fine sandy loam	0-5	37	Ustollic Haplargid	Fine, montmorillonitic, mesic	fs;l;loam
Pojoaque sandy clay loam	5-20	14	Typic Torriorthent	Fine-loamy, mixed, calcareous, mesic	scl;sl
Harvey loam	5-9	11	Ustollic Calcicorthid	Fine-loamy, mixed, mesic	loam;fs
Five Mile loam	0-5	11	Typic Torriorthent	Fine-silty, mixed, calcareous	loam
Silver loam	1-5	7	Ustollic Haplargid	Fine, mixed, mesic	loam
Cerrillos fine sandy loam	1-5	7	Ustollic Haplargid	Fine, montmorillonitic, mesic	fs;l;loam
Other soils and land types		13			
5 Witt-Harvey-Clovis					
Witt loam	0-3	49	Ustollic Haplargid	Fine-silty, mixed, mesic	loam
Harvey loam	1-5	28	Ustollic Calcicorthid	Fine-loamy, mixed, mesic	loam;fs
Clovis loam	0-3	15	Ustollic Haplargid	Fine-loamy, mixed, mesic	loam
Other soils		8			
6 Harvey-Dean-Tapia					
Harvey loam	1-9	29	Ustollic Calcicorthid	Fine-loamy, mixed, mesic	loam;fs
Dean loam	1-5	23	Ustollic Calcicorthid	Fine-loamy, carbonatic, mesic	loam
Tapia loam	0-5	12	Ustollic Haplargid	Fine-loamy, mixed, mesic	loam
Penistaja fine sandy loam	0-5	10	Ustollic Haplargid	Fine-loamy, mixed, mesic	fs;l
Other soils and land types		26			
7 Majada-Calabasas-Apache					
Majada stony fine sandy loam	20-50	18	Aridic Argiustoll	Loamy-skeletal, mixed, mesic	stfs;fs
Calabasas loam	1-5	19	Ustollic Camborthid	Fine-silty, mixed, mesic	loam
Apache stony fine sandy loam	1-15	14	Aridic Lithic Haplustoll	Loamy, mixed, mesic	stfs;st
Silver loam	1-5	12	Ustollic Haplargid	Fine, mixed, mesic	loam
Other soils and land types		37			
8 Travessilla-Rockland-Bernal					
Travessilla fine sandy loam	5-9	31	Lithic Ustic Torriorthent	Loamy, mixed, calcareous, mesic	fs;l;fs;
Rockland	5-65	22	A miscellaneous land type		
Bernal fine sandy loam	1-5	12	Aridic Lithic Argiustoll	Loamy, mixed, mesic	fs;l;sl
Loma loam	0-5	13	Aridic Argiustoll	Fine, montmorillonitic, mesic	loam
Prewitt loam	0-5	4	Fluventic Haplustoll	Fine-loamy, mixed, mesic	loam;s
Other soils and land types		18			

<sup>1</sup>Abbreviations used for textural classes are:

vgs-very gravelly sand	gsf-gravelly sandy loam	gl-gravelly loam	vcosl-very cobbly sandy clay
ls-loamy sand	vgsl-very gravelly sandy loam	vgl-very gravelly loam	cl-clay loam
lfs-loamy fine sand	stsl-stony sandy loam	col-cobbly loam	vgcl-very gravelly clay loam
lvfs-loamy very fine sand	fsf-fine sandy loam	stl-stony loam	stcl-stony clay loam
vgls-very gravelly loamy sand	stfsf-stony fine sandy loam	scl-sandy clay loam	sicl-silty clay loam
sl-sandy loam	sil-silt loam	gcl-gravelly sandy clay loam	sic-silty clay
			vcosl-very cobbly sandy clay

Surface Soil Features		Subsoil Features			Substratum	Soil Depth <sup>3</sup> (inches)	AWHC <sup>4</sup> (inches)
Color	Reaction	Texture <sup>1</sup>	Color	Permeability <sup>2</sup>			
Light reddish-brown	Calcareous	scl	Light brown	Moderate	Loamy alluvium	60 or more	7
Brown	Calcareous	sl;fsl;lvfs	Light brown	Rapid	Sandy alluvium	60 or more	5
Grayish-brown	Non-calc.	vgl;vgs;gsl	Light brown to pinkish-gray	Very rapid	Sandy and gravelly alluvium	60 or more	2.5 to 3
Light reddish-brown	Calcareous	gscl;gl;gsl	Light reddish-brown	Moderate	Gravelly alluvium	60 or more	4 to 5
Light reddish-brown	Calcareous	gscl;gl;gsl	Light reddish-brown	Moderate	Gravelly alluvium	60 or more	4 to 5
Brown to pale brown	Calcareous	cl;slcl	Light yellowish-brown	Slow	Shale	40 to 60	7
Reddish-brown	Calcareous	sic;slcl	Reddish-brown	Very slow	Alluvium from shale and sandstone	60 or more	7
Light brown	Non-calc.	cl;clay	Reddish-brown	Slow	Soft caliche	20 to 40	4 to 6
Light reddish-brown	Calcareous	gscl;gl;gsl	Light reddish-brown	Moderate	Gravelly alluvium	60 or more	4 to 5
Light brown to brown	Calcareous	Loam;sl;cl	Light brown	Moderate	Limy alluvial sediments and soft caliche	15 to 20	3 to 5
Light brown to brown	Calcareous	Loam;sl	Light brown	Slow	Loamy alluvium	60 or more	7
Brown	Non-calc.	Clay	Light brown to brown	Slow	Loamy and gravelly alluvial sediments	60 or more	7
Light brown	Non-calc.	cl	Reddish-brown	Slow	Limy alluvial sediments and soft caliche	15 to 20	3 to 4
Brown	Non-calc.	cl;slcl	Reddish-brown to brown	Slow	Limy alluvial sediments	60 or more	6 to 7
Light brown to brown	Calcareous	Loam;sl;cl	Light brown	Moderate	Limy alluvial sediments and soft caliche	15 to 20	3 to 5
Brown	Non-calc.	sl;cl	Brown to light brown	Moderate	Limy alluvial sediments and soft caliche	20 to 40	4 to 6
Light brown to brown	Calcareous	Loam;sl;cl	Light brown	Moderate	Limy alluvial sediments and soft caliche	15 to 20	3 to 5
Light brownish-gray	Calcareous	Loam;gl	Light brown	Moderate	Soft caliche and limy alluvial sediments	6 to 15	1 to 3
Light brown to brown	Non-calc.	cl	Light brown	Moderate	Weakly indurated caliche	20 to 40	3 to 5
Light brown	Non-calc.	scl	Light reddish-brown	Moderate	Eolian and alluvial sediments	60 or more	6
Grayish-brown	Non-calc.	vcoscl;vcosc	Light brown	Slow	Cobble and stones weakly to strongly cemented by lime	18 to 30	3
Brown to light brown	Non-calc.	Loam;cl	Light brown to pinkish-gray	Slow	Limy alluvial sediments	50 to 60	6 to 8
Brown	Calcareous	sl	Light brown	Moderate	Basalt	10 to 20	2 to 3
Brown	Non-calc.	Clay	Light brown to brown	Slow	Loamy and gravelly alluvial sediments	60 or more	7
Reddish-brown	Weakly calc.	fsl;gsl	Reddish-brown to light brown	Rapid	Sandstone	10 to 20	1 to 2
Brown	Non-calc.	cl;slcl	Reddish-brown	Moderate	Sandstone	8 to 20	2 to 3
Reddish-brown	Non-calc.	cl;clay	Brown to dark brown	Slow	Alluvial and eolian sediments	60 - occas.	7 to 8
Reddish-brown	Calcareous	sl;cl	Reddish-brown	Moderate to slow	Loamy alluvium	60 or more	8

<sup>2</sup>Permeability classes and approximate rates per hour:

Very slow - less than 0.20 inches      Rapid - 2.00 to 6.30 inches  
 Slow - 0.20 to 0.63 inches      Very rapid - more than 6.30 inches  
 Moderate - 0.63 to 2.00 inches

<sup>3</sup>Depth in inches from surface of effective soil

<sup>4</sup>AWHC - available water-holding capacity (estimated to a depth of 4 feet or to bedrock and other ineffective material if less than 4 feet)

Table 4. Continued

Soil Map Symbol and Soil Association	Dominant Slope Range (percent)	Approximate Percent of Association	Pedologic Classification		
			Subgroup	Family	Texture
9 Willard-LaBrier					
Willard loam	0-3	42	Ustollic Calciorthid	Fine-silty, mixed	loam
LaBrier loam	0-1	33	Torrertic Argiustoll	Fine, montmorillonitic, mesic	loam;cl
Other soils and land types		25			
10 LaPorte-Witt					
LaPorte cobbly loam	5-25	60	Aridic Lithic Haplustoll	Loamy, mixed, mesic	col;loam
Witt loam	0-3	10	Ustollic Haplargid	Fine-silty, mixed, mesic	loam
Other soils and land types		30			
11 Redmun-Pena-Stony Land					
Redmun loam	1-9	45	Aridic Argiustoll	Fine, montmorillonitic, mesic	loam
Hubert stony clay loam	1-25	40	Typic Calcicustoll	Loamy-skeletal, mixed, mesic	stl;stcl
Other soils and land types		15			
12 Chimayo-Mirabal-Supervisor					
Chimayo stony loam	30-60	22	Lithic Ustorthent	Loamy-skeletal, mixed, non-acid, mesic	stl;col
Mirabal stony loam	30-70	20	Typic Ustorthent	Loamy-skeletal, mixed, non-acid, frigid	stl
Supervisor gravelly sandy loam	15-60	12	Typic Cryoboroll	Loamy-skeletal, mixed	gsl
Other soils and land types		46			
13 Nambe-Cundiyo					
Nambe gravelly loam and stony loam	20-70	59	Typic Cryorthod	Loamy-skeletal, mixed	gl;stl
Cundiyo gravelly sandy loam	45-80	23	Typic Cryboralfs	Loamy-skeletal, mixed	gsl;stsl
Other soils and land types		18			

<sup>1</sup>Abbreviations used for textural classes are:

vgs-very gravelly sand	gsl-gravelly sandy loam	gl-gravelly loam	vcoscl-very cobbly sandy clay loam
ls-loamy sand	vgel-very gravelly sandy loam	vgl-very gravelly loam	cl-clay loam
lfs-loamy fine sand	stsl-stony sandy loam	col-cobbly loam	vgcl-very gravelly clay loam
lvfs-loamy very fine sand	fsl-fine sandy loam	stl-stony loam	stcl-stony clay loam
vgls-very gravelly loamy sand	stsl-stony fine sandy loam	scl-sandy clay loam	sicl-silty clay loam
sl-silt loam	sil-silt loam	gcl-gravelly sandy clay loam	sic-silty clay
			vcosc-very cobbly sandy clay

Surface Soil Features		Subsoil Features				Soil Depth <sup>3</sup>	AWHC <sup>4</sup>
Color	Reaction	Texture <sup>1</sup>	Color	Permeability <sup>2</sup>	Substratum	(inches)	(inches)
Light brownish-gray Brown	Strongly calc. Non-calc.	Loam;cl cl	Pale brown Dark reddish-gray	Moderate Slow	Lacustrine sediments Loamy alluvium	20 to 36 60 or more	4 to 5 8
Grayish-brown Brown	Weakly calc. Non-calc.	stl;stsl cl;sl	Pale brown to brown Reddish-brown to brown	Moderate Slow	Limestone Limy alluvial sediments	8 to 20 60 or more	1 to 3 6 to 7
Reddish-brown Dark reddish-brown	Non-calc. Weakly calc.	cl;clay vgl;vgl	Brown to dark brown Pinkish-gray	Slow Moderate to rapid	Alluvial and eolian sediments Gravel and stones; weakly cemented with lime	60 or more 15 to 30	7 to 8 2 to 3
Grayish-brown Dark grayish-brown	Neutral Neutral	col;stl stl;col	Light brownish-gray Grayish-brown and brown	Rapid Rapid	Acid igneous rock Acid igneous rock	15 to 20 15 to 20	2 to 3 2 to 3
Dark gray	Neutral	gsl;vgsl;vgl	Dark grayish-brown and pale brown	Rapid	Acid igneous rock	20 to 36	4
Light brown Light brownish-gray	Acid Slightly acid	gsl;stsl gsl;stsl	Reddish-brown Brown	Rapid Rapid	Glacial till Gravelly alluvium	60 or more 60 or more	4 to 5 4 to 5

<sup>2</sup>Permeability classes and approximate rates per hour:

Very slow - less than 0.20 inches  
 Slow - 0.20 to 0.63 inches  
 Moderate - 0.63 to 2.00 inches  
 Rapid - 2.00 to 6.30 inches  
 Very rapid - more than 6.30 inches

<sup>3</sup>Depth in inches from surface of effective soil

<sup>4</sup>AWHC - available water-holding capacity (estimated to a depth of 4 feet or to bedrock and other ineffective material if less than 4 feet)

irrigable land, there is some potential for expansion of irrigation, particularly where the Rednun soils occur in tracts of sufficient size so that they can be economically developed. Rednun soils, which have been classified as suitable for irrigation, are in irrigation land class 2 where they occur on gently sloping landscapes. The strongly sloping Rednun soils are in land class 3. Small acreages of Panky and Cerrillos soils, which were placed in irrigation land classes 2 and 3 respectively, also occur in this association. The remaining 49 percent of the land in this association is non-irrigable.

## 12. Chimayo-Mirabal-Supervisor association

This association comprises an area of about 162,660 acres in the northeastern part of the county. It occupies steep to very steep mountainous landscapes with slope gradients that generally range from about 15 to 70 percent or more. The soils, which are generally shallow to moderately deep, are developing dominantly in materials weathered from granite, gneiss, and schist. The surface soils are usually gravelly or stony and range in reaction from neutral to slightly acid. The altitude ranges from about 7,000 to 10,000 feet but is most commonly between 7,500 and 9,500 feet.

This association is used for timber production, range, and recreation. The major soils in this unit, in general, support good stands of native vegetation. The Mirabal and Supervisor soils, which are the principal timber-producing soils in this association, have an overstory vegetation consisting of Ponderosa pine, white and Douglas fir, and traces of aspen. Chimayo soils occur at slightly lower elevations and usually have an overstory vegetation of pinyon, juniper, and some oakbrush. The principal grasses are western wheatgrass, sideoats grama, little bluestem, mountain brome, Arizona fescue, galleta, blue grama, and dropseed. It also supports a number of desirable browse plants suitable for grazing by wildlife.

*Soil Characteristics.* Chimayo soils, which usually occur at lower elevations than the soils of the Mirabal and Supervisor soils, have a surface layer of grayish-brown stony loam. It is about six inches thick, neutral in reaction, and commonly has a surface cover of about two inches of litter of undecomposed and partially decomposed needles, leaves, twigs, and cones. The subsurface layers are a light brownish-gray noncalcareous cobbly loam. It is underlain by granite, gneiss, or schist at a depth of less than 20 inches.

The Mirabal soils, which are also extensive in

this association, have a surface layer of dark grayish-brown to grayish-brown noncalcareous stony loam. This grades through a brown very stony loam to the underlying granite and gneiss bedrock at a depth of about 15 to 20 inches.

Supervisor soils, the other major component of this association, have a thin surface layer of dark gray, gravelly sandy loam that is leached free of lime. A two- to three-inch layer of litter consisting of partially decomposed and undecomposed needles, leaves, and twigs commonly lies on the surface. The subsurface layer consist of a dark grayish-brown slightly acid gravelly sandy loam. This grades through a very gravelly loamy sand, about one foot thick, to the underlying granite, gneiss, or schist bedrock that occurs at a depth of about 20 to 26 inches.

Also in this association are small areas of alluvial soils and miscellaneous land types. The alluvial soils commonly occur as small areas in valley bottoms and on narrow flood plains adjacent to drainages. These soils are usually deep, moderately dark-colored to dark-colored and moderately coarse to medium-textured. Rockland, which consists of a complex of very shallow soils and outcrops of granite, schist, or gneiss, is the dominant land type.

*Irrigation Potential.* There is very little potential for development of irrigated land in this association. The only soils with properties suitable for irrigation are the small areas of deep alluvial soils. The small size, location, and isolation of these irrigable lands will generally preclude their use for this purpose.

## 13. Nambe-Cundiyo association

Included in this association is a high mountain area consisting of about 55,670 acres in the northeastern part of the county. Although the altitude ranges from slightly less than 9,000 feet to 12,629 feet on Baldy Peak, it is usually between 9,000 and 11,500 feet. Steep to very steep mountainous landscapes with slope gradients of 20 to 80 percent or more are characteristic of this general soil area.

This association is used largely for timber production, recreation, grazing by wildlife, and, to a much lesser extent, for grazing by livestock. The major soils in this association support good stands of native vegetation consisting of Engelmann spruce, white and Douglas fir, aspen, and ponderosa pine with a sparse understory of shrubs, forbs, and grasses. The more common grasses are Arizona fescue, bluegrass, Junegrass, little bluestem, sideoats grama, pine dropseed, mountain

muhly, western wheatgrass, and blue grama. It also supports a number of desirable browse plants suitable for grazing by wildlife.

*Soil Characteristics.* Nambe soils, which commonly occur at elevations of 9,000 to 11,000 feet, are forming in glacial till. They occupy steep to very steep mountain slopes with gradients ranging from 20 to about 70 percent. The surface layers are light brown to brown very strongly acid gravelly or stony loams. A two- to three-inch layer of fresh or partly decomposed organic material commonly lies on the surface. The subsoil is a reddish-brown, strongly acid, gravelly or stony sandy loam, about 15 to 20 inches thick. This is underlain by a substratum of brown, strongly acid, gravelly or stony sandy loam. The content of coarse fragments in the subsoil and substratum, which vary in size from gravel to stones, ranges from about 30 to 60 percent.

Cundiyo soils, which usually occur between elevations of 9,000 and 10,000 feet, are forming in alluvium from acid igneous rocks. These soils have a thick surface layer of light brownish-gray gravelly sandy loam. It is about 20 inches thick, slightly acid in reaction, and has a surface cover of about two inches of fresh or partially decomposed organic material. The subsoil commonly extends to a depth of 50 to 60 inches and consists of a light brownish-gray and brown, slightly acid, gravelly or stony sandy loam. The content of coarse fragments in the subsoil ranges from about 40 to 90 percent. These coarse fragments are commonly coated with clay.

Also in this association are soils of Bobtail,

Penitente, Lunch, and Tampico series, and miscellaneous land types which include rockland, rock slides, and drainageways. The Bobtail soils, which are forming in valley filling sediments of acid igneous origin, are often associated with outcrops of bedrock. They have light brownish-gray, strongly acid loam surface layers over pale brown stony subsoils and substrata. The Penitente soils occur on high mountain tops at elevations of 12,000 feet or more. These soils are characterized by their very dark gray to dark brown cobbly loam surface layers and very cobbly and very stony subsoils and substrata with the content of coarse fragments ranging from 50 to 80 percent. They are strongly to very strongly acid. The Lunch soils, which are poorly drained, occupy basins and low areas in high mountain valleys. These soils have a 3- to 10-inch surface layer of peat over a silt loam mineral soil that is dark grayish-brown in the upper part and of variable color in the lower layers. Many large prominent mottles indicating restricted drainage are common in these lower subsurface layers. Tampico soils, which occur in alluvial valley bottoms, are forming in alluvium derived principally from granite, gneiss, and schist. These deep well-drained soils have very dark gray loam surface layers over grayish-brown loam subsurface layers that often contain a few pebbles.

*Irrigation Potential.* This association is dominated by steep and mountainous topography, and there is little or no opportunity for development of irrigated land. In addition to the steep slopes, many of the soils are stony and rocky. All the land in this association has been included in class 6.

### *Suitability for Irrigation*

In this section, the placement of soils in the various irrigation land classes and the extent, location, and suitability of soils in Santa Fe County for irrigation are discussed. The acreage of irrigable and non-irrigable land in each of the 13 soil associations is shown in table 5. The estimated acreage and percentage of land in each of the five land classes were determined on the basis of the kinds of soils occurring in the soil associations. The acreages (table 6) of each soil and land type in the county also served as a guide in arriving at these estimates.

The approximate distribution of the irrigation land classes in Santa Fe County is indicated on the irrigation land class map (figure 2). The estimated

acreage and percentage of land in the various irrigation land classes for each soil association (table 5) were used as a guide in the construction of this map. In each delineated area, the land class or classes shown comprise more than 75 percent of the area. Every land class shown comprises at least 15 percent of the area. 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 suitable for irrigation. Therefore, because of limitation of map scale, these small

Table 5. Estimated acreage and approximate percentage of land in each irrigation land class by soil association, Santa Fe County, New Mexico.<sup>1</sup>

Soil Map Symbol and Soil Association	Classes 1 to 4												Principal Limiting Factor(s)			
	Class 1	Class 2	Class 3	Class 4	Total	Class 6	Grand Total	Percent		Acres						
1 El Rancho-Fruitland																
El Rancho sandy clay loam	2,279															
Fruitland soils	1,527															
Blowwing soils	1,307		197													
Pojoaque and Rough broken land																
Other soils and land types	364		230													
Total	2,643	17	2,834	13	487	3	2,270	14	654	2,603	4,943	3,257	15,780	48	15,780	1.3
2 Pojoaque-Rough Broken Land																
Pojoaque-Rough broken land complex																
Rough broken land																
El Rancho-Fruitland complex	18,049															
Other soils and land	18,049	13	4,437	3	22,456	16	120,884	84	143,370	11.7						
Total	36,098	13	4,437	3	22,456	16	120,884	84	143,370	11.7						
3 Las Lucas-Gallisteo																
Las Lucas loam	8,230															
Gallisteo loam and Gullied land																
Alluvial land, saline																
Other soils and land types																
Total	8,230	16	27,327	52	36,057	65	17,178	32	53,235	4.3						
4 Panky-Pojoaque-Harvey																
Panky fine sandy loam	55,169															
Pojoaque-Panky association																
Silver-Pojoaque association	12,733															
Five Mile loam	19,041															
Harvey-Cerrillos association																
Agua Fria fine sandy loam																
Cerrillos fine sandy loam																
Santa Fe-LaFonda association																
Other soils and land types																
Total	86,943	50	62,333	35	15,664	9	164,940	94	10,765	6	175,705	14.4				
5 Witt-Harvey-Clovis																
Witt loam	60,662															
Harvey loam																
Clovis loam	19,557															
Laharr loam	5,851															
Other soils																
Total	86,070	70	36,385	29	1,948	99	1,130	1	123,365	10.1						
6 Harvey-Dean-Tapia																
Harvey loam	8,200															
Harvey-Penitaja sandy loams																
Harvey-Dean loams																
Tapia-Dean loams																
Otero-Palma fine sandy loam																
Penitaja fine sandy loam	6,006															
Other soils and land types	9,130															
Total	15,136	13	33,849	29	48,985	42	69,250	58	118,235	9.7						

7	Majich-Culabasas-Avache	17,420	16	13,624	13	12,498	17,420	12,498	18,936	18,936	Slope:AWHC*
	Majich stony fine sandy loam								20,042	20,042	Slope:erecton
	Culabasas loam and eroded phase								14,377	14,377	Soil depth:AWHC*
	Apache stony fine sandy loam								12,498	12,498	Slope
	Silver loam								10,263	10,263	Slope:AWHC*
	Monoso gravelly silt loam								29,588	29,588	
	Other soils and land types								74,786	71	104,830
	Total	17,420	16	13,624	13	12,498	17,420	12,498	18,936	18,936	8.7
8	Travessilla-Rockland-Bernal								60,053	60,053	Soil depth
	Travessilla-Bernal fine sandy loams								40,020	40,020	Soil depth:slope
	Travessilla-Rock outcrop complex								23,776	23,776	Slope
	Rednum loam	23,776				23,776			1,780	5,090	Slope:soil depth
	Rednum-Travessilla association	3,310				3,310			24,046	24,046	Soil topography
	Stony Rockland								8,563	8,563	Slope
	Prewitt loam	8,563				8,563			20,559	41,247	
	Other soils and land types	13,791				13,791			146,458	72	202,735
	Total	49,440	24	36,337	28	36,337	49,440	36,337	9,534	9,534	16.6
9	Willard-LaBrier								2,047	2,047	Salinity:AWHC*
	Willard loam								1,588	1,588	Flooding hazard:permeability
	LaBrier loam	1,588				1,588			930	1,230	
	Other soils and land types	300				300			930	19	4,865
	Total	1,888	33	2,347	48	3,935	1,888	2,347	930	19	0.4
10	Laporte-Witt								606	606	Soil depth:slope
	Laporte-Rock outcrop complex								606	606	Slope
	Witt loam	606	6			606			9,534	94	10,140
	Total	606	6			606			9,534	94	0.8
11	Rednum-Pena-Stony Land								8,003	8,003	Slope
	Rednum loam								11,105	27,763	Slope:AWHC*
	Rednum-Pena soils	8,003				16,658			13,414	13,414	AWHC*;slope
	Pena stony clay loam								750	750	
	Other soils	760				760			24,519	49	49,930
	Total	8,763	18	16,658	33	25,411	8,763	16,658	30,901	30,901	Soil depth:slope
12	Chimayo-Mirabal-Supervisor								28,206	28,206	Soil depth:slope
	Chimayo stony loam								7,869	7,869	Soil depth:slope
	Mirabal stony loam								18,003	18,003	Soil depth:slope
	Mirabal-Rock outcrop complex								2,084	2,084	Soil depth:slope
	Supervisor gravelly sandy loam								75,597	75,597	Soil depth:slope
	Supervisor-Rock outcrop complex								162,660	100	162,660
	Other soils and land types								12,888	12,888	Slope:AWHC*
	Total	2,643	295,069	165,683	57,095	520,490	2,643	295,069	165,683	57,095	1,221,800
13	Nambe-Cundiyo								18,179	18,179	Slope:AWHC*
	Nambe gravelly loam								12,817	12,817	Slope:AWHC*
	Nambe stony loam								11,786	11,786	Slope:AWHC*
	Cundiyo gravelly sandy loam								55,670	100	55,670
	Other soils and land types								701,310	1,221,800	
	Total	2,643	295,069	165,683	57,095	520,490	2,643	295,069	165,683	57,095	1,221,800

\*Percentages are of association except grand total, which is percent of county.

\*AWHC is abbreviation for available water-holding capacity.

Table 6. Irrigation land class, approximate acreage and proportionate extent of soils in Santa Fe County, New Mexico<sup>1</sup>

Soil Mapping Unit	Irrigation			Soil Mapping Unit	Irrigation		
	Land Class	Acres	Percent		Land Class	Acres	Percent
Agua Fria fine sandy loam	3	7,904	.6	Harvey loam,			
Alluvial land, cobbly	6	2,853	.2	1 to 9 percent slopes	3	43,637	3.6
Alluvial land, gravelly	6	883	.1	Harvey-Dean loams,			
Alluvial land, saline	6	6,231	.5	1 to 9 percent slopes	6	29,683	2.4
Ancho clay loam	1	364	*	Harvey-Cerrillos association,			
Ancho clay loam, saline	3	290	*	undulating			
Apache stony fine sandy loam, 1 to 15 percent slopes	6	14,377	1.2	Harvey Cerrillos	3	17,665	1.5
Badland	6	2,300	.2	La Brier loam	3	7,570	.6
Basalt Rockland	6	11,012	.9	LaFonda loam,	2	13,289	1.1
Bluewing loamy fine sand	4	534	*	3 to 10 percent slopes	3	378	*
Bluewing loamy fine sand, saline	4	352	*	Laporte-Rock outcrop complex	6	10,609	.9
Bluewing gravelly sandy loam	4	6,290	.5	Las Lucas loam,			
Bobtail-Rock outcrop complex	6	3,609	.3	1 to 9 percent slopes	4	27,358	2.2
Bobtail loam, 20 to 70 percent slopes	6	7,030	.6	Los Alamos-Silver sandy loams, 0 to 10 percent slopes	3	1,144	.1
Borrego loam, 10 to 30 percent slopes	6	1,150	.1	Lunch peat, shallow variant	6	286	*
Calabasas loam, 0-10 percent slopes	2	17,420	1.4	Majada stony fine sandy loam, 20 to 50 percent slopes	6	18,936	1.5
Calabasas loam, 0-20 percent slopes, eroded	6	2,622	.2	McVickers sandy loam, Kaolinic variant	6	780	.1
Capillo gravelly sandy loam, 10 to 50 percent slopes	6	5,347	.5	Mirabel stony loam, 5 to 30 percent slopes	6	2,414	.2
Capillo-Rock outcrop complex, 25 to 70 percent slopes	6	3,750	.3	Mirabel stony loam, 30 to 70 percent slopes	6	25,792	2.1
Cerillos fine sandy loam, 0 to 5 percent slopes	3	3,827	.3	Mirabel-Rock outcrop complex, 40 to 100 percent slopes	6	7,869	.6
Chimayo stony loam, 30 to 60 percent slopes	6	30,901	2.6	Montoso gravelly silt loam, 5 to 30 percent slopes	6	2,095	.2
Clovis loam, 1 to 3 percent slopes	2	22,837	1.9	Montoso gravelly silt loam, 30 to 60 percent slopes	6	8,168	.7
Cueva very stony clay, 20 to 60 percent slopes	6	4,093	.3	Moriarty silty clay	2	5,178	.4
Cundiyo gravelly sandy loam, 45 to 80 percent slopes	6	12,817	1.1	Nambe gravelly loam, 30 to 50 percent slopes	6	12,888	1.1
Dean-Pastura loams, 1 to 9 percent slopes	6	11,290	.9	Nambe stony loam, 20 to 70 percent slopes	6	18,179	1.5
El Rancho sandy clay loam, 0 to 1 percent slopes	1	341	*	Nambe-Rock outcrop complex, 20 to 50 percent slopes	6	2,340	.2
El Rancho sandy clay loam, 1 to 3 percent slopes	1	1,930	.2	Nambe-Rock outcrop complex, 50 to 100 percent slopes	6	3,125	.3
El Rancho sandy clay loam, 3 to 5 percent slopes	2	1,174	.1	Ortiz gravelly loam, 5 to 40 percent slopes	6	2,293	.2
El Rancho sandy clay loam, sandy subsoil variant	2	353	*	Otero-Palma fine sandy loams, 1 to 9 percent slopes	3	13,597	1.1
El Rancho-Fruitland complex	2	15,049	1.5	Panky fine sandy loam	2	55,169	4.5
Encierro stony fine loam, 0 to 20 percent slopes	6	3,064	.3	Penistaja fine sandy loam, 0 to 5 percent slopes	2	14,619	1.2
Five Mile loam	2	19,041	1.6	Penitente cobbly loam, 0 to 30 percent slopes	6	515	*
Fort Wingate gravelly sandy loam, 30 to 60 percent slopes	6	1,425	.1	Persayo-Shale Rockland association, rolling	6	5,391	.4
Fruitland sandy loam, 0 to 3 percent slopes	2	298	*	Pojoaque-Panky association, rolling			
Fruitland sandy loam, 3 to 5 percent slopes	2	69	*	Pojoaque sandy clay loam, 5 to 25 percent slopes	4	15,664	1.3
Fruitland sandy loam, saline, 0 to 3 percent slopes	3	197	*	Panky loam, 0 to 9 percent slopes	3	10,440	.9
Fruitland sandy clay loam, 0 to 3 percent slopes	2	940	.1	Pojoaque-Rough Broken Land, complex	6	98,732	8.1
Gallisteo loam and Gallied land, level	2 and 6	10,288	.8	Prewitt loam, 0 to 5 percent slopes	2	8,563	.7
Guaje gravelly sandy loam, 10 to 30 percent slopes	6	2,846	.2	Rednum loam, 1 to 9 percent slopes	2	31,779	2.6
Hagerman fine sandy loam, 0 to 5 percent slopes	4	6,897	.6	Rednum-Pena association, rolling			
				Rednum loam, 1 to 9 percent slopes	3	16,658	1.4
				Pena gravelly clay loam, 1 to 25 percent slopes	6	11,105	.9

<sup>1</sup>Acreages and percentages taken from detailed "Soil Survey of Santa Fe Area"

\*Less than .1 percent

Table 6. Continued

Soil Mapping Unit	Irrigation Land Class	Acres	Percent	Soil Mapping Unit	Irrigation Land Class	Acres	Percent
Rednum-Travessilla association, undulating				Stony rockland	6	47,245	3.9
Rednum loam,				Supervisor gravelly sandy loam,			
1 to 5 percent slopes	2	3,310	.3	15 to 60 percent slopes	6	18,003	1.5
Travessilla loam,				Supervisor-Rock outcrop complex,			
5 to 9 percent slopes	6	1,780	.1	45 to 100 percent slopes	6	2,084	.2
Riverwash	6	4,677	.4	Tampico loam,			
Rockland and Chimayo soils,				5 to 35 percent slopes	6	1,082	.1
45 to 100 percent slopes	6	21,186	1.7	Tapia-Dean loams,			
Rock outcrop	6	7,186	.6	1 to 5 percent slopes	6	24,287	2.0
Rock slides	6	1,396	.1	Travessilla-Bernal fine sandy loam	6	60,053	4.9
Rough Broken Land	6	29,077	2.4	Travessilla-Rock outcrop complex,			
Santa Fe-LaFonda association, hilly				1 to 25 percent slopes	6	45,140	3.7
Santa Fe clay loam,				Tuff rockland	6	14,337	1.2
9 to 25 percent slopes	6	3,996	.3	Wilcoxson sandy clay loam,			
LaFonda loam,				soft bedrock variant,			
5 to 9 percent slopes	3	3,997	.3	15 to 40 percent slopes	6	2,933	.2
Santa Fe-Rock outcrop complex,				Willard loam	3	2,047	.2
5 to 25 percent slopes	6	9,904	.8	Witt loam	2	62,018	5.1
Silver loam,				Zuni loam, brown subsoil variant,			
0 to 10 percent slopes	3	12,498	1.0	10 to 40 percent slopes	6	2,269	.2
Silver-Pojoaque association				Waterway	6	403	*
Silver loam, 1 to 5 percent slopes	2	12,733	1.0				
Pojoaque clay loam,				Grand Total		1,221,800	100.0
5 to 9 percent slopes	3	8,488	.7				

\*Less than .1 percent

tracts that differ in capability for irrigation are now shown.

Although climate is not considered in the land classification system used here, it is important in determining which crops can be grown and their possible yields. Both length of frost-free season and soil temperatures decrease with elevation. The elevation of irrigable land in Santa Fe County ranges from about 6,000 to 7,200 feet.

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 in table 5, indicates that the following soil associations contain a high percentage of land suitable for irrigation:

1. El Rancho-Fruitland association
3. Las Lucas-Galisteo association
4. Panky-Pojoaque-Harvey association
5. Witt-Harvey-Cloviss association
6. Harvey-Dean-Tapia association
9. Willard-LaBrier association
11. Rednum-Pena-Stony Land association

These seven soil associations (figure 1) contain slightly more than 410,000 acres of irrigable land, or about 79 percent of the 520,490 acres of Santa Fe County land classified as irrigable. They also contain about 209,500 acres out of the 295,000 acres that were placed in irrigation land classes 1 and 2.

Although each of these seven soil associations contains a high percentage of land classified as suitable for irrigation, they differ significantly in potential for expansion of irrigation. The two soil associations that offer the best possibility for expansion of irrigated land in Santa Fe County are the Panky-Pojoaque-Harvey association and the Witt-Harvey-Cloviss association.

The Panky-Pojoaque-Harvey association (No. 4) is dominated by class 2 and class 3 land, which is well or moderately well suited for use as cropland under irrigation. Approximately 50 percent is in class 2; 35 percent in class 3; 9 percent in class 4; and the remaining 6 percent is non-irrigable or in class 6. These percentages indicate a possibility of developing relatively large tracts for irrigation, with little or no interspersed non-irrigable land. The class 3 and class 4 land in this association has moderate to severe limitations for irrigation and would need good management practices to insure

moderate to high yields of adapted crops under irrigation.

The Witt-Harvey-Clovis association (No. 5), like the Panky-Pojoaque association, has a high potential for expansion of irrigated land. About 70 percent of the land in this association is in class 2; 29 percent in class 3; and the remaining one percent is non-irrigable. The Witt, Clovis, and LeBrier soils, which account for most of the land in irrigation class 2, are well suited for use as cropland under irrigation. Although well suited to irrigation, these class 2 lands, in general, would require a moderate amount of land leveling and conditioning for irrigation. With the application of these essential improvement practices, the land could support sustained irrigation.

Although most of the soils in the El Rancho-Fruitland association are well suited to irrigation, there is little opportunity for expansion of irrigated land in this association because of the small acreage in the association, and because much of the irrigable land is either already irrigated or in built-up areas. Much of this irrigable land is now irrigated, but crop yields could be improved with an additional and more consistent water supply throughout the growing season.

There is some opportunity for expansion of irrigated land in the Harvey-Dean-Tapia association. This association, however, includes about 58 percent class 6 land, or land classified as non-irrigable. The shallow soils of Dean, Pastura, and Travessilla series comprise the majority of the land in class 6. Also included in class 6 are small acreages of Harvey and Tapia soils that occur in a complex pattern with the shallow soils of the Dean and Pastura soils. Although there is some intermingling of the class 6 lands with those classified as suitable for irrigation, the non-irrigable lands are often of sufficient size to permit their exclusion from the lands being considered for irrigation. In addition to the 58 percent of the land in this association that is in class 6; 29 percent is in class 3; and 13 percent is in class 2.

The Willard-LaBrier association, which is another of the small associations, offers some opportunity for expansion of irrigation in this county, particularly if the irrigable land in this association is developed in conjunction with that of the adjacent Witt-Harvey-Clovis association. Approximately 48 percent of the land in the Willard-LaBrier association is in class 3; 33 percent in class 2; and the remaining 19 percent is non-irrigable, or class 6.

Although nearly one-half of the land in the Rednun-Pena-Stony Land association is non-

irrigable, there is some potential for expansion of irrigation in the areas comprising this association, particularly where the irrigable lands occur in tracts of sufficient size so that they can be feasibly developed for irrigation. Rednun soils, which account for much of the land in irrigation classes 2 and 3, were placed in irrigation land class 2 when gently sloping and in class 3 when strongly sloping. Small acreages of Panky and Cerrillos soils, which were placed in irrigation land classes 2 and 3, respectively, also occur in this association.

The Las Lucas-Galisteo association also contains a high percentage of land classified as irrigable. However, unlike the Rednun-Pena-Stony Land association, a major part of the land classified as irrigable has a relatively low capability for such use. Approximately 52 percent of the land in this association is in class 4; 32 percent in class 6; and the remaining 16 percent is in class 2. The Las Lucas soils, which are underlain by shale, account for the majority of the land in class 4. The class 2 lands, or those with a higher capability for irrigation, commonly occur as small and irregular shaped tracts. This will undoubtedly tend to restrict their development for irrigation.

In the remainder of the associations, the percentage of irrigable land ranges from little or none in soil associations 12 and 13 to 29 percent in association 7. The characteristics of the soils and related land features in these associations are such that there is little or no opportunity for development of irrigated land. The Majada-Calabasas-Apache (No. 7) association and Travessilla-Rockland-Bernal (No. 8) association are the only ones containing an appreciable acreage of land classified as irrigable. Approximately 71 percent of the land in the Majada-Calabasas-Apache association is in class 6; 16 percent is in class 2; and 13 percent is in class 3. In the Travessilla-Rockland-Bernal association, about 72 percent of the land is in class 6; 24 percent in class 2; and 4 percent in class 4. Where the class 2 and 3 lands in these associations are of sufficient size or where they can be developed with irrigable lands in adjacent associations, they may merit consideration for such use.

The soils classified as suitable for irrigation in these associations, however, commonly occur in small tracts intermingled with large areas of non-irrigable lands. This will often tend to preclude their use for irrigation.

Of the 520,490 acres of land in Santa Fe County classified as suitable for irrigation, about 1 percent is class 1; 56 percent is class 2; 32 percent is class 3; and 11 percent is class 4.

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. 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 shown in figure 1. This correlation of engineering data and properties of soils within associations 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.

The 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 the location of 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 properties and engineering classifications are given in table 7. Information taken from the detailed soil survey, knowledge of the soil types 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.

Highway engineers generally classify soil materials in accordance with the system approved by the American Association of State Highway Officials.<sup>8</sup> 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 (gravelly 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.<sup>9</sup> This 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 is in the columns headed by these sieve numbers. The percentage of material as given reflects the normal range for the soil series, and most soils within a series will fall within the range indicated. The grain size of some soils may vary, so it should not be assumed that 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 indicates the relative suitability of soils to support various structures, to serve as construction materials for highways, farm facilities, and other engineering structures, to absorb sewage effluent, and to serve for other engineering purposes. Also listed are soil features or properties that might present difficulties or affect such uses. Although soil features restricting the use of soils for various engineering structures are emphasized, favorable soil features may also be listed. The ratings and other interpretations in this table are based on the estimated soil properties for engi-

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

<sup>9</sup>Waterways Experiment Station, Corps of Engineers, 1953 The Unified Soil Classification System. Tech. Memo. 3-357. 2V. and appendix.

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

Soil Map Symbol and Soil Association	Depth from Surface	Classification	USDA texture	Unified	AASHO	Course Fraction Greater than 3 inches	Percentage Less than 3 Inches Passing Sieve--			Range in Permeability in/hr	Shrink-swell Potential
							No. 4 (4.7mm)	No. 10 (2.0mm)	No. 200 (0.074mm)		
							in/hr				
<b>1 El Rancho-Fruitland</b>											
El Rancho . . . . .	0-60	SC	Sandy clay loam		A-6		100	100	35-50	0.63-2.00	Low to moderate
Fruitland . . . . .	0-13	SC	Sandy clay loam		A-6		100	100	35-45	0.63-2.00	Low to moderate
Pojoaque . . . . .	13-60	SM	Fine sandy loam (See association 2)		A2-4 or A4		100	100	25-50	2.00-6.30	Low
Bluewing . . . . .	0-4	GM	Very gravely sandy loam		A-2		35-50	35-50	15-25	2.00-6.30	Low
	4-20	ML	Gravelly loam		A-4		90-100	75-85	25-35	2.00-6.30	Low
	20-60	GM	Very gravely fine sand		A-1-b		35-50	25-50	5-10	> 6.30	Low
<b>2 Pojoaque-Rough Broken Land</b>											
Pojoaque . . . . .	0-7	SC	Sandy clay loam		A-6		95-100	90-100	35-50	0.63-2.00	Low to moderate
	7-25	SC or SM	Gravelly sandy clay loam		A6 or A4		80-90	70-80	25-40	0.63-2.00	Low to moderate
	25-60	SC	Sandy clay loam		A-6		90-100	80-90	35-45	0.63-2.00	Low to moderate
	(Estimates not made)										
<b>3 Las Lucas-Gallisteo</b>											
Rough broken land . . . . .											
Las Lucas . . . . .	0-5	ML	Loam		A-4		100	100	60-75	0.63-2.00	Low to moderate
	5-50	CL	Clay loam		A-6		100	100	70-80	0.20-0.63	Moderate
Gallisteo . . . . .	0-6	ML	Loam		A-4		100	100	60-75	0.63-2.00	Low to moderate
	6-60	CH	Silty clay		A-7		100	100	90-95	< 0.20	High
<b>4 Panky-Pojoaque-Harvey</b>											
Panky . . . . .	0-4	ML-CL	Fine sandy loam		A-4		100	100	70-85	2.00-6.30	Low
	4-24	CL	Clay loam		A-6		100	100	75-90	0.20-0.63	Moderate to high
	24-60	ML-CL	Sandy clay loam (high lime)		A-4		100	100	50-60	0.63-2.00	Low to moderate
	(See association 2)										
Pojoaque . . . . .	3-32	ML or CL	Sandy clay loam		A-4 or A-6		100	100	50-60	0.63-2.00	Low to moderate
Harvey . . . . .	12-27	CL	Clay loam		A-6		100	100	70-80	0.63-2.00	Moderate
	27-60	CL	Sandy clay loam		A-6		100	100	50-60	0.63-2.00	Low to moderate
Five Mile . . . . .	0-17	ML	Loam		A-4		100	100	60-75	0.63-2.00	Low to moderate
	17-60	ML	Silt loam		A-4		100	100	70-90	0.20-0.63	Low
Cerrillos . . . . .	0-5	SM	Fine sandy loam		A-4		100	100	40-50	2.00-6.30	Low
	5-30	CL	Clay loam		A-6 or A-7		100	100	75-85	0.20-0.63	Moderate
	30-60	SC	Sandy clay loam		A-6		100	100	40-50	0.63-2.00	Low to moderate
<b>5 Witt-Harvey-Clovis</b>											
Witt . . . . .	0-8	ML	Loam		A-4		100	100	60-75	0.63-2.00	Low to moderate
	8-23	CL	Clay loam		A-6		100	100	70-80	0.20-0.63	Moderate
	23-37	CL	Sandy clay loam		A-6		100	100	60-75	0.63-2.00	Moderate
	37-60	ML or CL	Loam		A-4		100	100	60-75	0.63-2.00	Low to moderate
	(See association 4)										
Harvey . . . . .	0-4	ML	Loam		A-4		100	100	60-75	0.63-2.00	Low to moderate
Clovis . . . . .	4-29	CL	Clay loam		A-6		100	100	75-85	0.20-0.63	Moderate
	29-34	SC	Sandy clay loam		A-6		100	100	35-50	0.63-2.00	Low to moderate
	34-60	SM	Sandy loam (high lime)		A-2		100	100	25-50	2.00-6.30	Low

## 6 Harvey-Dean-Tapia

Harvey	3-12	Sandy clay loam	ML or CL	A-4 or A-6	100	100	0.63-2.00	Low to moderate
	12-27	Clay loam	CL	A-6	100	100	0.63-2.00	Moderate
	27-60	Sandy clay loam	CL	A-6	100	100	0.63-2.00	Low to moderate
Dean	9-36	Very gravelly loam	GM	A-4	95-100	95-100	0.63-2.00	Low
	9-36	Loam	ML	A-2	50-60	25-50	2.00-6.30	Low
Tapia	4-21	Light clay loam	ML	A-4	100	100	0.63-2.00	Low to moderate
	21+	Weakly to strongly cemented caliche gravel cobbles	CL	A-6	100	90-100	0.63-2.00	Moderate
Penistaja	0-3	Fine sandy loam	ML	A-4	100	100	2.00-6.30	Low
	3-30	Sandy clay loam	CL	A-6	100	100	0.63-2.00	Low to moderate
	30-60	Very fine sandy loam	ML	A-4	100	100	0.63-2.00	Low

## 7 Majada-Calabasas-Apache

Majada	0-7	Cobbly fine sandy loam	SM	A-4	95-100	90-100	2.00-6.30	Low
	7-14	Very cobbly sandy clay loam	SC	A-6	95-100	90-100	0.63-2.00	Low to moderate
	14-19	Very cobbly sandy clay	CH	A-7	95-100	95-100	< 0.20	Moderate
	19-30	Very cobbly sandy clay loam	SC	A-6	95-100	90-100	0.63-2.00	Low to moderate
	30-40	Very cobbly loam	ML-CL	A-4	95-100	90-100	0.63-2.00	Low
Calabasas	0-21	Loam	CL	A-6	100	100	0.63-2.00	Low to moderate
	21-32	Clay loam	CL	A-6	100	100	0.20-0.63	Moderate
	32-44	Heavy loam	CL	A-6	100	100	0.63-2.00	Moderate
	44-53	Loam	ML	A-4	100	100	0.63-2.00	Low
Apache	0-9	Stony fine sandy loam	SM	A-4	95-100	95-100	2.00-6.30	Low
	9-16	Stony loam	CL	A-6	95-100	90-100	0.63-2.00	Low to moderate
Silver	0-3	Loam	ML	A-4	100	100	0.63-2.00	Low to moderate
	3-14	Clay	CL or CH	A-6 or A-7	100	100	< 0.20	High
	14-45	Silty clay loam	CL	A-6 or A-7	100	100	0.20-0.63	Moderate
	45-60	Loam	ML	A-6	100	100	0.63-2.00	Low to moderate

## 8 Travessilla-Rockland-Bernal

Travessilla	0-10	Loam	ML	A-4	95-100	90-100	0.63-2.00	Low
Bernal	0-3	Fine sandy loam	SM	A-4	100	100	2.00-6.30	Low
	3-7	Very fine sandy loam	ML	A-4	100	100	0.63-2.00	Low
	7-18	Clay loam	CL	A-6	100	100	0.20-0.63	Moderate
Redman	(See association 11)							
Prewitt	0-5	Loam	ML	A-4	100	100	0.63-2.00	Low to moderate
	5-35	Sandy clay loam	SC	A-6	100	100	0.63-2.00	Low to moderate
	35-50	Clay loam	CL	A-6 or A-7	100	100	0.20-0.63	Moderate

## 9 Willard-LaBrier

Willard	0-10	Loam	ML	A-4	100	100	0.63-2.00	Low to moderate
LaBrier	10-26	Clay loam	CL	A-6 or A-7	100	100	0.20-2.00	Moderate
	3-60	Clay loam	CL	A-6 or A-7	100	100	0.20-0.63	Moderate to high

## 10 Laporte-Witt

Laporte	0-7	Cobbly loam	ML	A-4	95-100	90-100	0.63-2.00	Low
	7-13	Cobbly sandy clay loam	CL	A-6 or A-4	95-100	90-100	0.63-2.00	Low
Witt	13-19	Gravelly loam	ML	A-4	90-100	70-80	2.00-6.30	Low
	(See association 5)							

Table 7. Continued

Soil Map Symbol and Soil Association	Depth from Surface in.	Classification		Coarse Fraction Greater than 3 inches	Percentage Less than			Range in Permeability in/hr	Shrink-swell Potential	
		USDA texture	Unified		AASHO	3 Inches Passing Sieve--				
						No. 4 (4.7mm)	No. 10 (2.0mm)			No. 200 (0.074mm)
11 Redman-Pena-Stony Land	0-7	Loam	ML	A-4	100	100	65-80	0.63-2.00	Low to moderate	
	7-35	Clay loam	CL	A-6 or A-7	100	100	75-90	0.20-0.63	Moderate	
	35-50	Sandy clay loam	CL	A-6	100	100	55-75	0.63-2.00	Low to moderate	
	0-13	Stony clay loam	CL or ML	A-6 or A-4	95-100	85-100	60-75	0.63-2.00	Low to moderate	
	13-24	Very gravelly clay loam	GM	A-4	65-75	40-50		0.63-2.00	Low	
24-60	Very gravelly loam	GM	A-2	20-40	50-60	35-45	2.00-6.30	Low		
12 Chimayo-Mirahat-Supervisor	0-6	Stony loam	ML	A-4	90-100	75-85	35-45	0.63-2.00	Low	
	6-18	Cobby loam	ML	A-4	25-35	60-85	30-45	2.00-6.30	Low	
	0-18	Very stony loam	SM	A-1-b	70-95	65-90	20-35	2.00-6.30	Low	
	0-10	Gravelly sandy loam	SM	A-1-b	90-100	75-85	25-35	2.00-6.30	Low	
	10-23	Very gravelly loamy sand	GM	A-1-b	80-90	55-65	10-20	6.30	Low	
	0-8	Gravelly loam	ML	A-4	5-15	80-90	60-70	0.63-2.00	Low	
13 Nambé-Cundiyo	8-60	Gravelly sandy loam	SM	A-2	85-95	65-75	20-30	2.00-6.30	Low	
	0-6	Gravelly sandy loam	SM	A-2	95-95	75-85	25-35	2.00-6.30	Low	
	6-20	Sandy loam	SM	A-2	20-30	90-100	30-35	2.00-6.30	Low	
	20-33	Gravelly sandy loam	SM	A-2	95-100	90-100	30-35	2.00-6.30	Low	
	33-60	Gravelly sandy loam	SM	A-2	25-35	75-85	65-75	2.00-6.30	Low	

neering uses listed in table 7, on available test data, and field experience.

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

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

In the remainder of the columns in table 8 are given the major soil features or properties that affect the use of a soil for specified purposes. For example, under the column headed "Foundation

Support" are listed those features of the undisturbed soil that influence its capacity to support low buildings with 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 include the depth to bedrock and caliche, the content of stones and rocks, the suitability for embankments, susceptibility to overflow, erodibility, stability, ease of excavation and hauling, salinity, plasticity, and topography. The more common soil features affecting highway construction and maintenance are listed in the column headed "Highway Location".

The soil features that affect seepage or loss of water from excavated reservoir sites are those considered under farm pond reservoir areas. The permeability, depth to bedrock or caliche, and possibility of exposing porous strata are some of the items listed.

Farm pond embankments serve as dams. The major soil features of both subsoil and substratum that are of importance in the use of soils for constructing embankments are considered.

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.

Table 8. Interpretation of soil properties for engineering uses, Santa Fe 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)
	Topsoil	Road fill		
1 El Rancho-Fruitland				
El Rancho sandy clay loam	Fair; moderate fertility	Fair; low to moderate shrink-swell	Moderate; moderately permeable	Moderate
Fruitland sandy loam	Fair; sandy surface layer	Fair to good	Slight	Low
Pojoaque	(See association 2)			
Bluewing gravelly sandy loam	Poor; high gravel content	Good when mixed to 60 inches; 4- to 20-inch layer fair	Moderate; subject to flooding	Low
2 Pojoaque-Rough Broken Land				
Pojoaque sandy clay loam	Fair; gravel content; low fertility	Fair; low to moderate shrink-swell	Slight to moderate depending on slope	Moderate
Rough broken land	(Interpretations not made)			
3 Las Lucas-Galisteo				
Las Lucas loam	Fair to a depth of 5 inches	Poor; clayey material	Severe; slow permeability	Moderate to high
Galisteo loam	Poor; strongly alkaline, high clay content below 6 inches	Poor; clayey material; poor compaction characteristics	Severe; slowly permeable	High
4 Panky-Pojoaque-Harvey				
Panky fine sandy loam	Fair to a depth of 3 to 5 inches; clayey below 3 to 5 inches	Poor; clayey material from 4 to 24 inches	Moderate; moderately slow permeability	Moderate
Pojoaque sandy clay loam	(See association 2)			
Harvey loam	Fair to a depth of 12 inches	Fair; low to moderate shrink-swell	Moderate to severe; caliche layers may restrict permeability	Moderate
Five Mile loam	Good to depth of 5 inches; fair 5 to 20 inches	Poor to fair; silty material; poor compaction characteristics	Moderate; subject to flooding	Low
Cerrillos fine sandy loam	Fair to a depth of 5 inches; clayey below 5 inches	Fair when mixed to depth of 4 feet; poor between 5 and 20 inches	Moderate; caliche layers restrict permeability	Moderate
5 Witt-Harvey-Clovis				
Witt loam	Good to a depth of 5 to 8 inches	Poor; moderate shrink-swell	Moderate; moderately slow permeability	Moderate
Harvey loam	(See association 4)			
Clovis loam	Good to a depth of 5 to 10 inches	Fair when mixed to a depth of 4 to 5 feet	Slight to moderate; moderately permeable caliche layers	Moderate
6 Harvey-Dean-Tapia				
Harvey loam	(See association 4)			
Dean loam	Poor; limy; some caliche fragments	Good; very high lime content	Moderate to severe; shallow to lime zone that restricts permeability	Moderate
Tapia loam	Fair; moderate fertility; clayey below 4 inches	Fair when mixed to a depth of 4 to 5 feet	Moderate to severe; lime zone restricts permeability	Moderate
Penistaja fine sandy loam	Fair; sandy and erodible	Fair; low to moderate shrink-swell	Slight	Moderate

Foundation support	Highway location	Soil Features Affecting --			Terraces, diversions
		Farm ponds		Reservoir area	
		Embankment	Embankment		
Good bearing capacity and shear strength; moderate shrink-swell	Moderately susceptible to frost heave; low to moderate shrink-swell	Features favorable; may require compaction	Fair stability; good compaction characteristics	**	
Good bearing capacity and fair shear strength; low shrink-swell	Erodible when exposed on embankments	Rapidly permeable; subject to seepage	Erodible; fair stability if compacted	Susceptible to soil blowing	
Good bearing capacity and shear strength below 20 inches	Subject to flooding	Subject to seepage; very rapidly permeable	Permeable material; fair stability	Sandy and gravelly; permeable; subject to siltation	
Good bearing capacity; good to fair shear strength; low to moderate shrink-swell	Rolling topography; erodible when exposed on embankments; low to moderate shrink-swell	Moderately permeable; occasional gravel strata; may require sealing	Erodible; fair stability if compacted	*	
Fair bearing capacity and shear strength; moderate shrink-swell	Unstable material; shale at 40 to 60 inches	Shale at 4 to 5 feet; subject to seepage if exposed	Clayey material; erodible	Undulating topography; subject to channel erosion and siltation	
High shrink-swell; poor to fair bearing capacity	Dissected by gullies; erodible when exposed on embankments; high shrink-swell	**	Clayey material; fair to poor stability; fair to poor compaction	Clayey material; difficult to vegetate; erodible	
Fair bearing capacity and shear strength; moderate to high shrink-swell	Plastic material from 4 to 24 inches	Soil features generally favorable; exposed caliche layers below 24 inches may require sealing	Clayey material; difficult to vegetate and compact	Clayey subsoil layers	
Fair bearing capacity and shear strength; low to moderate shrink-swell	Erodible when exposed on embankments; low to moderate shrink-swell	Soil features generally favorable; exposed caliche layers may require sealing	Limy material; difficult to vegetate; fairly stable	Susceptible to soil blowing	
Poor bearing capacity; low to moderate shrink-swell	Subject to flooding	**	Poor stability and compaction characteristics	Subject to flooding	
Moderate shrink-swell	Plastic material from 5 to 20 inches	Soil features generally favorable; exposed caliche layers below 20 inches may require sealing	Clayey material; erodible and difficult to vegetate if lime layers are exposed	Clayey subsoil layers	
Fair bearing capacity shear strength; low to moderate shrink-swell	Moderately plastic material at a depth of 8 to 36 inches; low to moderate shrink-swell	Moderately permeable strata; may require sealing	Fair to good compaction characteristics; low to moderate permeability	**	
Fair bearing capacity to 30 inches; good below 30 inches; low to moderate shrink-swell	Exposed limy material below a depth of 20 to 40 inches erodible and difficult to vegetate; low to moderate shrink-swell	Moderately permeable substratum	Fair to good compaction characteristics; low to moderate permeability	**	
Low shrink-swell; good bearing capacity	Exposed caliche erodible and difficult to vegetate	Shallow to a lime zone; subject to seepage	Limy material; erodible and difficult to vegetate	Shallow to a lime zone**	
Moderate shrink-swell; fair bearing capacity	Limy material below 20 to 40 inches; if exposed erodible and difficult to vegetate; moderate shrink-swell	Moderately deep to lime zone; subject to seepage	Fair to good compaction characteristics; limy material below 20 to 40 inches	Limy materials below 20 to 40 inches; if exposed erodible and difficult to vegetate	
Fair bearing capacity and shear strength; low shrink-swell below 30 inches	Low shrink-swell below 30 inches	Moderately permeable; may require compaction and sealing	Fair stability if compacted	Surface layers sandy and erodible	

\*Unsuitable or practice not applicable

\*\*Soil features favorable

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		
7 Majada-Calabasas-Apache Majada stony fine sandy loam	Poor; stony	Fair; stones; bedrock at 3 to 5 feet	Severe; bedrock at 3 to 5 feet; moderately steep	Moderate
Calabasas loam	Good to a depth of 5 to 12 inches	Fair to poor; moderate shrink-swell	Moderate; moderate to slow permeability	Moderate
Apache stony fine sandy loam	Poor; stony	Fair; limited amount of material	Severe; shallow to bedrock	Moderate
Silver loam	Good to a depth of 3 to 9 inches	Poor; plastic; moderate to high shrink-swell	Severe; slow permeability	Moderate to high
8 Travessilla-Rockland-Bernal Travessilla loam	Poor; sandstone fragments	Fair to good material; amount of material limited	Severe; shallow to bedrock	Low
Bernal fine sandy loam	Fair to a depth of 5 to 8 inches (Interpretations not made)	Fair; limited amount of material	Severe; shallow to bedrock	Moderate
Rockland				
9 Willard-LaBrier Willard loam	Fair to a depth of 6 to 10 inches; limy; erodible	Poor; moderately plastic; moderate shrink-swell	Severe; slow permeability	High
LaBrier loam	Good to a depth of 5 to 8 inches	Poor; plastic; moderate to high shrink-swell	Severe; subject to flooding; slow permeability	Moderate
10 Laporte-Witt Laporte cobbly loam	Poor; high content of cobbles and stones	Fair; material very limited	Severe; shallow to bedrock	Moderate
Witt loam	(See association 5)			
11 Redmun-Pena-Stonyland Redmun loam	Good to a depth of 4 to 9 inches	Poor; plastic moderate shrink-swell	Moderate to severe; moderate to slow permeability; occasionally bedrock below 4 feet	Moderate
Pena stony clay loam	Poor; high content of cobbles and stones	Fair to good; high content of cobbles and stones	Slight to moderate depending on slope	Low
12 Chimayo-Mirabal-Supervisor Chimayo stony loam	Poor; stony	Fair; moderate to high cobble and stone content; limited material	Severe; steep slopes; shallow to bedrock	Low
Mirabal stony loam	Poor; high stone content	Fair; high content of stones; limited amount of borrow materials	Severe; steep slopes; shallow to bedrock	Low
Supervisor gravelly sandy loam	Poor; gravelly and stony	Fair; very limited amount of borrow materials	Severe; steep slopes; shallow to bedrock	Low
13 Nambu-Cundiyo Nambu gravelly loam	Poor; gravelly and stony	Good; some stones	Moderate to severe; steep slopes	Low
Cundiyo gravelly sandy loam	Poor; gravelly and sandy	Good; moderate stone content	Moderate to severe; steep slopes	Low

## Soil Features Affecting --

Foundation support	Highway location	Farm ponds		
		Reservoir area	Embankment	Terraces, diversions
Low to moderate shrink-swell; bedrock at 3 to 5 feet; cobbly material above bedrock; fair bearing capacity	Steep and hilly; stones hinder grading and hauling operations	*	Stony material	*
Fair bearing capacity; poor to fair shear; low to moderate shrink-swell	Moderately plastic material; low to moderate shrink-swell	Pervious strata in substratum	Fair to good stability if compacted	**
Shallow to bedrock	Shallow to bedrock; stony	*	Very limited amount of material	*
Fair to poor bearing capacity; moderate to high shrink-swell	Plastic subsoil layers; moderate to high shrink-swell	Moderately permeable below 45 inches	Clayey material; high volume change; difficult to compact	Dense clayey subsoil; difficult to vegetate
Shallow to bedrock	Shallow to bedrock; interspersed with rock outcrops and steep slopes	*	*	*
Bedrock at 1 to 2 feet	Shallow to bedrock	*	Limited amount of borrow material	*
Fair bearing capacity and shear strength; moderate shrink-swell	Limy material; erodible when exposed on embankments; few seepage areas; some flooding; moderate shrink-swell	**	Limy material; erodible and difficult to vegetate; fair stability when compacted	Exposed limy material; erodible
Moderate to high shrink-swell; subject to flooding	Subject to flooding; plastic materials; moderate to high shrink-swell	**	Clayey material; poor compaction characteristics	Subject to flooding
Limestone bedrock 8 to 20 inches; steep slopes	Shallow to bedrock; steep slopes and rolling topography	*	Limited amount of borrow material; stony	*
Fair bearing capacity and shear strength; moderate shrink-swell	Gently to strongly sloping; plastic material	Moderately permeable substratum	Clayey material; poor compaction characteristics	Clayey subsoil; difficult to vegetate and construct
Good bearing capacity; fair shear strength; low shrink-swell	High content of cobbles and stones	Subject to seepage; stone and cobble content	Stony and cobbly material; fair stability when compacted	Moderately steep topography; stony
Shallow to bedrock	Steep slopes and hilly topography; shallow to bedrock	*	*	*
Shallow to bedrock	Steep slopes and hilly topography; shallow to bedrock	*	*	*
Shallow to bedrock	Steep slopes and hilly topography; shallow to bedrock	*	*	*
Good bearing capacity; fair shear strength; low shrink-swell	Steep slopes and hilly topography; stony material	*	*	*
Good bearing capacity; fair shear strength; low shrink-swell	Steep slopes and hilly topography	*	*	*

\*Unsuitable or practice not applicable

\*\*Soil features favorable

New Mexico State University's Agricultural Experiment Station publishes many bulletins and research reports of interest to residents of New Mexico. You may obtain a copy of the latest list of such publications by contacting the County Extension Office in your county, or by writing to:

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