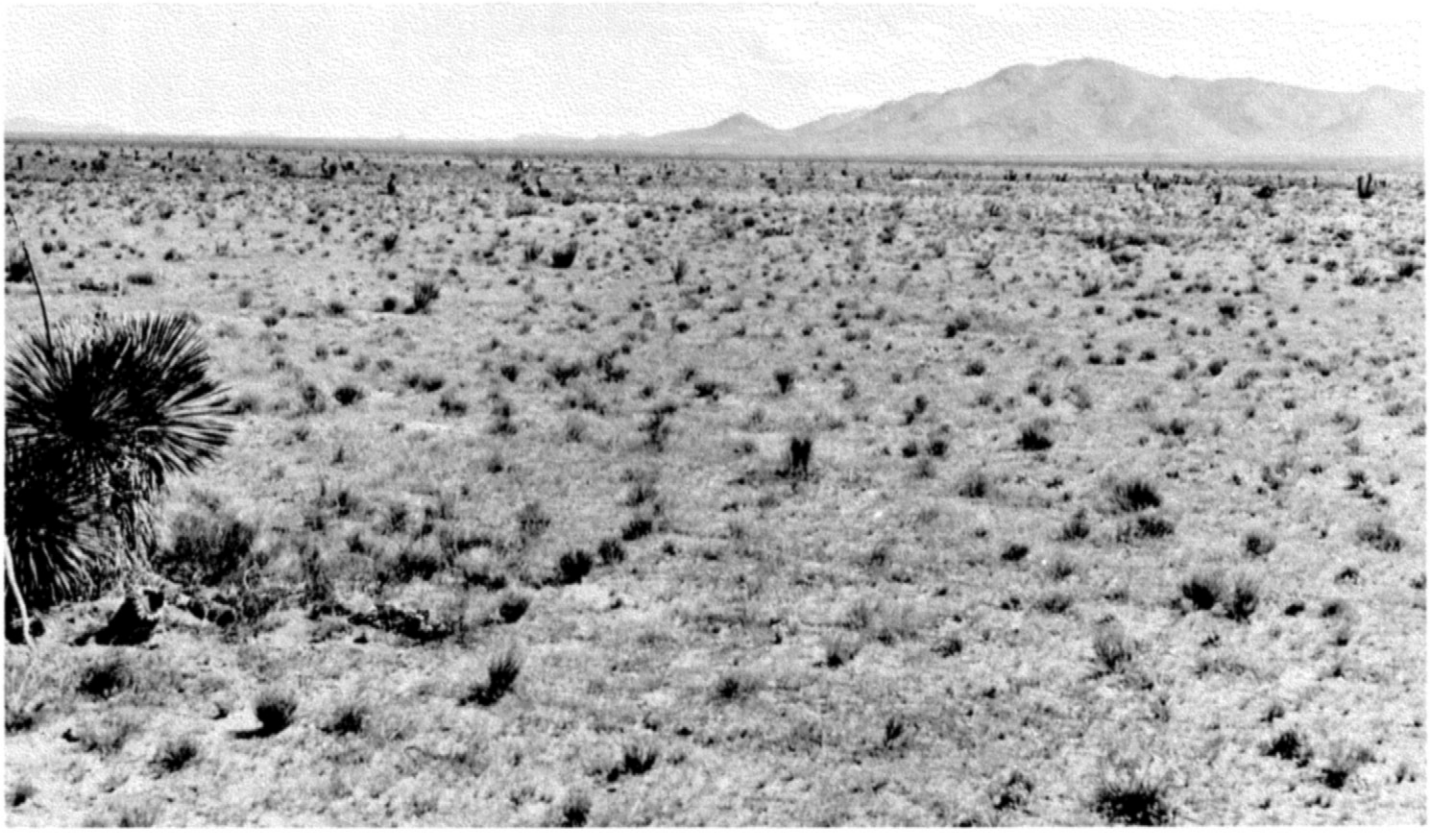
SOIL SURVEY OF

Hidalgo County, New Mexico



United States Department of Agriculture
Soil Conservation Service and Forest Service
In cooperation with
New Mexico Agricultural Experiment Station

Issued December 1973

Major fieldwork for this soil survey was done in the period 1957-67. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the survey area in 1967. This survey was made cooperatively by the Soil Conservation Service and the Forest Service, U.S. Department of Agriculture, and the New Mexico Agricultural Experiment Station. It is part of the technical assistance furnished to the Animas Valley, the Virden Valley, and the Grant Soil and Water Conservation Districts.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

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

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

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

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

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

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

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

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

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

Cover: Typical landscape of the Sonoita-Yturbide-Hap association. Pyramid Mountains are in background.

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Issued December 1973

SOIL SURVEY OF HIDALGO COUNTY, NEW MEXICO

BY DELLON N. COX, SOIL CONSERVATION SERVICE

SOILS SURVEYED BY DELLON N. COX, TERRY E. HILLEY, AND RAYMOND E. NEHER, SOIL CONSERVATION SERVICE [1]

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

HIDALGO COUNTY is in the southwest corner of New Mexico (fig. 1). It contains 2,206,080 acres, or 3,447 square miles.

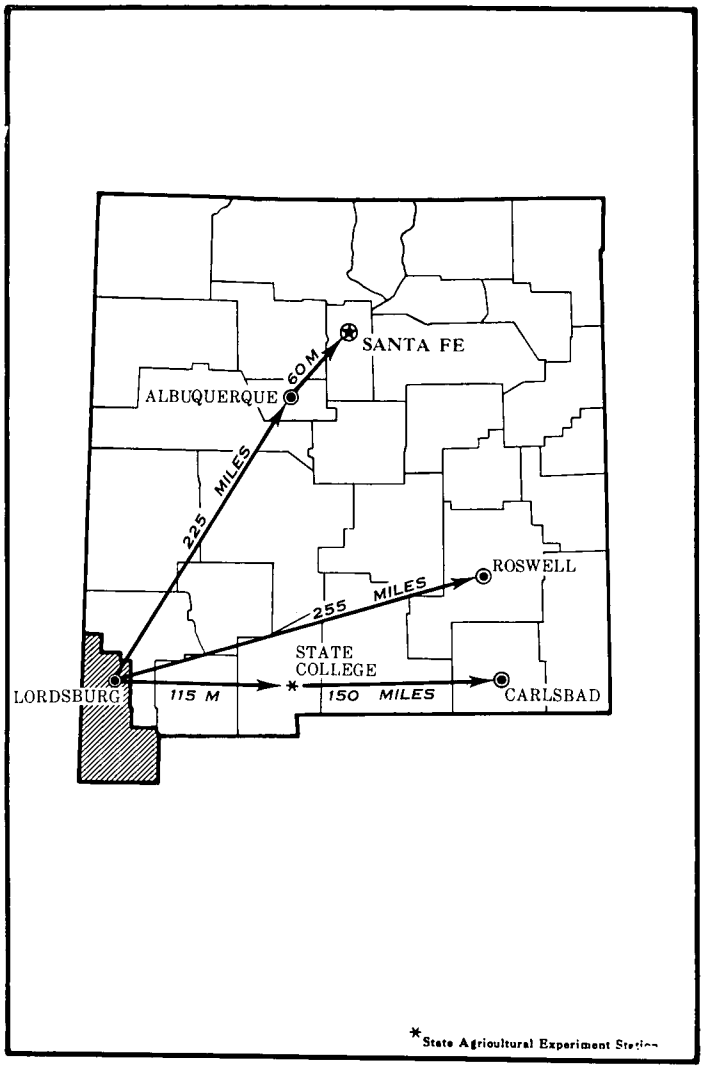

Figure 1.—**Location of Hidalgo County in New Mexico.**

The county is in the Southern Rocky Mountains geographic area. The elevation generally is between 4,000 and 5,000 feet. About one-third of the county is made up of hills and mountains. Most of these are acid igneous geological formations of the Tertiary Period, but a few areas of limestone are included. Most of the mountain peaks are more than 6,000 feet in elevation. The Big Hatchet Peak and the Animas Peak, about 8,500 feet in elevation, are the highest peaks and are well-known landmarks. Parts of the Coronado and Gila National Forests are in Hidalgo County.

Nearly two-thirds of the county is made up of valley fill that forms broad upland plains between the mountain ranges. About one-tenth of the county is made up of sediments that were deposited by streams and lakes during the Pleistocene Period or at a more recent time.

The population of Hidalgo County was about 4,300 in 1960. Lordsburg, the county seat, had a population of 3,436. Ranches occupy about 98.5 percent of the total land area, and irrigated farms occupy about 1.5 percent. The county is rich in minerals, and some heavy metals are mined. Copper is the main metal mined, but manganese, zinc, and lead are also mined. The principal mining area is in the Pyramid Mountains near Lordsburg.

The chief products of the county are beef cattle, cotton, grain sorghum, barley, alfalfa, and beans. Some vegetables are grown and marketed locally.

Hidalgo County is in three Soil and Water Conservation Districts. The Animas Valley and Virden Valley Soil and Water Conservation Districts are assisted by the Lordsburg Work Unit of the Soil Conservation Service at Lordsburg. A small part of the Grant Soil and Water Conservation District occurs in Hidalgo County. It is assisted by the Silver City Work Unit of the Soil Conservation Service in Silver City, New Mexico.

How This Soil Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Hidalgo County, where they are located, and how they can be used. The soil scientists went into the county knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils.

[1] Other soil scientists who contributed to the fieldwork were JESS C. EPPLE, JR., DANA R. GRANTHAM, and ABE STEVENSON, Soil Conservation Service, and L. D. WHEELER, JR., Forest Service.

They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide uniform procedures. The *soil series* and the *soil phase* (*7*) [2] are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Gila and Glendale, for example, are the names of two soil series. All the soils in the United States having the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Mohave sandy clay loam, 0 to 1 percent slopes, is one of several phases within the Mohave series.

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

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

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

A soil complex consists of areas of two or more soils, so intermingled or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. The name of a soil complex consists of the names of the dominant soils, joined by a hyphen. Glendale-Arizo complex is an example.

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

An undifferentiated group is made up of two or more soils that could be delineated individually but are shown as one unit because, for the purpose of the soil survey, there is little value in separating them. The pattern and proportion of soils are not uniform. An area shown on the map may be made up of only one of the dominant soils, or of two or more. The name of an undifferentiated group consists of the names of the dominant soils, joined by "and." Mimbres and Glendale loams is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, or so severely eroded that it cannot be classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Rough broken land is a land type in Hidalgo County.

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

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

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under present methods of use and management.

Soil Survey Intensities

The soils in Hidalgo County were mapped at two different intensities, high and low (fig. 2). In the high-intensity survey, where detailed information was needed, the mapping was done in considerable detail. In the low-intensity survey, which is mainly rangeland, the need for detail was less and the mapping was more generalized.

To distinguish between the two intensities of mapping, the "Guide to Mapping Units" is divided into two sections, one for the soils that were mapped in the high-intensity survey and one for the soils that were mapped in the low-intensity survey.

[2] Italic numbers in parentheses refer to Literature Cited, page 88.

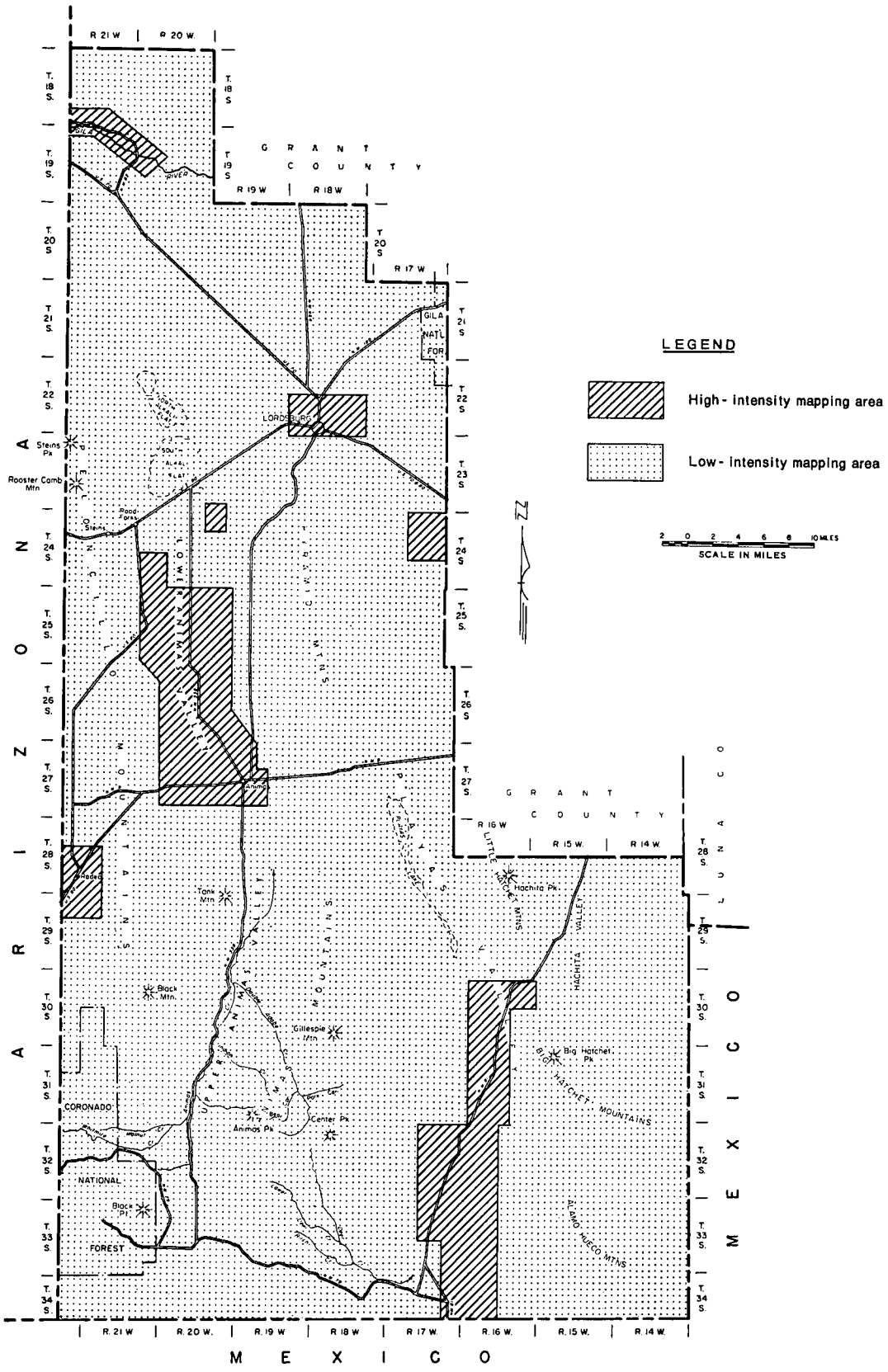

Figure 2.—Soil survey intensities in Hidalgo County.

The type of soil symbol used on the soil maps at the back of this survey indicates the level of mapping intensity. In the high-intensity survey, a capital and lower case letter are used in each soil symbol. In the low-intensity survey, both letters in the symbol are capitals.

General Soil Map

The general soil map at the back of this publication shows the soil associations in Hidalgo County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils for which it is named, and at least one minor soil. The soils in one association may occur in another, but in a different pattern. The areas of the associations conform generally to the topography in the county (fig. 3).

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of farming or other land use. Such a map is not generally suitable for planning management, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect management.

The eight soil associations in Hidalgo County are discussed in the following paragraphs.

1. Eba-Cloverdale-Eicks association

Deep, fine-textured, nearly level to strongly sloping soils on old alluvial fans

This association consists of well-drained soils that formed in old valley fill on old alluvial fans. It is in the Upper Animas Valley. Parent rocks are mixed but are mainly acid and igneous. Slopes are 0 to 15 percent. Vegetation consists of short and mid grasses, Mormon-tea, and mesquite. Elevation ranges from 4,200 to 6,000 feet. Average annual air temperature is 56° to 62° F. Average annual precipitation is 10 to 17 inches. The frost-free season is 160 to 215 days.

This association makes up 8 percent of the county. Eba soils make up about 55 percent of the association, Cloverdale soils about 15 percent, and Eicks soils about 10 percent. Anamite, Forrest, and Stellar soils make up the remaining 20 percent.

Typically, Eba soils have a reddish-brown very gravelly loam and very gravelly clay loam surface layer and a reddish-brown and red very gravelly clay subsoil. The substratum is pink, weakly cemented caliche of very gravelly light clay loam texture. The substratum restricts most plant roots. Cloverdale soils have a dark grayish-brown clay loam surface layer and a very dark grayish-brown and dark grayish-brown clay subsoil. The substratum is mixed reddish-brown, light reddish-brown, and light-gray gravelly clay. Eicks soils have a thick, dark grayish-brown loam and gravelly sandy clay loam surface layer and a dark grayish-brown gravelly clay subsoil. The substratum is grayish-brown very gravelly loam and very gravelly clay loam.

This association is used for range, wildlife, and watershed.

2. Verhalen-Glendale-Mimbres association

Deep, moderately fine textured and fine textured, nearly level to gently sloping soils on alluvial bottoms

This association consists of well drained and moderately well drained soils that formed in mixed alluvium of various textures. The Verhalen soils are mainly in the

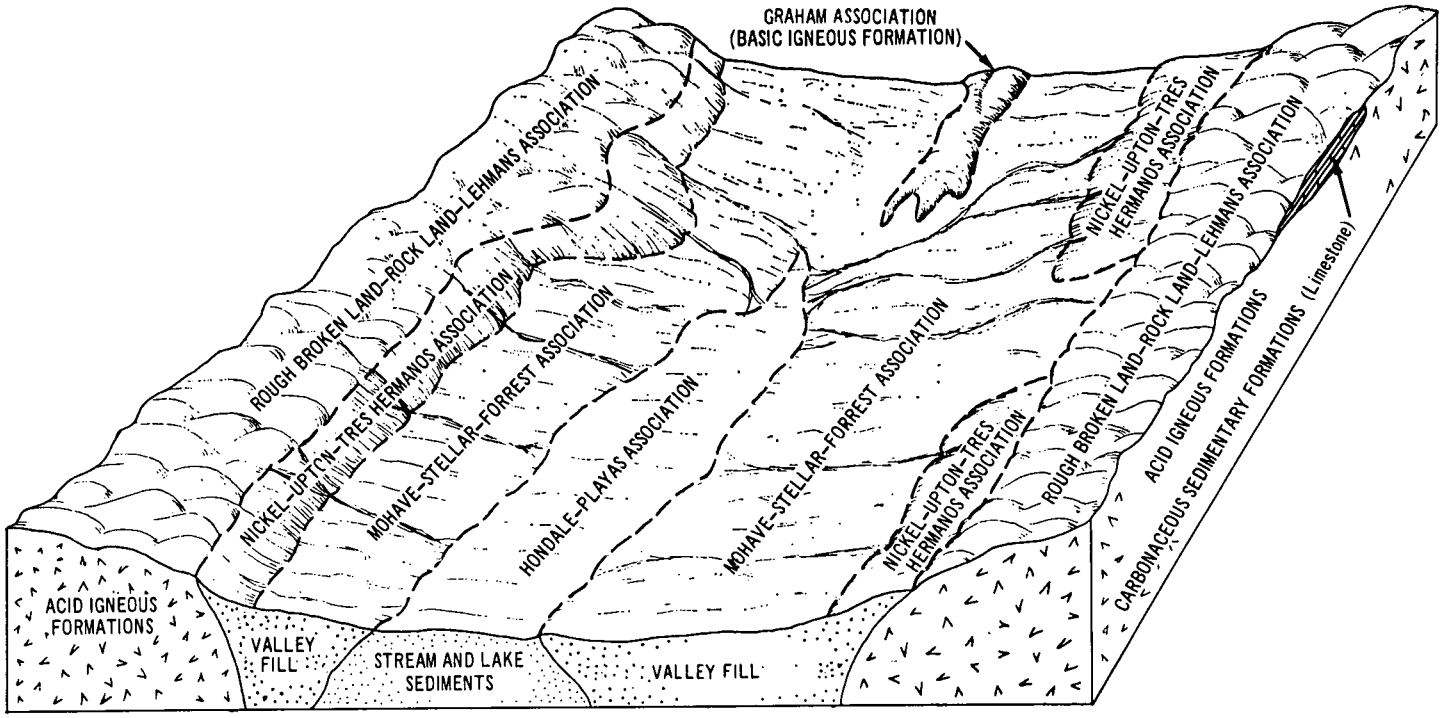

Figure 3.—Diagram showing relationship of several soil associations and the topography in Hidalgo County.

Hachita and Lordsburg Valleys. Glendale and Mimbres soils are mainly in the San Simon Valley. Glendale soils also are in the Virden Valley (fig. 4). Some areas of these soils are subject to occasional flooding. Slopes are 0 to 3 percent. Vegetation consists of short and mid grasses and mesquite. Elevation ranges from 3,700 to 5,000 feet. Average annual air temperature is 59° to 62° F. Average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

This association makes up about 1 percent of the county. Verhalen soils make up about 35 percent of the association, Glendale soils about 30 percent, and Mimbres soils about 25 percent. Grabe, Comoro, and Pima soils make up the remaining 10 percent.

Typically, Verhalen soils have a pinkish-gray and brown silty clay loam and clay loam surface layer. The next layers are brown clay and pinkish-gray silty clay. The substratum is pinkish-gray, light brownish-gray, and brown silty clay, clay loam, and silt loam. Glendale soils have a light brownish-gray silty clay loam surface layer. The substratum is light brownish-gray clay loam and very pale brown, stratified silty clay loam and silt loam. Mimbres soils have a pale-brown silty clay loam surface layer and a light-brown and brown clay loam subsoil. The substratum is pinkish-gray, brown, and pale-brown loam, sandy clay loam, and clay loam.

This association is used for irrigated cropland, range, wildlife, and watershed. Most of the irrigated acreage, about 3,000 acres, is in the Virden Valley, where cotton, corn, and alfalfa are grown.

3. *Mohave-Stellar-Forrest association*

Deep, moderately fine textured and fine textured, nearly level to gently sloping soils on old alluvial fans

This association consists of well-drained soils that formed in old valley fill from mixed igneous rocks. It is in the major valleys between mountains, primarily on old alluvial fans. Slopes are 0 to 5 percent. Vegetation consists of short and mid grasses, Mormon-tea, yucca, and mesquite. Elevation ranges from 3,700 to 6,000 feet. Average annual air temperature is 57° to 62° F. Average annual precipitation is 9 to 14 inches. The frost-free season is 160 to 215 days.

This association makes up 26 percent of the county. Mohave soils make up about 30 percent of the association, Stellar soils about 20 percent, and Forrest soils about 15 percent. Berino, Jal, Pintura, Nickel, Karro, and Eba soils make up the remaining 35 percent.

Typically, Mohave soils have a reddish-brown sandy clay loam surface layer and a reddish-brown and light reddish-brown sandy clay loam and clay loam subsoil. The substratum is light reddish-brown gravelly sandy loam. Stellar soils have a pinkish-gray sandy clay loam surface layer and a reddish-brown clay loam and light reddish-brown loam subsoil. The substratum is pink gravelly clay loam. Forrest soils have a reddish-brown gravelly loam surface layer. The subsoil is reddish-brown and red gravelly heavy clay loam and gravelly clay in the upper part and red very gravelly heavy clay loam, high in lime, in the lower part.

This association is used for irrigated cropland, range, wildlife, and watershed. Although the largest areas of potential irrigated cropland in the county are in this association, only a small percentage is used for this purpose.

4. *Graham association*

Shallow and very shallow, fine-textured, gently sloping to steep, stony soils and rock outcrops on upland basalt flows

This association consists of well-drained soils that formed in material weathered from basalt bedrock on old

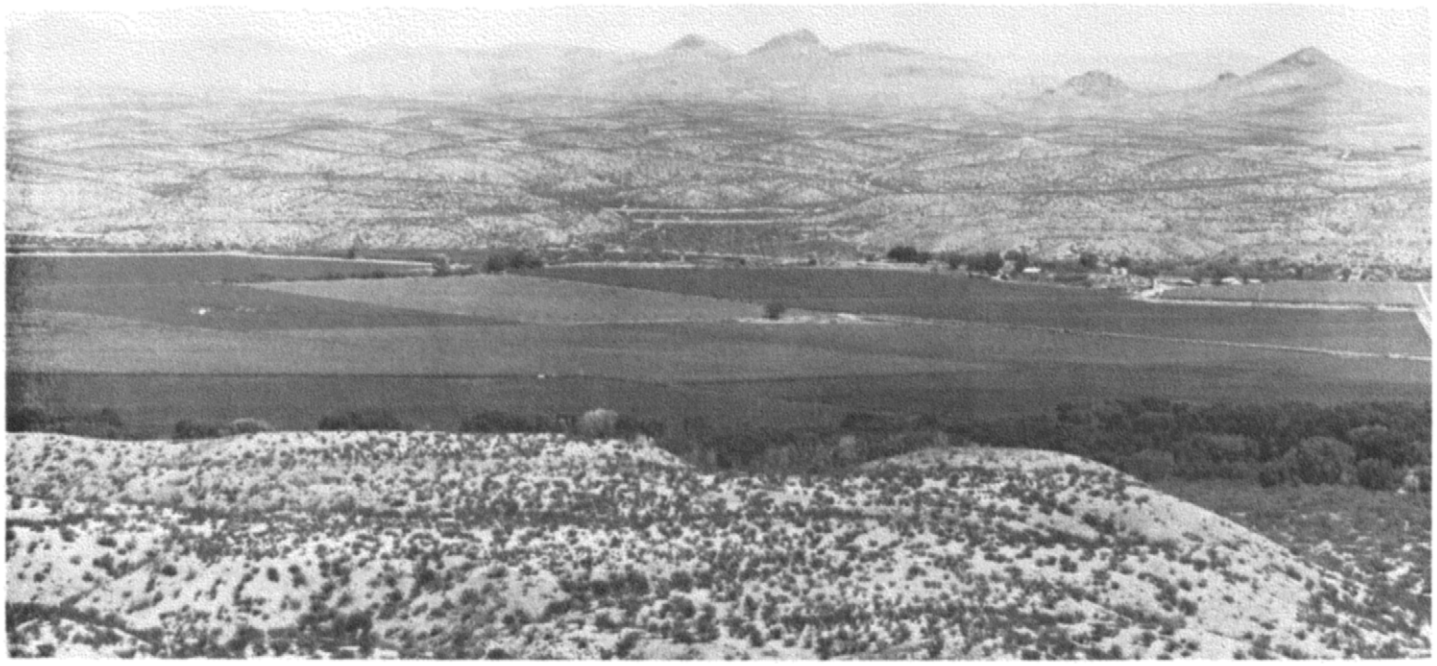

***Figure 4.*—Typical landscape of Verhalen-Glendale-Mimbres association in the Virden Valley. Rough broken land is in foreground and background.**

flows. These soils are mainly in the Animas Valley near Animas. Slopes are 0 to 45 percent. Vegetation consists of short and mid grasses and creosotebush. Elevation ranges from 4,000 to 7,000 feet. Average annual air temperature is 58° to 61° F. Average annual precipitation is 9 to 17 inches. The frost-free season is 170 to 210 days.

This association makes up about 2 percent of the county. Graham soils make up about 50 percent of the association and rock outcrops about 35 percent. Other stony, very shallow to deep soils make up the remaining 15 percent.

Typically, Graham soils have a brown, stony clay loam surface layer and a reddish-brown clay subsoil overlying basalt bedrock at a depth of 10 to 20 inches. An accumulation of lime is in the lower part of the subsoil immediately over the bedrock.

This association is used for range, wildlife, and watershed.

5. *Nickel-Upton-Tres Hermanos association*

Very shallow to deep, medium-textured and moderately fine textured, gently sloping to very steep, limy soils on uplands

This association consists of well-drained soils that formed in old valley fill from mixed limestone and rhyolite rocks. It is primarily around the bases of the major hills and mountains (fig. 5). Slopes are 0 to 60 percent. Vegetation consists of creosotebush, tarbush, annuals, and short and mid grasses. Elevation ranges from 4,000 to 6,000 feet. Average annual air temperature is 59° to 62° F. Average annual precipitation is 9 to 11 inches. The frost-free season is 170 to 210 days.

This association makes up about 19 percent of the county. Nickel soils make up about 35 percent of the association, Upton soils about 30 percent, and Tres Hermanos soils about 15 percent. Rough broken land and Turney, Mohave, and Lehmans soils make up the remaining 20 percent.

Typically, Nickel soils have a light brownish-gray gravelly sandy loam surface layer. The next layer is pale-brown gravelly loam. Beneath this, at a depth of 10 to 20 inches, is weakly cemented caliche of very gravelly loam texture. Upton soils have a brown gravelly loam surface layer that is high in lime content. The next layer, at a depth of 4 to 12 inches, is indurated caliche. Tres Hermanos soils have a light-brown gravelly clay loam surface layer and a reddish-brown and pink gravelly clay loam subsoil that is high in lime content. The substratum is pink very gravelly loam that is high in lime content and contains thin strata of sand and gravel.

This association is used for range, wildlife, and watershed.

6. *Rough broken land-Rock land-Lehmans association*

Very shallow to shallow, moderately fine textured, gently sloping to very steep, rocky and stony soils, rough broken land, and rock land on hills and mountains

This association consists of well-drained soils in major areas of hills and mountains (fig. 6). Slopes are 1 to 75 percent. Vegetation consists of short and mid grasses, yucca, century plant, pinyon pine, juniper, and live oak. Elevation ranges from 4,200 to 8,500 feet. Average annual air temperature is 58° to 61° F. Average annual precipitation is 10 to 20 inches. The frost-free season is 150 to 210 days.

This association makes up 31 percent of the county. Rough broken land and Rock land make up about 50 percent of the association, and Lehmans soils about 40 percent. Nickel, Upton, and other soils make up the remaining 10 percent.

Rough broken land and Rock land are land types that are so steep or have so many rock outcrops that it is impractical to separate individual kinds of soil within them. Some areas of Rough broken land consist of unconsolidated materials. Typically, Lehmans soils have a yellowish-red stony loam surface layer and a reddish-brown stony clay loam subsoil. Beneath this, at a depth of 15 to 20 inches, is acid igneous bedrock.

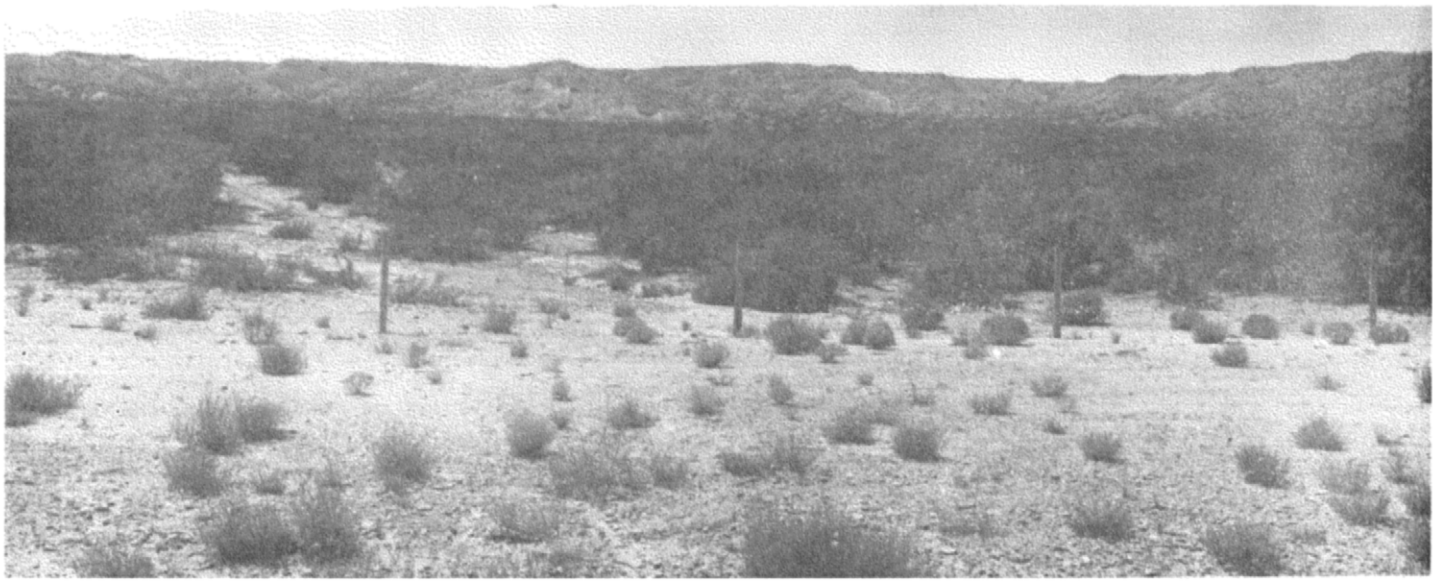

Figure 5.—Typical landscape of Nickel-Upton-Tres Hermanos association.

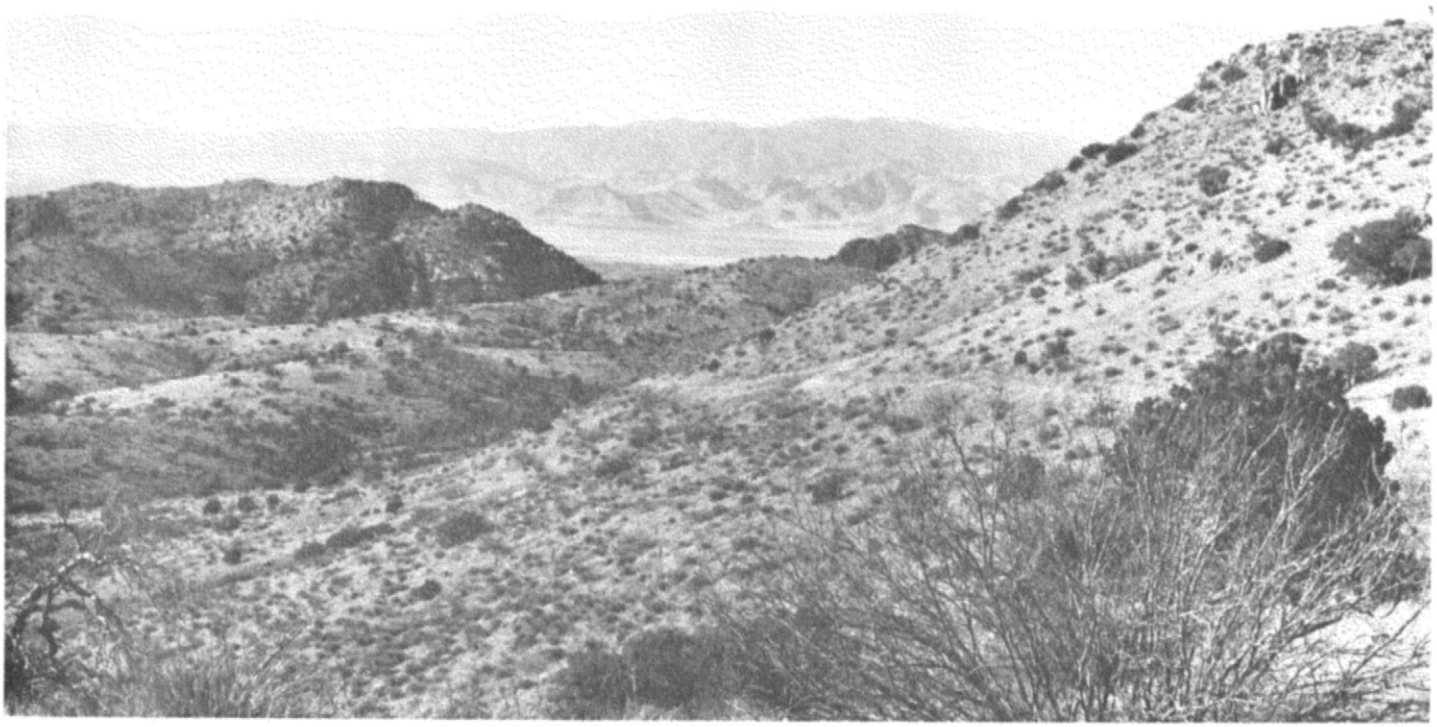

Figure 6.—**Typical landscape of Rough broken land-Rock land-Lehmans association. The San Simon Valley and Chiricahua Mountains are in the background.**

This association is used for range, wildlife, and watershed. In places wood is cut for fuel and fenceposts.

7. *Hondale-Playas association*

Deep, moderately fine textured and fine textured, nearly level to gently sloping soils on alkali flats

This association consists of well-drained Hondale soils and periodically wet Playas that formed in moderately fine textured valley fill on the bottoms of the major valleys. Slopes are 0 to 3 percent. The Playas are devoid of vegetation. Vegetation on the Hondale soils (fig. 7) consists of short and mid grasses, mesquite, fourwing saltbush, and allthorn, but many slick spots are devoid of vegetation. Elevation ranges from 4,000 to 4,500 feet.

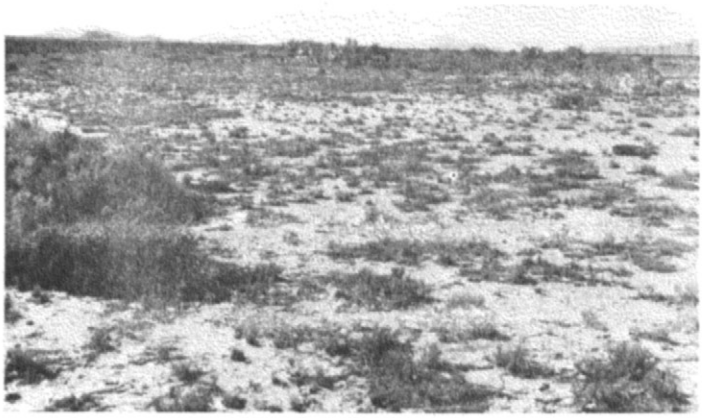

Figure 7.—**Landscape of Hondale silt loam in Hondale-Playas association.**

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Average annual air temperature is 60° to 62° F. Average annual precipitation is 9 to 11 inches. The frost-free season is 190 days to 210 days.

This association makes up about 8 percent of the county. Hondale soils make up about 65 percent of the association, and Playas about 15 percent. Alkali-affected Mimbres, Glendale, and Verhalen soils make up the remaining 20 percent.

Typically, Hondale soils have a light brownish-gray silt loam surface layer. The subsoil is grayish-brown and light-gray heavy silty clay loam that grades to light brownish-gray heavy sandy clay loam in the lower part. The substratum is stratified, light-gray sandy loam and sand. Playas are a fine-textured miscellaneous land type and are covered with water at some time in most years. Because of excessive amounts of sodium and very slow permeability, water remains on the surface of Playas until it evaporates.

This association is used for range, wildlife, and watershed. Hondale soils produce a fair amount of forage. About 1,500 acres are used for irrigated cropland.

8. *Sonoita-Yturbide-Hap association*

Deep, coarse-textured and moderately fine textured, gently sloping to moderately sloping, gravelly soils on old alluvial fans

This association consists of well-drained to excessively drained soils that formed from granitic materials on old alluvial fans around the base of the Burro Mountains. Slopes are 0 to 9 percent. Vegetation consists of short and mid grasses, yucca, mesquite, and Mormon-tea. Elevation ranges from 4,200 to 5,500 feet. Average annual

air temperature is 59° to 62° F. Average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

This association makes up about 5 percent of the county. Sonoita soils make up about 40 percent of the association, Yturbide soils about 35 percent, and Hap soils about 10 percent. Mohave, Stellar, and Forrest soils make up the remaining 15 percent.

Typically, Sonoita soils have a brown gravelly sandy loam surface layer and a brown gravelly sandy clay loam subsoil. The substratum is strong-brown gravelly loamy sand. Yturbide soils have a brown loamy sand surface layer. The substratum is brown gravelly loamy sand and strong-brown gravelly coarse sand. Hap soils have a brown gravelly loam surface layer and a red and reddish-brown gravelly sandy clay loam subsoil. The substratum is white and pinkish-gray, weakly cemented caliche that restricts most plant roots.

This association is used for range, wildlife, and watershed.

Descriptions of the Soils

This section describes the soil series and mapping units of Hidalgo County. The acreage and proportionate extent of each mapping unit are given in table 1.

The procedure in this section is first to describe the soil series, and then the mapping units in that series. A profile of a soil representative of each series is described in the series description.

Not all mapping units are soil series. Rock land, for example, is a miscellaneous land type; nevertheless, it is listed in alphabetical order with the soil series.

Following the name of each mapping unit, there is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. At the end of each description of a mapping unit are listed the irrigated capability unit, dryland capability subclass, range site, and wildlife habitat group in which the mapping unit has been placed. The pages on which the interpretative groups are described can be found by referring to the "Guide to Mapping Units" at the back of this survey.

Unless otherwise stated, the profile of the representative soil described has been located in an undisturbed area. The color of each soil horizon is described in words, such as light brownish gray, but it can also be indicated by symbols for the hue, value, and chroma, such as 10YR 6/2. These symbols, called Munsell color notations (7), are used by soil scientists to evaluate the color of the soil precisely. Unless otherwise noted, the pH was determined by using soil and water in a ratio of 1 to 5.

Unless otherwise specified, all terms used for color and consistence are for the soil when dry. In the detailed descriptions of profiles, a range in thickness is shown at the end of each horizon. This is the range in thickness of that horizon in Hidalgo County.

Zones referred to in this section are discussed in the subsection "Climatic Zones."

Many terms used in the soil descriptions and other sections of the report are defined in the Glossary.

Anamite Series

The Anamite series consists of well-drained soils that formed in water-laid sediments on dry lake bottoms. The sediments are mainly from rhyolite rocks but in part are from andesite, basalt, and limestone. Slopes are 0 to 1 percent. The principal associated soils are in the Cloverdale and Eicks series.

In a representative profile, the surface layer is grayish-brown silty clay loam about 3 inches thick. The subsoil is light brownish-gray and light olive-gray silty clay about 40 inches thick. The substratum is light-gray silty clay. The profile is slightly calcareous in the lower part of the subsoil and in the substratum.

Areas of Anamite soils range from 5,100 to 5,200 feet in elevation. The average annual precipitation is 14 to 16 inches, and the average annual air temperature is 57° to 59° F. The frost-free season is 160 to 180 days.

Anamite soils are used for range and wildlife. The vegetation consists of short grasses, annual grasses, and forbs.

Representative profile of Anamite silty clay loam, 0.1 mile west of the northwest corner of sec. 2, T. 34 S., R. 20 W.:

A1—0 to 3 inches, grayish-brown (10YR 5/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, very fine, granular structure; soft, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many very fine pores; mildly alkaline; clear, smooth boundary. 0 to 5 inches thick.

B21—3 to 14 inches, light brownish-gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; hard, firm when moist, very sticky and very plastic when wet; common fine and very fine roots; common, very fine pores; moderately alkaline; clear, wavy boundary. 8 to 14 inches thick.

B22—14 to 43 inches, light olive-gray (5Y 6/2) silty clay, olive gray (5Y 5/2) when moist; weak, fine and medium, angular blocky structure; hard, firm when moist, very sticky and very plastic when wet; common fine roots; common very fine pores; faint evidence of stratification in lower part; noncalcareous in upper part, slightly calcareous in lower few inches. lime in common, fine, soft bodies; moderately alkaline; clear, wavy boundary. 23 to 33 inches thick.

C—43 to 60 inches, light-gray (5Y 7/2) silty clay, olive gray (5Y 5/2) when moist; massive; hard, firm when moist, very sticky and very plastic when wet; few fine roots; few very fine pores; slightly calcareous, lime in common fine bodies in the upper few inches, but number of bodies decreases sharply as depth increases and lime in lower part is disseminated; few fine iron and manganese stains; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and a value of 3 to 5 when moist. Chroma is 1 or 2. This horizon ranges from silty clay loam to clay or silty clay. The B horizon has a value of 5 to 7 when dry and 4 to 6 when moist. Chroma is 1 or 2. The B horizon ranges from heavy silty clay loam to silty clay and clay. The C horizon has a value of 6 or 7 when dry and 5 or 6 when moist. Chroma ranges from 1 to 3.

Anamite silty clay loam (0 to 1 percent slopes) (AN).—This soil is in two naturally drained lakebeds near Cloverdale in the southern part of Hidalgo County. The lakebeds are separated by sandy beach material a few yards wide. Included with this soil in mapping are minor areas of Eicks and Cloverdale soils.

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

ACREAGE IN THE HIGH-INTENSITY SURVEY

Soil	Acres	Percent	Soil	Acres	Percent
Arizo gravelly sandy loam	372	(1)	Mohave sandy clay loam, 0 to 1 percent slopes	27, 242	1. 25
Berino sandy loam	1, 419	0. 05	Mohave sandy clay loam, 1 to 3 percent slopes	1, 233	. 05
Comoro fine sandy loam	333	(1)	Nickel gravelly loam, 1 to 5 percent slopes	2, 966	. 15
Comoro gravelly loam	1, 141	. 05	Playas	66	(1)
Frye sandy loam, hummocky	777	. 05	Riverwash	537	(1)
Frye loam	1, 194	. 05	Sonoita sandy loam	1, 304	. 05
Gila loam	3, 071	. 15	Stellar sandy clay loam	10, 096	. 45
Glendale silty clay loam	519	(1)	Stellar silty clay loam	4, 657	. 20
Grabe loam	795	. 05	Stellar cobbly silty clay loam	2, 591	. 10
Grabe silty clay loam	399	(1)	Tres Hermanos gravelly clay loam	2, 344	. 10
Graham extremely rocky clay loam, 0 to 3 percent slopes	8, 039	. 35	Ubar silt loam	2, 981	. 15
Hondale silt loam, strongly alkali	4, 384	. 20	Upton gravelly loam, 1 to 5 percent slopes	2, 297	. 10
Hondale complex	23, 061	1. 05	Vekol sandy clay loam	5, 625	. 25
Jal loam	5, 121	. 25	Vekol silty clay loam	5, 732	. 25
Lehmans extremely rocky loam, 10 to 25 percent slopes	1, 173	. 05	Verhalen silty clay loam	6, 786	. 30
Maricopa loamy sand	1, 317	. 05	Verhalen silty clay loam, alkali	1, 804	. 10
Mimbres and Glendale loams	1, 037	. 05	Whitlock gravelly loam, 5 to 10 percent slopes	599	. 05
Mimbres and Glendale silty clay loams	11, 765	. 55	Yturbide gravelly loamy sand	5, 385	. 25
Mimbres and Glendale silty clay loams, alkali	3, 101	. 15	Yturbide loamy sand, heavy subsoil variant	3, 222	. 15
Mimbres and Glendale silty clay loams, strongly alkali	1, 221	. 05	Total	157, 706	7. 10

ACREAGE IN THE LOW-INTENSITY SURVEY

Anamite silty clay loam	14, 421	0. 65	Lehmans-Nickel association, 1 to 9 percent slopes	43, 207	1. 95
Berino loamy sand, hummocky	31, 973	1. 45	Mimbres and Glendale silty clay loams	33, 563	1. 50
Berino sandy loam	16, 702	. 75	Mohave sandy clay loam, 0 to 5 percent slopes	125, 204	5. 65
Chiricahua-Comoro association, 5 to 25 percent slopes	6, 082	. 30	Nickel gravelly sandy loam, 3 to 9 percent slopes	128, 310	5. 80
Cloverdale loam, 0 to 3 percent slopes	5, 087	. 25	Nickel-Turney association, 0 to 5 percent slopes	7, 644	. 35
Cloverdale stony clay loam, 3 to 15 percent slopes	5, 726	. 25	Pima-Hawkeye complex	9, 888	. 45
Cloverdale-Stellar association, 0 to 3 percent slopes	21, 682	1. 00	Pinaleno-Mimbres association	2, 027	. 10
Eba very gravelly loam, 1 to 15 percent slopes	98, 371	4. 45	Pintura-Berino complex, eroded	22, 139	1. 00
Eba-Nickel complex, 10 to 60 percent slopes	31, 619	1. 45	Playas	28, 121	1. 30
Eicks loam	19, 961	. 90	Rock land	121, 030	5. 50
Forrest loam	13, 315	. 60	Rough broken land	39, 821	1. 80
Forrest gravelly loam	47, 318	2. 15	Rough broken land and rock land	274, 115	12. 40
Forrest-Pinaleno association	7, 122	. 30	Sonoita-Yturbide complex	51, 347	2. 35
Forrest-Stellar association	9, 214	. 40	Stellar sandy clay loam	88, 064	4. 00
Frye loam	2, 645	. 10	Terino-Turney association	2, 932	. 15
Gila sandy loam	15, 389	. 70	Tres Hermanos gravelly clay loam	65, 948	3. 00
Glendale-Arizo complex	9, 657	. 45	Ubar soils	19, 958	. 90
Graham rocky clay loam, 1 to 9 percent slopes	13, 616	. 60	Upton gravelly loam, 1 to 9 percent slopes	120, 749	5. 45
Graham extremely rocky clay loam, 10 to 45 percent slopes	22, 465	1. 00	Vekol soils	3, 916	. 20
Hap-Yturbide association, 1 to 9 percent slopes	19, 622	. 90	Verhalen silty clay loam	34, 865	1. 60
Hondale soils	82, 334	3. 75	Verhalen silty clay loam, alkali	13, 866	. 60
Jal loam	39, 756	1. 80	Yana gravelly sandy loam, 1 to 9 percent slopes	7, 579	. 35
Jal-Karro association	20, 648	. 95	Yturbide soils	13, 508	. 60
Keno cobbly clay loam	6, 594	. 30	Yturbide loamy sand, heavy subsoil variant	4, 291	. 20
Lehmans extremely rocky loam, 10 to 25 percent slopes	224, 963	10. 20	Total	2, 048, 374	92. 85
			Total acreage in survey area	2, 206, 080	100. 00

[1] Less than 0.05 percent.

This soil has very slow permeability. Runoff is very slow. The available water holding capacity is 9 to 10 inches. The water-supplying capacity is about 15 to 20 inches and is from precipitation and additional runoff. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for range and wildlife habitat. (Dryland capability subclass VIs; Bottomland range site, zones 6 and 7; wildlife habitat group A)

Arizo Series

The Arizo series consists of excessively drained soils that formed in sediments from well-mixed igneous rocks

on recent alluvial fans. Slopes are 2 to 5 percent. Associated soils are in the Grabe, Glendale, and Comoro series.

In a representative profile, the surface layer is light brownish-gray gravelly sandy loam about 10 inches thick. The substratum, to a depth of about 60 inches, is light brownish-gray and light-gray very gravelly loamy sand. The substratum is stratified with sand and gravel. The profile is calcareous throughout.

Areas of Arizo soils range from 3,600 to 3,900 feet in elevation. The average annual air temperature is 60° to 62° F., and the average annual precipitation is 9 to 11 inches. The frost-free season is 185 to 215 days.

Arizo soils are used for irrigated cropland and pasture, range, and wildlife habitat. The vegetation consists of mid grasses, annuals, common mesquite, and catclaw.

Representative profile of Arizo gravelly sandy loam, 1,150 feet south and 530 feet east of the center of sec. 32, T. 18 S., R. 21 W.:

Ap—0 to 10 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, crumb structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine pores; common cobblestones; slightly calcareous; mildly alkaline; clear, wavy boundary. 8 to 14 inches thick.

C1—10 to 22 inches, light brownish-gray (10YR 6/2) very gravelly loamy sand, very dark grayish brown (10YR 3/2) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many fine pores; common cobblestones; slightly calcareous; moderately alkaline; gradual, wavy boundary. 6 to 18 inches thick.

C2—22 to 60 inches, light-gray (10YR 7/2) very gravelly loamy sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry and moist, nonsticky and nonplastic when wet; common fine roots; many fine pores; few cobblestones; slightly calcareous; moderately alkaline.

The Ap horizon has a value of 6 or 7 when dry and 3 or 4 when moist. The C horizon is stratified with sand and gravel, but average texture is very gravelly loamy sand.

Arizo gravelly sandy loam (2 to 5 percent slopes) (Ar).—This soil occurs only in the Virden Valley. Included with this soil in mapping are minor areas of Grabe and Comoro soils.

This soil has very rapid permeability. Runoff is slow. The available water holding capacity is 2 to 3.5 inches. The water-supplying capacity is about 7 to 8 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

Nearly all of this soil is used for irrigated crops and pasture, but a small acreage is used for range. (Irrigated capability unit IVs–2; dryland capability subclass VIIs; Gravelly range site, zone 7; wildlife habitat group B)

Berino Series

The Berino series consists of well-drained soils that formed in old alluvium from well-mixed igneous rocks, mainly rhyolite, on alluvial fans on uplands. Slopes are 0 to 3 percent. Associated soils are in the Pintura, Sonoita, Mohave, Forrest, and Stellar series.

In a representative profile, the surface layer is reddish-yellow and yellowish-red sandy clay loam about 10 inches thick. The subsoil is yellowish-red sandy clay loam about 26 inches thick. The substratum is light-red sandy clay loam that is high in content of lime. It is weakly to strongly cemented.

Areas of Berino soils range from 4,000 to 5,500 feet in elevation. The average annual air temperature is 60° to 62° F., and the average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Berino soils are used for range, irrigated cropland, wildlife habitat, and watershed. The vegetation consists mainly of mid grasses, broom snakeweed, yucca, common mesquite, and annual weeds.

Representative profile of Berino sandy loam, 1,700 feet north and 1,200 feet west of the southeast corner of sec. 32, T. 33 S., R. 16 W.:

A11—0 to 3 inches, reddish-yellow (5YR 6/6) light sandy loam, yellowish red (5YR 4/6) when moist; weak, thick, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many, fine, interstitial pores; noncalcareous; mildly alkaline; clear, smooth boundary. 0 to 6 inches thick.

A12—3 to 10 inches, yellowish-red (5YR 5/6) sandy loam, dark red (2.5YR 3/6) when moist; weak, coarse, subangular blocky structure; soft, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many, fine, interstitial pores; noncalcareous; mildly alkaline; clear, smooth boundary. 3 to 10 inches thick.

B21t—10 to 18 inches, yellowish-red (5YR 5/6) sandy clay loam, dark red (2.5YR 3/6) when moist; moderate, medium, subangular blocky structure and moderate, coarse, prismatic structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; patchy clay films on ped surfaces; noncalcareous; mildly alkaline; clear, smooth boundary. 6 to 12 inches thick.

B22t—18 to 25 inches, yellowish-red (5YR 5/6) sandy clay loam, dark red (2.5YR 3/6) when moist; weak, medium, prismatic structure parting to moderate, medium, subangular blocky structure; very hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; nearly continuous clay films on ped surfaces; noncalcareous; mildly alkaline; clear, smooth boundary. 5 to 10 inches thick.

B3tca—25 to 36 inches, yellowish-red (5YR 5/6) sandy clay loam, reddish brown (5YR 4/4) when moist; weak, coarse, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common, very fine, tubular pores; few patchy clay films on ped surfaces; strongly calcareous; moderately alkaline; abrupt, smooth boundary. 9 to 13 inches thick.

Cca—36 to 60 inches, light-red (2.5YR 6/6) sandy clay loam, dark red (2.5YR 3/6) when moist; massive; very hard, very firm when moist, slightly sticky and slightly plastic when wet; few very fine roots in upper part; few, very fine, tubular pores; strongly calcareous; weakly to strongly cemented with lime, decreasing below a depth of about 48 inches; moderately alkaline.

The A horizon ranges from 3 to 6 in chroma. It ranges from loamy sand to sandy loam in texture. The B2t horizon has a value of 4 or 5 when dry and a chroma of 4 to 6 when dry or moist. It ranges from light sandy clay loam to light clay loam in texture. The Cca horizon is weakly to strongly cemented. It is a few inches to several feet thick. It is high in content of lime, but lime content decreases with depth. Depth to the Cca horizon ranges from 30 to 48 inches.

Berino sandy loam (0 to 3 percent slopes) (Bb) (BD).—This soil has the profile described as representative for the series.

This soil is nearly level to gently sloping in the high-intensity survey. A few small areas of sandy loam or loamy sand on hummocks occur where this soil is not cultivated. Included in the high-intensity survey are areas of Yturbide, Mohave, and Nickel soils, which make up about 10 percent of the area mapped as this Berino soil.

This soil is nearly level to gently undulating in the low-intensity survey. Typically, small areas of sandy loam or loamy sand on hummocks are scattered throughout this unit. Included in the low-intensity survey are areas of Pintura, Yturbide, Stellar, Forrest, Mohave, and Nickel soils, which make up 15 to 20 percent of the acreage.

This soil has moderate permeability. Runoff is medium. The available water holding capacity is about 5 to 6.5 inches. The water-supplying capacity is about 5 to 7 inches. The rooting depth to the strong lime zone is 30 to 40 inches. Hazard of soil blowing is moderate. Hazard of water erosion is slight to moderate.

This soil is used for range, wildlife habitat, and watershed. A few acres are irrigated in the Playas Valley. (Irrigated capability unit IIe–2; dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group C)

Berino loamy sand, hummocky (0 to 3 percent slopes) (BA).—This soil is in the eastern and northern parts of the low-intensity survey. It is on hummocks that are 10 to 36 inches high. It has a profile similar to that described as representative for the series, except that the surface layer is loamy sand and the substratum contains less lime and is not cemented. The texture of the surface layer ranges from sandy clay loam in bare areas between hummocks to loamy sand on the hummocks.

Included with this soil in mapping are areas of Pintura, Mohave, Stellar, and Yturbide soils.

This soil has moderate permeability. Runoff is slow. The available water holding capacity is 7 to 8 inches. The water-supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. The hazard of soil blowing is severe.

The soil is used entirely for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group C)

Chiricahua Series

The Chiricahua series consists of well-drained, rolling soils that formed on hills in material weathered from granitic bedrock. Bedrock is at a depth of 20 to 35 inches. Slopes are 9 to 25 percent. Associated soils are in the Comoro and Hap series.

In a representative profile, the surface layer is reddish-brown very cobbly clay loam about 4 inches thick. The subsoil is dark reddish-brown light clay and brown heavy clay loam about 16 inches thick. The substratum is brown clay loam that grades to gneiss and granite bedrock at a depth of about 25 inches.

Areas of Chiricahua soils range from 5,000 to 6,500 feet in elevation. The average annual air temperature is 59° to 61° F., and the average annual precipitation is 12 to 14 inches. The frost-free season is 180 to 200 days.

Chiricahua soils are used for range, wildlife habitat, recreation, and watershed. The vegetation is short and mid grasses, sacahuista, shrub live oak, and one-seed juniper. In places juniper and oak trees are cut for firewood and fenceposts.

Representative profile of a Chiricahua very cobbly clay loam, from an area of Chiricahua-Comoro association, 5 to 25 percent slopes, 1,600 feet west and 600 feet north of the southeast corner of sec. 11, T. 21 S., R. 17 W.:

A1—0 to 4 inches, reddish-brown (5YR 4/4) very cobbly clay loam, dark reddish brown (5YR 3/4) when moist; weak, fine, granular structure; slightly hard, friable when moist, sticky and plastic when wet; many fine roots; many, fine, tubular pores; about 10 percent fine, angular granite pebbles; 50 to 60 percent gravel and cobblestones larger than 2 inches in diameter on surface; noncalcareous; mildly alkaline; clear, smooth boundary. 2 to 5 inches thick.

B2t—4 to 10 inches, dark reddish-brown (2.5YR 3/4, dry and moist) light clay; moderate, medium, subangular blocky structure; hard and firm when moist, very sticky and very plastic when wet; common fine roots; common, fine, tubular pores; thin, discontinuous clay films on peds and pebbles; few fine pebbles; noncalcareous; mildly alkaline; gradual boundary. 4 to 8 inches thick.

B3t—10 to 20 inches, brown (7.5YR 4/4) heavy clay loam, dark brown (7.5YR 3/4) when moist; moderate, medium, subangular and angular blocky structure; hard, friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; many mica particles; noncalcareous; mildly alkaline; gradual, wavy boundary. 3 to 12 inches thick.

C—20 to 25 inches, brown (7.5YR 4/4) clay loam that is high in mica, dark brown (7.5YR 3/4) when moist; massive; hard, friable when moist, sticky and plastic when wet; few fine roots; few, fine, tubular pores; strongly calcareous; mildly alkaline; gradual, wavy boundary. 3 to 10 inches thick.

R—25 inches, gneiss bedrock that is high in mica, approaches granite in places; moderately calcareous in cracks and fissures.

The A horizon has a value of 4 or 5 when dry. Chroma is 3 or 4. The A horizon ranges from very cobbly loam to very cobbly clay loam in texture, but it is stony in places. The B horizon has a value of 3 or 4 when moist. It is heavy clay loam to clay in texture. Depth to bedrock ranges from 20 to 35 inches.

Chiricahua-Comoro association, 5 to 25 percent slopes (CC).—This association is only in the northeastern part of the low-intensity survey. About 55 percent of the association is Chiricahua very cobbly clay loam, 9 to 25 percent slopes; about 30 percent is Comoro gravelly fine sandy loam, 5 to 9 percent slopes; and about 15 percent is rock outcrop. The Chiricahua is a rolling soil on hills, and the Comoro is a less sloping soil in lower areas between the hills. The rock outcrop is on hilltops.

The Chiricahua soil has slow permeability. Runoff is rapid. The available water holding capacity is 4 to 6 inches. The water-supplying capacity is about 5 to 8 inches. Effective rooting depth is 20 to 35 inches. Hazard of water erosion is moderate.

The Comoro soil has a profile similar to that described as representative for the Comoro series, except that it has slightly more fine gravel throughout. This Comoro soil does not have a seasonal water table. It has moderately rapid permeability. Runoff is medium. The available water holding capacity is 6 to 7 inches. The water-supplying capacity is about 7 to 8 inches. Effective rooting depth is about 60 inches. Hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat, recreational areas, and watershed. In places on

the Chiricahua soil, juniper and oak trees are cut for firewood and fenceposts. (Chiricahua soil in dryland capability subclass VIIs, Hills range site, zone 6, and wildlife habitat group K; Comoro soil in dryland capability subclass VIe, Sandy range site, zones 6 and 7, and wildlife habitat group C)

Cloverdale Series

The Cloverdale series consists of well-drained soils on old alluvial fans on uplands. These soils formed in material from mixed igneous rocks, mainly rhyolite and basalt. Slopes are 0 to 15 percent. Associated soils are in the Eicks, Forrest, and Stellar series.

In a representative profile, the surface layer is dark grayish-brown clay loam about 4 inches thick. The subsoil is very dark grayish-brown and dark grayish-brown clay about 32 inches thick. The substratum is mixed reddish-brown, light reddish-brown, and light-gray gravelly clay.

Areas of Cloverdale soils range from 5,000 to 6,000 feet in elevation. The average annual air temperature is 57° to 59° F., and the average annual precipitation is 14 to 16 inches. The frost-free season is 160 to 180 days.

Cloverdale soils are used for range, wildlife habitat, and watershed. The vegetation consists of short and mid grasses and forbs.

Representative profile of a Cloverdale clay loam, from an area of Cloverdale-Stellar association, 0 to 3 percent slopes, 900 feet east and 50 feet north of the southwest corner of sec. 32, T. 32 S., R. 20 W.:

A1—0 to 4 inches, dark grayish-brown (10YR 4/2) clay loam, dark brown (7.5YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable when moist, sticky and plastic when wet; many fine and very fine roots; many, medium and fine, interstitial pores; noncalcareous; neutral; clear, smooth boundary. 3 to 6 inches thick.

B21t—4 to 9 inches, very dark grayish-brown (10YR 3/2) clay, very dark brown (10YR 2/2) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; many fine roots; few, fine and very fine, tubular pores; common, moderately thick clay films on peds; few indistinct slickensides; noncalcareous; mildly alkaline; gradual, smooth boundary. 5 to 10 inches thick.

B22t—9 to 18 inches, very dark grayish-brown (10YR 3/2) clay, very dark brown (10YR 2/2) when moist; weak, very coarse, prismatic structure and moderate, coarse and very coarse, subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; few fine and very fine roots; few, fine and very fine, tubular pores; common moderately thick clay films on peds; few indistinct slickensides; slightly calcareous; mildly alkaline; clear, irregular boundary. 6 to 10 inches thick.

B3—18 to 36 inches, dark grayish-brown (10YR 4/2) clay, dark brown (7.5YR 3/2) when moist; weak, very coarse, prismatic structure and weak, very coarse, subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; few very fine roots; few, very fine, tubular pores; strongly calcareous; moderately alkaline; clear, wavy boundary. 10 to 20 inches thick.

Cca—36 to 72 inches, mottled reddish-brown (5YR 5/3), light reddish-brown (2.5YR 6/4) and light-gray (10YR 7/2) gravelly clay; mostly massive, but a few pockets have moderate, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; few very fine roots; many fine and very fine pores; common, medium, prominent, black iron concretions and stains; common, fine, distinct lime masses; strongly calcareous; moderately alkaline.

The A horizon has a value of 3 or 4 when dry and 2 or 3 when moist. Chroma is 2 or 3. This horizon ranges from loam to clay loam or stony clay loam in texture. The B horizon has a value ranging from 2 to 4 when dry and a chroma of 2 or 3. The Cca horizon has a wide range in hue, value, and chroma. It is highly mottled and has concretions of iron and manganese. The Cca horizon ranges from clay loam to clay in texture and has a gravel content ranging from 10 to 30 percent.

Cloverdale loam, 0 to 3 percent slopes (CD).—This soil is in the southern part of the low-intensity survey, near Cloverdale. It has a profile similar to that described as representative for the Cloverdale series, except that the surface layer is loam about 5 inches thick. Included with this soil in mapping are small tracts of Stellar soils, sand bars, and gravelly ridges.

This soil has very slow permeability. Runoff is medium. The available water holding capacity is about 7.5 to 9 inches. The water-supplying capacity is about 8 to 10 inches. Effective rooting depth is about 60 inches. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIs; Clayey range site, zone 6; wildlife habitat group A)

Cloverdale stony clay loam, 3 to 15 percent slopes (CE).—This soil is in the southern part of the low-intensity survey. It has a profile similar to that described as representative for the series, except that the surface layer is stony clay loam about 4 inches thick. About 15 to 80 percent of the surface is covered with cobblestones and stones. Included with this soil in mapping are small tracts of Eicks, Forrest, and Stellar soils.

This soil has very slow permeability. Available water holding capacity is about 7.5 to 9 inches. Water supplying capacity is about 6 to 8 inches. Runoff is rapid. Hazard of water erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIe; Hills range site, zone 6; wildlife habitat group D)

Cloverdale-Stellar association, 0 to 3 percent slopes (CL).—This association is in the vicinity of Cloverdale in the low-intensity survey. About 50 percent of the association is Cloverdale clay loam, 0 to 3 percent slopes, and about 40 percent is Stellar gravelly clay loam, 0 to 3 percent slopes. The Stellar soil is on slightly elevated ridges, and the Cloverdale soil is in broad swales between the ridges. Included in mapping are areas of Eicks and Forrest soils that make up about 10 percent of the association.

The Cloverdale soil has the profile described as representative for the Cloverdale series. It has very slow permeability. Runoff is medium. The available water holding capacity is about 7.5 to 9 inches. The water-supplying capacity is about 8 to 10 inches. Effective rooting depth is about 60 inches. Hazard of erosion is slight.

The Stellar soil has a profile similar to that described as representative for the Stellar series, except that it has a surface layer of gravelly clay loam about 5 inches thick. It has slow permeability. Runoff is medium. The available water holding capacity is 8 to 9.5 inches. The water-supplying capacity generally is about 8 to 10 inches; in a few areas that receive runoff, however, the water-supply-

ing capacity is as much as 15 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The soils in this association are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIs; Clayey range site, zone 6; wildlife habitat group A)

Comoro Series

The Comoro series consists of well-drained soils that formed in recent alluvium from well-mixed igneous and sedimentary rocks on alluvial bottoms and fans. Slopes are 0 to 9 percent. Associated soils are in the Chiricahua, Hap, Grabe, Pima, and Arizo series.

In a representative profile, the surface layer is brown fine sandy loam about 12 inches thick. The substratum, to a depth of 24 inches, is grayish-brown sandy loam that is highly stratified with thin layers of loamy sand, silts, and clays. Below this, the substratum is brown stratified sand, loamy sand, and sandy loam to a depth of about 60 inches.

Areas of Comoro soils range from 3,600 feet in the Virden Valley to 5,500 feet in the northeastern corner of the county. The average annual air temperature is 58° to 60° F. The average annual precipitation is 10 inches in the Virden Valley and 12 inches at the higher elevations. The frost-free season is 185 to 215 days.

Comoro soils are used for irrigated crops, range, wildlife habitat, and watershed. The vegetation consists of annual grasses, mid grasses, sacahuista, shrub live oak, one-seed juniper, and desert willows.

Representative profile of Comoro fine sandy loam, 660 feet west and 400 feet north of south quarter corner of sec. 12, T. 19 S., R. 21 W.:

Ap—0 to 12 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine, crumb structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common, very fine, interstitial pores; slightly calcareous; moderately alkaline; abrupt, smooth boundary. 5 to 16 inches thick.

C1—12 to 24 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; highly stratified with thin layers of loamy sand, silts, and clays; hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common, very fine, tubular pores; slightly calcareous; moderately alkaline; clear, smooth boundary. 8 to 20 inches thick.

C2—24 to 60 inches, brown (10YR 5/3) stratified sand, loamy sand, and sandy loam, with thin layers of silt loam or silty clay loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine roots; common, very fine, interstitial pores; strongly calcareous; moderately alkaline; free water at a depth of 53 inches.

The A horizon has a value of 4 or 5 when dry and 2 or 3 when moist. Chroma is 2 or 3. This horizon ranges from gravelly loam to loamy sand in texture, but it is typically fine sandy loam. The co'or of the C horizon is similar to that of the A horizon. The C horizon is stratified, but the texture averages sandy loam. In many places it contains gravel, especially in the lower part.

Comoro fine sandy loam (0 to 1 percent slopes) (Cm).—This soil is only in the Virden Valley in the high-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are areas of Grabe and Arizo soils and Comoro loam and Comoro loamy sand.

This soil is well drained, but in places it has a seasonal water table at a depth of 48 to 60 inches. It has moderately rapid permeability. Runoff is slow. The available water holding capacity is 6 to 8 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. Runoff has been diverted away from areas of farmland. Effective rooting depth is about 60 inches. Hazard of soil blowing is moderate, and that of water erosion is slight.

This soil is used for irrigated crops, range, and wildlife habitat. (Irrigated capability unit IIe–2; dryland capability subclass VIIe; Bottomland range site, zones 6 and 7; wildlife habitat group C)

Comoro gravelly loam (1 to 3 percent slopes) (Co).—This soil is only in the Virden Valley in the high-intensity survey. It has a profile similar to that described as representative for the series, except that it has a surface layer of gravelly loam and contains more gravel throughout the profile. Included with this soil in mapping are small tracts of Grabe and Arizo soils.

This soil has moderately rapid permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is 15 to 20 inches from precipitation and extra runoff. Runoff has been diverted away from areas of cropland. Effective rooting depth is about 60 inches. Hazard of water erosion is moderate.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IIe–3; dryland capability subclass VIIs; Bottomland range site, zones 6 and 7; wildlife habitat group C)

Eba Series

The Eba series consists of well-drained soils that formed in old cobbly alluvium from mixed igneous rocks, mainly rhyolite, on foot slopes of mountains and on alluvial fans. Slopes are 1 to 60 percent. Associated soils are in the Forrest, Stellar, and Lehmans series.

In a representative profile, the surface layer is reddish-brown very gravelly loam and very gravelly clay loam about 6 inches thick. The subsoil is reddish-brown and red very gravelly clay about 23 inches thick. The substratum is pink, weakly cemented caliche of very gravelly light clay loam texture. It is very high in content of lime. The substratum restricts most plant roots. Cobblestones and stones occur throughout the profile.

Areas of Eba soils range from 4,200 to 6,000 feet in elevation. The average annual air temperature is 62° F. at Lordsburg and 57° F. in the southernmost part of the county. The average annual precipitation is 10 inches at the lower elevations and 17 inches at the higher elevations. The frost-free season is about 160 days at the higher elevations and about 215 days at the lower elevations.

Eba soils are used for range, wildlife habitat, and watershed. The vegetation consists mainly of short and mid grasses, common mesquite, and Mormon-tea.

Representative profile of Eba very gravelly loam, 1 to 15 percent slopes, 20 feet east of a ranch road and 528 feet west of the center of sec. 19, T. 26 S., R. 20 W.:

A11—0 to 2 inches, reddish-brown (5YR 5/4) very gravelly loam, dark reddish brown (2.5YR 3/4) when moist; weak, thin, platy structure and moderate, fine, granular structure; soft, very friable when moist, non-

sticky and nonplastic when wet; many fine roots; common, very fine, interstitial pores; about 60 percent gravel and cobblestones; noncalcareous; neutral; abrupt, smooth boundary. 2 to 5 inches thick.

A12—2 to 6 inches, reddish-brown (5YR 4/4) very gravelly clay loam, dark reddish brown (2.5YR 3/4) when moist; massive around gravel and moderate, fine, granular structure in pockets between gravel; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine pores; about 60 percent gravel and cobblestones; noncalcareous; neutral; clear, smooth boundary. 0 to 4 inches thick.

B21t—6 to 19 inches, reddish-brown (2.5YR 4/4) very gravelly clay, dark reddish brown (2.5YR 3/4) when moist; massive around gravel and moderate, fine, angular blocky structure in pockets between gravel; hard, firm when moist, sticky and plastic when wet; common fine and very fine roots; common fine pores; about 75 percent gravel and cobblestones; nearly continuous thin clay films on peds, lining pores, and on coarse fragments; noncalcareous; mildly alkaline; clear, wavy boundary. 10 to 15 inches thick.

B22t—19 to 29 inches, red (2.5YR 4/6) very gravelly clay, dark red (2.5YR 3/6) when moist; massive around gravel and moderate, fine, angular blocky structure in pockets between gravel; hard, firm when moist, very sticky and very plastic when wet; few fine and very fine roots; few very fine pores; about 60 percent gravel and cobblestones; continuous moderately thick clay films on peds and on coarse fragments; noncalcareous grading to silghtly calcareous in lower two inches; moderately alkaline; clear, wavy boundary. 8 to 16 inches thick.

Cca—29 to 60 inches, pink (5YR 8/3) very gravelly light clay loam, yellowish red (5YR 5/6) when moist; massive; very hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; weakly cemented caliche with more than 50 percent gravel and cobblestones embedded; below a depth of about 50 inches, the lime content decreases gradually; moderately alkaline.

The A horizon has a value of 4 to 6 when dry and a chroma of 3 or 4. It ranges from gravelly to very gravelly and cobbly loam to very gravelly clay loam in texture. The B horizon has a value of 3 to 7 when dry. It is heavy clay loam or clay and contains 40 to 75 percent gravel and cobblestones. The Cca horizon ranges from soft to very hard in consistence and is commonly weakly cemented. This horizon is clay loam or clay and contains 35 to 75 percent gravel and cobblestones.

Eba very gravelly loam, 1 to 15 percent slopes (EB).—This soil is extensive and occurs throughout the low-intensity survey. It has the profile described as representative for the Eba series. Included with this soil in mapping are areas of Mohave, Forrest, and Yturbide soils.

This soil has slow permeability. Runoff is medium. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 9 to 11 inches in zone 6 and 6 to 8 inches in zone 7. Effective rooting depth is about 29 inches. Hazard of water erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Gravelly range site, zone 6, and Gravelly range site, zone 7; wildlife habitat group E)

Eba-Nickel complex, 10 to 60 percent slopes (EN).—This complex consists of about 65 percent Eba stony loam, about 20 percent Nickel gravelly loam, and about 15 percent other very steeply sloping soils. It occupies the steep terminal ends of old alluvial fans and the steep side slopes along major drainages. The Eba and Nickel soils are closely intermingled. The Eba soils occupy the upper part of the fans and the Nickel soils occupy the side slopes.

The Eba soil has a profile similar to that described as representative for the Eba series, except that it has more stones on the surface. It has slow permeability. Runoff is rapid. The available water holding capacity is 2 to 4 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is about 29 inches. Hazard of water erosion is moderate to severe.

The Nickel soil has a profile similar to that described as representative for the Nickel series, except that it has a gravelly loam surface layer. The Nickel soil has moderately slow permeability. Runoff is rapid. The available water holding capacity is 1 to 2 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 12 to 20 inches. Hazard of water erosion is moderate.

This complex is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Gravelly range site, zone 6; wildlife habitat group E)

Eicks Series

The Eicks series consists of well-drained soils that formed on old alluvial fans on uplands from mixed igneous rocks, mainly rhyolite. Slopes are 0 to 3 percent. Associated soils are in the Cloverdale, Stellar, and Forrest series.

In a representative profile, the surface layer is dark grayish-brown loam and gravelly sandy clay loam about 15 inches thick. The subsoil is dark grayish-brown gravelly clay about 10 inches thick. The substratum, to a depth of 60 inches or more, is grayish-brown very gravelly loam and very gravelly clay loam.

Areas of Eicks soils range from 5,000 to 6,000 feet in elevation. The average annual air temperature is 57° to 59° F. The average precipitation is 14 to 16 inches. The frost-free season is 160 to 180 days.

Eicks soils are used for range, wildlife habitat, and watershed. The vegetation consists of short and mid grasses.

Representative profile of Eicks loam, 50 feet west of road, east center of NW¼SW¼ sec. 3, T. 33 S., R. 20 W.:

A11—0 to 3 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, thin, platy structure and moderate, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine and very fine roots; many fine and very fine pores; 10 percent fine gravel; noncalcareous; neutral; clear, wavy boundary. 2 to 5 inches thick.

IIA12—3 to 13 inches, dark grayish-brown (10YR 4/2) gravelly sandy clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; slightly hard, friable when moist, sticky and slightly plastic when wet; common fine and very fine roots; common fine and very fine pores; 25 percent fine gravel; noncalcareous; mildly alkaline; clear, smooth boundary. 8 to 12 inches thick.

IIIA3—13 to 15 inches, grayish-brown (10YR 5/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; common fine and very fine pores; 25 percent fine gravel; noncalcareous; mildly alkaline; abrupt, wavy boundary. 0 to 3 inches thick.

IVB21tb—15 to 25 inches, dark grayish-brown (10YR 4/2) gravelly clay, very dark grayish brown (10YR 3/2) when moist; common, medium, distinct mottles of yellowish brown (10YR 5/6); massive; very hard, firm when moist, sticky and plastic when wet; few fine and very fine roots and pores; thick clay films in the few, fine and very fine, tubular pores and on surfaces of pebbles; 35 percent fine gravel; noncalcareous; mildly alkaline; clear, wavy boundary. 8 to 16 inches thick.

IVB22tb—25 to 60 inches, grayish-brown (10YR 5/2) stratified very gravelly loam and very gravelly clay loam, dark grayish brown (10YR 4/2) when moist; common, medium, distinct mottles of yellowish brown (10YR 5/6); massive; hard, friable when moist, slightly sticky and plastic when wet; few fine and very fine roots and pores; moderately thick clay films on surfaces of pebbles; 45 percent fine gravel; slightly calcareous; moderately alkaline.

The A horizon has a value ranging from 3 to 5 when dry and 2 to 4 when moist. Chroma is 2 or 3. This horizon is sandy loam, loam, and sandy clay loam in texture and contains 5 to 30 percent gravel. The IVB21tb horizon has a value ranging from 3 to 5 when dry and 2 to 4 when moist. Chroma is 2 or 3. The IVB22tb horizon is stratified very gravelly sand, silt, and clay, but on the average is gravelly light clay loam in texture. In many places, some small iron and manganese concretions occur in the IVB21tb and IVB22tb horizons.

Eicks loam (0 to 3 percent slopes) (ES).—This soil is only in the southwestern part of the low-intensity survey, near Cloverdale. Included with this soil in mapping are areas of Cloverdale, Stellar, and Forrest soils.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is about 10 to 12 inches. Effective rooting depth is about 60 inches. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIs; Loamy range site, zone 6; wildlife habitat group A)

Forrest Series

The Forrest series consists of well-drained soils that formed on old alluvial fans on uplands from mixed igneous rocks, mainly rhyolite. Slopes are 0 to 5 percent. Associated soils are in the Stellar, Mohave, Pinaleno, Mimbres, and Yturbide series.

In a representative profile, the surface layer is reddish-brown gravelly loam about 4 inches thick. The subsoil extends to a depth of 60 inches. The upper 7 inches of the subsoil is reddish-brown gravelly heavy clay loam; the next 12 inches is red gravelly clay; the next 7 inches is reddish-brown light clay; and the lower 30 inches is red very gravelly clay loam that is high in content of lime. The lower 30 inches is weakly cemented and restricts plant roots.

Areas of Forrest soils range from 3,700 to 6,000 feet in elevation. The average annual air temperature is about 62° F. at the lower elevations and 57° F. at the highest elevations. The average annual precipitation is 10 to 14 inches. The frost-free season is 160 to 215 days.

Forrest soils are used for range, wildlife habitat, and watershed. The vegetation consists of short and mid grasses, broom snakeweed, and common mesquite.

Representative profile of Forrest gravelly loam, 530 feet north of the southwest corner of sec. 18, T. 28 S., R. 19 W.:

A1—0 to 4 inches, reddish-brown (5YR 5/4) gravelly loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common fine pores; noncalcareous; mildly alkaline; clear, smooth boundary. 2 to 6 inches thick.

B1t—4 to 11 inches, reddish-brown (2.5YR 4/4) gravelly heavy clay loam, dark reddish brown (2.5YR 3/4) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; common very fine roots; common, very fine, tubular pores; thin continuous clay films on peds; noncalcareous; mildly alkaline; clear, smooth boundary. 5 to 10 inches thick.

B21t—11 to 17 inches, red (2.5YR 4/6) gravelly clay, dark red (2.5YR 3/6) when moist; mottles of dark reddish-brown (2.5YR 3/4) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; common very fine roots; common, very fine, tubular pores; thick continuous clay film on peds; few, small, black stains; slightly calcareous; mildly alkaline; gradual, irregular boundary. 4 to 8 inches thick.

B22t—17 to 23 inches, red (2.5YR 4/6) gravelly clay, dark red (2.5YR 3/6) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; common very fine roots; common, very fine, tubular pores; continuous clay film on peds and pebbles; few black stains; slightly calcareous; mildly alkaline; clear, smooth boundary. 4 to 8 inches thick.

B23tca—23 to 30 inches, reddish-brown (2.5YR 4/4) gravelly light clay, dark red (2.5YR 3/6) when moist; weak, coarse, subangular blocky structure; very hard, friable when moist, very sticky and plastic when wet; few very fine roots; common, very fine, tubular pores; patchy clay films on ped surfaces; few lime mycelia, few lime flecks, and few, medium, prominent, soft lime concretions; patchy lime coatings on pebbles; strongly calcareous; moderately alkaline; clear, smooth boundary. 5 to 10 inches thick.

B3ca—30 to 60 inches, red (2.5YR 5/6) very gravelly heavy clay loam, red (2.5YR 4/6) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; no roots; few, very fine, tubular pores; pockets of weakly cemented caliche and gravel that are easily broken with shovel; strongly calcareous; moderately alkaline; cementation and lime content gradually decrease below a depth of 40 inches.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 3 to 5. This horizon ranges from gravelly loam to gravelly sandy loam or from loam to sandy loam in texture. The Bt horizon has a value of 4 or 5 when dry. It ranges from gravelly clay to gravelly clay loam in texture and contains 15 to 35 percent gravel. The B3ca horizon is high in content of lime and is weakly to strongly cemented. It contains from 35 to 50 percent gravel.

Forrest gravelly loam (1 to 3 percent slopes) (FG).—This soil is throughout the low-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are areas of Stellar and Mohave soils, Forrest sandy loam, and Forrest loam.

This soil has slow permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is about 6 inches at the lowest elevations and about 8 inches at the highest elevations. Effective rooting depth is about 30 inches. Hazard of water erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIe in zone 6 and VIIe in zone 7; Loamy range site, zone 6, and Loamy range site, zone 7; wildlife habitat group C)

Forrest loam (1 to 3 percent slopes) (FE).—This soil has a profile similar to that described as representative for the series, except that the surface layer is loam about 1 foot thick. Included with this soil in mapping are small tracts of Mohave and Pinaleno soils, Forrest sandy loam, and Forrest gravelly loam.

This soil has slow permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is about 6 inches at the lowest elevations and about 8 inches at the highest elevations. Effective rooting depth is about 30 inches. Hazard of water erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIe in zone 6 and VIIe in zone 7; Loamy range site, zone 6, and Loamy range site, zone 7; wildlife habitat group C)

Forrest-Pinaleno association (0 to 3 percent slopes) (FL).—This association is only in the San Simon Valley in the low-intensity survey. It consists of about 60 percent Forrest gravelly loam and about 30 percent Pinaleno gravelly loamy sand. The Pinaleno soil is on narrow, elongated ridges, and the Forrest soil is in swales between the ridges. Inclusions of Mohave, Mimbres, Stellar, and Glendale soils make up about 10 percent of the association.

The Forrest soil has slow permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is about 6 inches at the lowest elevations and about 8 inches at the highest elevations. Effective rooting depth is about 30 inches. Hazard of water erosion is moderate.

The Pinaleno soil has moderately slow permeability. Runoff is medium. The available water holding capacity is 3 to 4 inches. The water-supplying capacity is 6 to 7 inches. Effective rooting depth is about 60 inches. Hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat, and watershed. (Forrest soil in dryland capability subclass VIIe, Loamy range site, zone 7, and wildlife habitat group C; Pinaleno soil in dryland capability subclass VIIe, Gravelly range site, zone 7, and wildlife habitat group B)

Forrest-Stellar association (1 to 5 percent slopes) (FM).—This association consists of about 45 percent Forrest gravelly sandy loam, 1 to 5 percent slopes, and about 40 percent Stellar sandy clay loam, 1 to 3 percent slopes. Inclusions of Mohave, Mimbres, and Verhalen soils make up about 15 percent of the association. The Forrest soil is on slightly elevated ridges, and the Stellar soil is in broad swales between the ridges.

The Forrest soil has a profile similar to that described as representative for the Forrest series, except that it has a gravelly sandy loam surface layer. It has slow permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is about 6 inches at the lowest elevations and about 8 inches at the highest elevations. Effective rooting depth is about 30 inches. Hazard of water erosion is moderate.

The Stellar soil has a profile similar to that described as representative for the Stellar series, except that it has a sandy clay loam surface layer about 8 inches thick. It has slow permeability. Runoff is slow. The available water holding capacity is 8 to 9.5 inches. The water-supplying capacity generally is about 10 inches at the highest elevations and about 8 inches at the lowest elevations. In a few areas that receive runoff, the water-supplying capacity is as much as 15 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat, and watershed. (Forrest soil in dryland capability subclass VIe in zone 6 and VIIe in zone 7, Loamy range site, zone 6, Loamy range site, zone 7, and wildlife habitat group C; Stellar soil in dryland capability subclass VIs in zone 6 and VIIs in zone 7, Loamy range site, zone 6, and Loamy range site, zone 7, and wildlife habitat group C)

Frye Series

The Frye series consists of well-drained soils that formed in old valley fill from mixed igneous rocks, mainly rhyolite, on alluvial fans on uplands. A strongly cemented silica hardpan is at a depth of 20 to 36 inches. Slopes are 0 to 3 percent. Associated soils are in the Stellar, Forrest, Jal, and Mimbres series.

In a representative profile, the surface layer is pinkish-gray loam about 5 inches thick. The subsoil is reddish-brown heavy clay loam about 23 inches thick and is calcareous in the lower part. The substratum is a light-brown, silica-cemented hardpan.

Areas of Frye soils range from 3,800 to 4,500 feet in elevation. The average annual air temperature is about 62° F. in the San Simon Valley and about 59° in the Upper Animas Valley. The average annual precipitation is 10 to 12 inches. The frost-free season is 190 to 220 days in the San Simon Valley and 160 to 180 days in the Upper Animas Valley.

Frye soils are used for irrigated crops, range, wildlife habitat, and watershed. The vegetation consists mainly of short and mid grasses, Mormon-tea, and common mesquite shrubs.

Representative profile of Frye loam, 500 feet northwest of the east quarter corner of sec. 36, T. 28 S., R. 22 W., on the south side of borrow pit on the east side of the highway:

A11—0 to 2 inches, pinkish-gray (7.5YR 6/2) loam, dark brown (7.5YR 4/2) when moist; weak, thin, platy structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many vesicular pores; noncalcareous; mildly alkaline; clear, smooth boundary. 0 to 4 inches thick.

A12—2 to 5 inches, pinkish-gray (7.5YR 6/2) heavy loam, dark reddish brown (5YR 3/3) when moist; weak, thick, platy structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many vesicular pores; noncalcareous; mildly alkaline; clear, smooth boundary. 2 to 5 inches thick.

B21t—5 to 16 inches, reddish-brown (5YR 4/3) heavy clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium, prismatic structure and moderate, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; many fine roots; common, fine, tubular pores; patchy to nearly continuous clay films on peds; noncalcareous; mildly alkaline; clear, smooth boundary. 6 to 18 inches thick.

B22t—16 to 24 inches, reddish-brown (5YR 5/3) heavy clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium, prismatic structure and moderate, medium, subangular blocky structure; very hard,

friable when moist, sticky and plastic when wet; few fine roots; common, fine, tubular pores; patchy clay films on peds; few threads of lime; slightly calcareous within peds, strongly calcareous on peds; mildly alkaline; clear, smooth boundary. 4 to 14 inches thick.

B3ca—24 to 28 inches, reddish-brown (5YR 5/4) clay loam, reddish-brown (5YR 4/4) when moist; moderate, thick, platy structure and weak, medium, subangular blocky structure; very hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common, fine, tubular pores; small specks of manganese stains on peds; common, medium, soft lime concretions; slightly calcareous in peds, strongly calcareous between peds; moderately alkaline; clear, smooth boundary. 2 to 6 inches thick.

Csim—28 inches, light-brown (7.5YR 6/4) strongly cemented silica hardpan, brown (7.5YR 4/4) when moist; no roots; no pores; slightly calcareous to strongly calcareous.

The A horizon ranges from 5 to 7 in value when dry and from 2 to 4 in chroma. It ranges from loamy sand to loam in texture. The B horizon has a value of 4 to 6 when dry and has a chroma of 3 or 4. The Bt horizon ranges from heavy clay loam to light clay in texture. The silica pan is stratified and contains thin veins of weakly cemented caliche in places. Depth to the silica pan ranges from 20 to 36 inches. Where wells have been drilled in these soils, the silica pan extends to a depth of about 12 to 33 feet and is intermittent or continuous.

Frye sandy loam, hummocky (0 to 3 percent slopes) (Fn).—This soil is only in the high-intensity survey near Rodeo. It has a profile similar to that described as representative for the series, except that it has a sandy loam surface layer about 6 inches thick. About 50 percent of the surface is covered with loamy sand hummocks that average about 24 inches in height.

This soil has slow permeability. The available water holding capacity is 4 to 5 inches. The water-supplying capacity is about 7 to 8 inches. Runoff is slow. Effective rooting depth is 20 to 36 inches. Hazard of soil erosion is severe.

This soil is used for range, wildlife habitat, and watershed. A small acreage has been used for irrigated cropland. (Irrigated capability unit IIIe-4; dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group F)

Frye loam (0 to 1 percent slopes) (Fr).—This soil is only in the San Simon Valley near Rodeo in the high-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are areas of Jal and Mimbres soils.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 4 to 5 inches. The water-supplying capacity is about 8 to 9 inches. Effective rooting depth is 20 to 36 inches. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IIIs-6; dryland capability subclass VIIs; Loamy range site, zone 7; wildlife habitat group F)

Frye loam (0 to 3 percent slopes) (FY).—This soil is only near Rodeo and in the Upper Animas Valley in the low-intensity survey. Included with this soil in mapping are small areas of Karro, Forrest, and Mimbres soils. Also included are areas of soils that have a sandy loam surface layer.

This soil has slow permeability. The available water holding capacity is 4 to 5 inches. The water-supplying capacity is 7 to 8 inches. Runoff is slow to medium. Effective rooting depth is 20 to 36 inches. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Loamy range site, zone 7; wildlife habitat group F)

Gila Series

The Gila series consists of well-drained soils that formed in recent alluvial sediments from mixed igneous and sedimentary rocks on alluvial bottoms and fans. Slopes are 0 to 3 percent. Associated soils are in the Mimbres, Glendale, Stellar, and Mohave series.

In a representative profile, the surface layer is brown loam about 4 inches thick. The underlying material, to a depth of about 23 inches, is brown loam. Between depths of about 23 and 40 inches is light-brown loam. Below this, to a depth of about 60 inches, is light-brown gravelly loamy sand. It is stratified with loam and fine sandy loam.

Areas of Gila soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

Gila soils are used for irrigated cropland, range, wildlife habitat, and watershed. The vegetation consists of mid grasses, common mesquite, allthorn, yucca, and annual weeds.

Representative profile of Gila loam, three-fourths mile west of the southeast corner of sec. 28, T. 25 S., R. 20 W.:

A1—0 to 4 inches, brown (10YR 5/3) loam, dark yellowish brown (10YR 3/4) when moist; weak, thick, platy structure parting to weak, thin, platy structure and weak, fine, granular structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common fine interstitial pores; slightly calcareous; mildly alkaline; clear, smooth boundary. 2 to 6 inches thick.

AC—4 to 13 inches, brown (10YR 5/3) loam, dark yellowish brown (10YR 3/4) when moist; weak, medium, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; slightly calcareous; mildly alkaline; clear, wavy boundary. 5 to 14 inches thick.

C1—13 to 23 inches, brown (10YR 5/3) loam, dark brown (7.5YR 3/4) when moist; very weak, coarse, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; slightly calcareous; mildly alkaline; gradual, wavy boundary. 6 to 14 inches thick.

C2—23 to 31 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 4/4) when moist; massive; hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; slightly calcareous; mildly alkaline; gradual, wavy boundary. 4 to 14 inches thick.

C3ca—31 to 40 inches, light-brown (7.5YR 6/4) loam, brown (7.5YR 4/4) when moist; massive; hard, very friable when moist, slightly sticky and slightly plastic when wet; few threads of lime; few fine roots; common, fine, tubular pores; strongly calcareous; moderately alkaline; abrupt, smooth boundary. 0 to 10 inches thick.

IIC4ca—40 to 60 inches, light-brown (7.5YR 6/4) gravelly loamy sand that contains strata of loam and fine sandy loam, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; very few fine roots; common,

fine, interstitial pores; thin lime coatings on the surface of pebbles; strongly calcareous; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. This horizon ranges from fine sandy loam to loam and sandy clay loam in texture. The AC and C horizons have colors similar to those of the A horizon. Texture is very fine sandy loam or loam that contains thin strata of fine sandy loam. Clay content averages 12 to 18 percent. The A and AC horizons range from noncalcareous to moderately calcareous. The IIC horizon ranges from sandy loam to gravelly sand that contains strata of loam and sandy loam.

Gila sandy loam (0 to 3 percent slopes) (GA).—This soil is only in the low-intensity survey. It has a profile similar to that described as representative for the series, except that it has a sandy loam surface layer about 3 inches thick. The underlying material is fine sandy loam that has strata of loam, silt loam, and very fine sandy loam. Included with this soil in mapping are areas of Mimbres and Yturbide soils that make up as much as 20 percent each of the areas mapped as this Gila soil.

This soil has moderate permeability. Runoff is slow. The available water holding capacity is 7.5 to 9 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. The effective rooting depth is 60 inches or more. Hazard of soil blowing is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Bottomland range site, zones 6 and 7; wildlife habitat group C)

Gila loam (0 to 1 percent slopes) (Gb).—This soil is only in the high-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are minor areas of Glendale and Yturbide soils and other Gila soils.

This soil has moderate permeability. Runoff is slow. The available water holding capacity is 7.5 to 9 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. Runoff is generally diverted from cropland. The effective rooting depth is about 60 inches or more. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit I–1; dryland capability subclass VIIc; Bottomland range site, zones 6 and 7; wildlife habitat group C)

Glendale Series

The Glendale series consists of well-drained soils that formed in recent alluvium from mixed igneous and sedimentary rocks on alluvial bottoms and in swales. Slopes are 0 to 2 percent. Associated soils are in the Arizo, Mimbres, Grabe, Gila, Verhalen, Mohave, and Stellar series.

In a representative profile, the surface layer is light brownish-gray silty clay loam about 16 inches thick. The substratum, to a depth of 24 inches, is light brownish-gray silty clay loam. Between depths of 24 and 45 inches, it is pale-brown silty clay loam stratified with thin layers of clay, silt loam, and sand and gravel. Below this, the substratum, to a depth of about 60 inches, is very pale brown, stratified silty clay loam and silt loam that has thin layers of sand and gravel.

Areas of Glendale soils range from 3,700 to 5,000 feet in elevation. The average annual air temperature is about 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

Glendale soils are used for irrigated cropland, range, wildlife habitat, and watershed. The vegetation consists of short and mid grasses and common mesquite.

Representative profile of Glendale silty clay loam, 330 feet south and 330 feet west of the east quarter corner of sec. 31, T. 18 S., R. 21 W.:

Ap1—0 to 9 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; hard, very friable when moist, sticky and plastic when wet; common fine roots; few, fine, tubular pores; slightly calcareous; mildly alkaline; abrupt, wavy boundary. 6 to 12 inches thick.

Ap2—9 to 16 inches, same as Ap1 horizon but more compact and massive; older and deeper plow zone. 0 to 8 inches thick.

C1—16 to 24 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; moderately calcareous; moderately alkaline; abrupt, wavy boundary. 6 to 10 inches thick.

C2—24 to 45 inches, pale-brown (10YR 6/3) silty clay loam stratified with thin layers of clay and silt loam and small pockets of sand or gravel, or both, dark brown (10YR 4/3) when moist; massive; hard, friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; moderately calcareous; moderately alkaline; abrupt, wavy boundary. 15 to 25 inches thick.

C3—45 to 60 inches, very pale brown (10YR 7/4), stratified silty clay loam and silt loam, and discontinuous strata of sand or gravel, or both, yellowish brown (10YR 5/4) when moist; moderate, thin, platy structure; hard, very friable when moist, sticky and plastic when wet; few fine roots; common, fine, tubular pores; slightly calcareous; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. The A horizon is clay loam, loam, or silty clay loam in texture. The C horizon is stratified with material of variable texture but is commonly clay loam or silty clay loam. The profile is slightly to strongly calcareous and contains disseminated lime.

Glendale silty clay loam (0 to 2 percent slopes) (Gc).—This soil is in the Virden Valley in the high-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are areas of Mimbres and Grabe soils and other Glendale soils.

This soil has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 12 inches. The water-supplying capacity is 15 to 20 inches from precipitation and additional runoff. Runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit I–2; dryland capability subclass VIIc; Bottomland range site, zones 6 and 7; wildlife habitat group H)

Glendale-Arizo complex (0 to 3 percent slopes) (GD).—This complex consists of about 50 percent Glendale clay loam, 0 to 1 percent slopes, intermingled with about 30 percent Arizo loamy fine sand, 1 to 3 percent slopes. The Glendale soil occurs on broad alluvial bottom lands. The Arizo soil occurs on long, narrow, undulating sand bars within the areas of alluvial bottom lands. Included in

mapping are about 20 percent Mimbres soils and other Glendale and Arizo soils.

The Glendale soil has a profile similar to that described as representative for the Glendale series, except that it has a surface layer of brown clay loam about 10 inches thick. It has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 12 inches. The water-supplying capacity is 15 to 20 inches from precipitation and additional runoff. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The Arizo soil has a profile similar to that described as representative for the Arizo series, except that it has a surface layer of grayish-brown loamy sand about 11 inches thick. It has very rapid permeability. Runoff is slow. The available water holding capacity is 2 to 3.5 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. Effective rooting depth is about 60 inches. Hazard of erosion is slight.

The soils in this complex are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Bottomland range site, zones 6 and 7; wildlife habitat group H)

Grabe Series

The Grabe series consists of well-drained soils that formed in recent alluvium from mixed igneous and sedimentary rocks on alluvial bottoms. Slopes are 0 to 1 percent. Associated soils are in the Glendale, Comoro, and Arizo series.

In a representative profile the surface layer is grayish-brown loam about 11 inches thick. The substratum, to a depth of 60 inches or more, is stratified, grayish-brown and brown loam.

Areas of Grabe soils range from 3,700 to 4,000 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Grabe soils are used for irrigated crops, range, wildlife habitat, and watershed. The native vegetation is short and mid grasses.

Representative profile of Grabe loam, 500 feet west and 100 feet south of the north quarter corner of sec. 18, T. 19 S., R. 20 W.:

Ap—0 to 11 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, somewhat compact near bottom, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many wormholes; slightly calcareous; mildly alkaline; clear, wavy boundary. 6 to 15 inches thick.

C1—11 to 16 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure; slightly hard, less compact than Ap horizon, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; slightly calcareous; moderately alkaline; diffuse boundary. 5 to 20 inches thick.

C2—16 to 60 inches, brown (7.5YR 5/2) loam, dark brown (7.5YR 3/2) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; thin strata of fine sandy loam to silt loam underlain by stratified sandy material; moderately calcareous; moderately alkaline.

The A horizon has a value of 4 or 5 when dry and 2 or 3 when moist. It ranges from loam to silty clay loam in texture. The C horizon is stratified; it averages loam in texture and contains 14 to 18 percent clay.

Grabe loam (0 to 1 percent slopes) (Ge).—This soil is only in the Virden Valley in the high-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are small areas of Glendale and Comoro soils.

This soil has moderate permeability. Runoff is slow. The available water holding capacity is 9 to 11 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. The water from additional runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit I–1; dryland capability subclass VIIc; Bottomland range site, zones 6 and 7; wildlife habitat group C)

Grabe silty clay loam (0 to 1 percent slopes) (Gm).—This soil is only in the Virden Valley in the high-intensity survey. It has a profile similar to that described as representative for the series, except that it has a silty clay loam surface layer about 12 inches thick. Included with this soil in mapping are areas of Pima and Glendale soils that make up less than 15 percent of the mapping unit.

This soil has moderate permeability. Runoff is slow. The available water holding capacity is 9 to 11 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. The water from additional runoff is generally diverted away from cropland. Effective rooting depth is 60 inches and more. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit I–2; dryland capability subclass VIIc; Bottomland range site, zones 6 and 7; wildlife habitat group C)

Graham Series

The Graham series consists of well-drained soils that formed on old basalt flows in material weathered from basalt bedrock. Basalt bedrock is at a depth of 10 to 20 inches. Slopes are 0 to 45 percent. Associated soils are in the Stellar, Mohave, and Vekol series.

In a representative profile, the surface layer is brown stony clay loam about 3 inches thick. The subsoil is reddish-brown clay about 13 inches thick. The substratum is reddish-yellow very cobbly clay loam about 3 inches thick. Basalt bedrock is at a depth of about 19 inches.

Areas of Graham soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 170 to 200 days.

Graham soils are used for range, wildlife habitat, and watershed. The vegetation consists mainly of short and mid grasses and annuals.

Representative profile of a Graham stony clay loam from an area of Graham extremely rocky clay loam, 0 to

3 percent slopes, 150 feet northwest of the east quarter corner of sec. 14, T. 27 S., R. 20 W.:

A1—0 to 3 inches, brown (7.5YR 5/3) stony clay loam, dark reddish brown (5YR 3/3) when moist; weak, thin, platy structure parting to weak, fine, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, interstitial pores; stones up to 4 feet across are 15 feet apart; slightly calcareous; mildly alkaline; clear, smooth boundary. 2 to 5 inches thick.

B21t—3 to 10 inches, reddish-brown (5YR 4/3) clay, dark reddish brown (5YR 3/3) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; common fine roots; common, fine, tubular pores; approximately 10 percent basalt stones, cobblestones, and gravel; nearly continuous thin clay films on surfaces of peds; slightly calcareous; mildly alkaline; clear, smooth boundary. 5 to 10 inches thick.

B22t—10 to 16 inches, reddish-brown (5YR 4/4) clay, dark reddish brown (5YR 3/4) when moist; weak, coarse, prismatic structure and moderate, medium, subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; common fine roots; common, fine, tubular pores; approximately 10 percent basalt stones, cobblestones, and gravel; few, thin, patchy clay films on surfaces of peds; strongly calcareous; moderately alkaline; clear, wavy boundary. 3 to 8 inches thick.

Cca—16 to 19 inches, reddish-yellow (5YR 6/6) very cobbly clay loam, yellowish red (5YR 4/6) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; few fine roots; common, fine, tubular pores; about 50 percent basalt gravel, cobblestones, and stones that have patchy lime coatings on their surfaces; disseminated lime within the soil mass; strongly calcareous; moderately alkaline; abrupt, wavy boundary. 0 to 6 inches thick.

R—19 inches, basalt bedrock with coating of lime.

The A horizon has a value of 4 or 5 when dry. It is stony loam or stony clay loam. The B2t horizon has a value of 3 or 4 when dry. It is clay or gravelly clay that contains 5 to 25 percent basalt gravel, cobblestones, and stones. The Cca horizon has a value of 5 or 6 when dry and a chroma of 4 to 6. It is high in content of lime and is very gravelly or very cobbly clay loam. Depth to basalt bedrock ranges from 10 to 20 inches.

Graham rocky clay loam, 1 to 9 percent slopes (GO).—This soil is throughout the low-intensity survey. Rock outcrops make up about 2 to 10 percent of the mapping unit. Included with this soil in mapping are areas of soils that are similar to this Graham soil but are 20 to 40 inches deep to bedrock.

Runoff is rapid. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 4 to 5 inches. Effective rooting depth is 10 to 20 inches. Hazard of water erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Malpais range site, zone 7; wildlife habitat group E)

Graham extremely rocky clay loam, 0 to 3 percent slopes (Gr).—This soil is in the central part of Hidalgo County in the high-intensity survey. It has the profile described as representative for the series. Rock outcrops make up about 30 to 45 percent of this mapping unit. Included with this soil in mapping are areas of soils that are similar to this Graham soil but are 20 to 40 inches deep to bedrock.

This soil has slow permeability. Runoff is medium. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Malpais range site, zone 7; wildlife habitat group E)

Graham extremely rocky clay loam, 10 to 45 percent slopes (GT).—This soil is throughout the low-intensity survey. Rock outcrops make up about 30 to 45 percent of this mapping unit. Included with this soil in mapping are small tracts of barren rock land.

This soil has slow permeability. Runoff is rapid. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of water erosion is severe.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Hills range site, zone 7; wildlife habitat group E)

Hap Series

The Hap series consists of well-drained soils that formed in old alluvium from granitic rocks on alluvial fans on uplands. Slopes are 1 to 9 percent. Associated soils are in the Yturbide and Sonoita series.

In a representative profile, the surface layer is brown gravelly loam about 3 inches thick. The subsoil is red and reddish-brown gravelly sandy clay loam about 25 inches thick. The substratum, to a depth of 38 inches, is white, weakly cemented caliche of sandy clay loam texture, and this restricts most plant roots. Below this, to a depth of 60 inches and more, the substratum is pinkish-gray sandy clay loam.

Areas of Hap soils range from 4,200 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 200 days.

Hap soils are used for range, wildlife habitat, and watershed. The vegetation is mainly short and mid grasses, yucca, common mesquite, and Mormon-tea.

Representative profile of a Hap gravelly loam from an area of Hap-Yturbide association, 1 to 9 percent slopes, 220 feet east of the northeast corner of sec. 26, T. 22 S., R. 17 W.:

A1—0 to 3 inches, brown (7.5YR 5/4) gravelly loam, dark brown (7.5YR 4/4) when moist; weak, medium, platy structure and weak, medium, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; many very fine roots; many very fine pores; approximately 15 percent gravel; noncalcareous; neutral; clear, irregular boundary. 2 to 12 inches thick.

B21t—3 to 7 inches, reddish-brown (5YR 4/4) gravelly sandy clay loam, dark reddish brown (2.5YR 3/4) when moist; weak, coarse, subangular blocky structure; slightly hard, friable when moist, sticky and plastic when wet; many very fine roots; many very fine pores; few thin clay films; approximately 15 percent gravel; noncalcareous; neutral; clear, irregular boundary. 0 to 4 inches thick.

B22t—7 to 18 inches, red (2.5YR 4/6) gravelly sandy clay loam, dark red (2.5YR 3/6) when moist; moderate, coarse, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; many very fine roots; many, very fine, interstitial

and tubular pores; many moderately thick clay films on gravel, on ped surfaces, in pores, and as bridging between sand grains; approximately 15 percent gravel; noncalcareous; neutral; clear, irregular boundary. 10 to 16 inches thick.

B23tca—18 to 28 inches, reddish-brown (5YR 5/4) gravelly sandy clay loam, reddish brown (5YR 4/4) when moist; moderate, coarse, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; few very fine roots; many, very fine, interstitial and tubular pores; common thin clay films on gravel, on ped surfaces, in pores, and as bridging between sand grains; approximately 20 percent gravel; some segregated threads of strongly calcareous lime; strongly calcareous; mildly alkaline; abrupt, irregular boundary. 8 to 18 inches thick.

C1ca—28 to 38 inches, white (5YR 8/1) weakly cemented caliche of gravelly sandy clay loam texture, pinkish gray (5YR 6/2) when moist; massive; hard, firm when moist, sticky and plastic when wet; no roots; common, very fine, tubular pores; strongly calcareous; moderately alkaline; clear, irregular boundary. 5 to 18 inches thick.

C2ca—38 to 60 inches, pinkish-gray (7.5YR 7/2) sandy clay loam, light reddish brown (5YR 6/3) when moist; massive; soft, very friable when moist, slightly sticky and slightly plastic when wet; no roots; many, fine and very fine, tubular pores; 10 percent fine gravel; disseminated lime; strongly calcareous; moderately alkaline.

The A horizon has a value of 4 to 6 when dry and 3 to 5 when moist. Chroma is 3 or 4. This horizon is commonly gravelly loam in texture, but it ranges from gravelly sandy loam to gravelly sandy clay loam. The B2t horizon has a value of 3 to 5 when dry. It ranges from gravelly heavy sandy loam to gravelly sandy clay loam in texture; a large part of the sand fraction is coarse, and content of gravel is 15 to 35 percent. The Cca horizon has a calcium carbonate equivalent of 15 to 50 percent that decreases with depth. The Cca horizon ranges from gravelly loam to gravelly sandy clay loam, gravelly clay loam, or sandy clay loam in texture. It has soft to hard consistence or is weakly cemented. Depth to the Cca horizon is 20 to 40 inches.

Hap-Yturbide association, 1 to 9 percent slopes (HA).—This association is mainly on the foot slopes of low mountains in the low-intensity survey. It is made up of about 50 percent Hap gravelly loam and about 40 percent Yturbide loamy sand. Included in mapping are areas of Sonoita and Nickel soils that make up about 10 percent of the association.

The Hap soil has the profile described as representative for the Hap series. It has moderate permeability. Runoff is medium. The available water holding capacity is 3 to 6 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 20 to 40 inches. Hazard of soil blowing is slight, and hazard of water erosion is moderate.

The Yturbide soil has a profile similar to the one described as representative for the Yturbide series. It has rapid permeability. Runoff is medium to slow. The available water holding capacity is 2.5 to 3.75 inches. The water-supplying capacity is about 5 to 8 inches. Effective rooting depth is 60 inches or more. Hazard of soil blowing is severe.

The soils in this association are used for range, wildlife habitat, and watershed. (Hap soil in dryland capability subclass VIIe, Sandy range site, zones 6 and 7, and wildlife habitat group C; Yturbide soil in dryland capability subclass VIIe, Deep Sand range site, zones 6 and 7, and wildlife habitat group B)

Hawkeye Series

The Hawkeye series consists of well-drained soils that formed in recent coarse-textured alluvium from mixed igneous rocks on alluvial fans. Slopes are 0 to 3 percent. Associated soils are in the Pima, Eba, and Forrest series. Hawkeye soils are mapped only in a complex with Pima soils.

In a representative profile, the surface layer is dark grayish-brown gravelly loam about 12 inches thick. Below this, the substratum, to a depth of 60 inches or more, is brown gravelly loamy coarse sand stratified with sand and gravel.

Areas of Hawkeye soils range from 4,500 to 6,000 feet in elevation. The average annual air temperature is 57° to 59° F. The average annual precipitation is 14 to 16 inches. The frost-free season is 160 to 180 days.

Hawkeye soils are used for range, wildlife habitat, and watershed. The vegetation consists of short and mid grasses, annual grasses, and weeds.

Representative profile of a Hawkeye gravelly loam from an area of Pima-Hawkeye complex, 0.4 mile east and 0.5 mile south of the northwest corner of sec. 2, T. 31 S., R. 20 W.:

A11—0 to 5 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; about 3 percent organic matter; about 15 percent semirounded to angular gravel; few scattered cobblestones; noncalcareous; mildly alkaline; clear, wavy boundary. 3 to 10 inches thick.

A12—5 to 12 inches, dark grayish-brown (10YR 4/2) gravelly heavy loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure; hard, very friable when moist, slightly sticky and slightly plastic when wet; about 2 percent organic matter; about 30 percent angular to semirounded gravel; few scattered cobblestones; noncalcareous; mildly alkaline; clear, wavy boundary. 4 to 10 inches thick.

C—12 to 60 inches, brown (7.5YR 5/2) gravelly loamy coarse sand, dark brown (7.5YR 3/2) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common, fine, interstitial pores; 40 percent angular to semirounded gravel; many strata of very fine sand to coarse sand and gravel; few cobblestones; noncalcareous; mildly alkaline.

The A horizon has a value of 3 or 4 when dry and 2 or 3 when moist. Chroma is 2 or 3. This horizon ranges from gravelly sandy loam to gravelly heavy loam in texture. The C horizon has a value of 4 or 5 when dry and 3 or 4 when moist. Chroma is 2 or 3. The C horizon has strata of very fine sand to coarse gravel.

Hondale Series

The Hondale series consists of well-drained soils that formed in valley fill from mixed igneous and sedimentary rocks on broad alluvial flats. Slopes are 0 to 3 percent. Associated soils are in the Mimbres, Verhalen, and Ubar series.

In a representative profile (fig. 8), the surface layer is light brownish-gray silt loam about 8 inches thick. The subsoil is about 28 inches thick. It is grayish-brown and

Figure 8.—**Profile of a Hondale silt loam. This soil is strongly alkaline and very strongly alkaline and is high in content of exchangeable sodium.**

light-gray heavy silty clay loam grading to light brownish-gray heavy sandy clay loam in the lower part. The substratum, to a depth of 42 inches, is light-gray heavy sandy loam. Below this, to a depth of 60 inches or more, it is light gray sand. The soil is strongly alkaline and very strongly alkaline and is high in content of exchangeable sodium.

Areas of Hondale soils range from 4,000 to 4,500 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Hondale soils are used for range, wildlife habitat, and watershed. A few areas have been used as irrigated cropland. The native vegetation is mid grasses, common mesquite, saltbush, and allthorn.

Representative profile of a Hondale silt loam from an area of Hondale soils, SE¼NE¼ sec. 30, T. 31 S., R. 16 W.:

A11—0 to 2 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist; strong, thin, platy structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common fine pores; moderately calcareous; strongly alkaline; abrupt, smooth boundary. 0 to 3 inches thick.

A12—2 to 8 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; common, fine, vesicular pores, and common, fine, tubular pores; moderately calcareous; strongly alkaline; abrupt, wavy boundary. 2 to 8 inches thick.

B21t—8 to 15 inches, grayish-brown (10YR 5/2) heavy silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, angular blocky structure; very hard, friable when moist, sticky and plastic when wet; many fine roots; common, fine, tubular pores; thin clay films; moderately calcareous; very strongly alkaline; clear, wavy boundary. 5 to 10 inches thick.

B22tca—15 to 21 inches, light-gray (10YR 7/2) heavy silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; thin clay films; common, fine, distinct lime mottles that are white (10YR 8/2) and light brownish gray (10YR 6/2) when moist; strongly calcareous; very strongly alkaline; gradual, wavy boundary. 5 to 10 inches thick.

B3tca—21 to 36 inches, light brownish-gray (10YR 6/2) heavy sandy clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure and strong, fine, granular structure; very hard, friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common, fine, tubular pores; thin clay films; common, fine, distinct lime mottles that are white (10YR 8/2) and light gray (10YR 7/2) when moist; strongly calcareous; very strongly alkaline; abrupt, smooth boundary. 0 to 20 inches thick.

IIC1ca—36 to 42 inches, light-gray (10YR 7/2) heavy sandy loam, grayish brown (10YR 5/2) when moist; massive; very hard, friable when moist, nonsticky and nonplastic when wet; no roots; few fine pores; common, fine, distinct lime mottles; strongly calcareous; very strongly alkaline; abrupt, smooth boundary. 4 to 20 inches thick.

IIIC2—42 to 60 inches, light-gray (10YR 7/2) sand, grayish brown (10YR 5/2) when moist; single grain; loose when dry and moist, nonsticky and nonplastic when wet; no roots; common, fine, interstitial pores; moderately calcareous; very strongly alkaline.

The A horizon has a value of 5 to 7 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. Texture of this horizon differs greatly within short distances, but it ranges from loamy sand in small, winnowed areas to silty clay loam in bare, exposed areas. The B2 horizon has a value of 5 to 7 when dry and a chroma of 2 to 4. It ranges from heavy silty clay loam or heavy clay loam to light clay. The B3 horizon ranges from heavy silty clay loam to heavy sandy clay loam. The C horizon has a value of 6 or 7 when dry and 4 or 5 when moist. The profile is strongly alkaline or very strongly alkaline and contains more than 15 percent exchangeable sodium.

Hondale silt loam, strongly alkali (0 to 1 percent slopes) (Hd).—This soil is in the high-intensity survey near playas. It has a profile similar to that described as representative for the series, except that it is strongly affected by alkali. Included with this soil in mapping are small areas of gently sloping Hondale silt loam and Verhalen soils.

This soil has very slow permeability. Runoff is slow.

The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 10 to 12 inches from precipitation and runoff from surrounding soils. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Salt Flats range site, zone 7; wildlife habitat group I)

Hondale soils (0 to 3 percent slopes) (HN).—These soils are throughout the low-intensity survey, generally adjacent to playa lakes. They have the profile described as representative for the series, but the texture of the surface layer differs greatly within short distances. The surface layer ranges from loamy sand in small, winnowed areas to loam, silt loam, or silty clay loam in bare, exposed areas. Silt loam is the most common. The soils are moderately alkaline to strongly alkaline. Included with these soils in mapping are areas of Verhalen, Mimbres, and Glendale soils.

Hondale soils have very slow permeability. Runoff is slow. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 10 to 12 inches from precipitation and runoff from surrounding soils. Effective rooting depth is 60 inches or more. Hazard of water erosion is slight where slopes are less than 1 percent and moderate where slopes are greater than 1 percent.

These soils are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Salt Flats range site, zone 7; wildlife habitat group I)

Hondale complex (0 to 1 percent slopes) (Hs).—This complex is in the high-intensity survey near playas. It consists of Hondale silt loam, Hondale loam, and Hondale sandy loam that are nearly equal in extent and are intermingled. Included in mapping are areas of alkali-affected Verhalen, Mimbres, and Glendale soils that make up less than 5 percent of the complex.

Hondale silt loam has a profile similar to that described as representative for the series, except that it has less exchangeable sodium in its profile. Hondale loam and sandy loam have a profile similar to that described as representative for the series, except that the surface layer is loam and sandy loam, respectively, and the profile contains less exchangeable sodium. The soils of this complex are slightly to moderately affected by alkali.

These soils have very slow permeability. Runoff is slow. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 10 to 12 inches from precipitation and runoff from surrounding soils. Effective rooting depth is 60 inches and more. Hazard of erosion is slight.

This complex is used for range, wildlife habitat, and watershed. Some areas have been used for irrigated cropland. These soils are suited only to alkali-tolerant crops. (Irrigated capability unit IVs–5; dryland capability subclass VIIs; Salt Flats range site, zone 7; wildlife habitat group I)

Jal Series

The Jal series consists of well-drained soils that formed in old alluvium from igneous and sedimentary rocks on alluvial fans on uplands. Caliche is at a depth of 10 to 20 inches. Slopes are 0 to 5 percent. Associated soils are in the Hondale, Karro, Mohave, and Stellar series.

In a representative profile, the surface layer is pinkish-gray and pink loam about 12 inches thick. The substratum, to a depth of 60 inches or more, is white caliche of clay loam texture.

Areas of Jal soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 200 days.

Jal soils are used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. The vegetation consists mainly of mid grasses, winterfat, cactus, and allthorn.

Representative profile of Jal loam, 150 feet southwest of the northeast corner of sec. 32, T. 20 S., R. 20 W.:

A11—0 to 4 inches, pinkish-gray (7.5YR 7/2) loam, brown (7.5YR 5/4) when moist; weak, thin, platy structure and weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common, fine, tubular pores; common hard lime fragments on the surface; strongly calcareous; moderately alkaline; clear, wavy boundary. 3 to 6 inches thick.

A12—4 to 12 inches, pink (7.5YR 7/4) heavy loam, brown (7.5YR 5/4) when moist; weak, medium, subangular blocky structure; soft, very friable when moist, slightly sticky and nonplastic when wet; many fine roots; common, fine, tubular pores; many fine lime concretions; strongly calcareous; moderately alkaline; abrupt, smooth boundary. 7 to 10 inches thick.

Cca—12 to 60 inches, white (10YR 8/2) soft caliche of clay loam texture, light gray (10YR 7/2) when moist; massive; hard, firm when moist, sticky when wet; no roots; many, hard, fine lime nodules, decreasing below a depth of 23 inches; strongly calcareous; strongly alkaline.

The A horizon has a value of 6 or 7 when dry and 5 or 6 when moist. It is sandy loam, loam, or silt loam in texture. The Cca horizon ranges from 7.5YR to 10YR in hue and has a value of 7 or 8 when dry and 6 or 7 when moist. It ranges from heavy loam to clay loam. It has soft to hard consistence. In places, it is weakly cemented in the upper part. Depth to the Cca horizon is 10 to 20 inches.

Jal loam (0 to 3 percent slopes) (Ja) (Jl).—This soil is nearly level in the high-intensity survey. Here, it has a profile similar to that described as representative for the series, except that the surface layer is very pale brown loam about 13 inches thick. Included in mapping in the high-intensity survey are areas of Jal silt loam and Jal sandy loam, which make up about 10 percent of this mapping unit, and of Karro soils, which make up about 5 percent.

This soil is nearly level to gently sloping in the low-intensity survey. Here, it has the profile described as representative for the series. Included in mapping in the low-intensity survey are areas of Jal silt loam and Jal sandy loam, which make up about 20 percent of this mapping unit, and of Karro, Verhalen, Hondale, and Tres Hermanos soils, which make up about 10 percent.

This soil has moderate permeability. Runoff is medium. The available water holding capacity is 1.5 to 3.5 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of soil blowing is moderate where the vegetation has been removed.

This soil is used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. (Irrigated capability unit IVs–7; dryland capability subclass VIIs; Limy range site, zones 6 and 7; wildlife habitat group G)

Jal-Karro association (0 to 3 percent slopes) (JR).—This association is in the north-central part of the low-intensity survey. It consists of about 50 percent Jal loam and 40 percent Karro silt loam. The Jal soil is gently sloping and occurs on slightly elevated ridges. The Karro soil is nearly level and occurs in broad areas between the ridges. Included in mapping are areas of Mohave and Stellar soils that make up about 10 percent of the association.

The Jal soil has a profile similar to the one described as representative for the Jal series. It has moderate permeability. Runoff is medium. The available water holding capacity is 1.5 to 3.5 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of soil blowing is moderate if the vegetation is removed.

The Karro soil has the profile described as representative for the Karro series. It has moderately slow permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 16 to 24 inches. Hazard of soil blowing is moderate where the vegetation has been removed.

The soils in this association are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Limy range site, zones 6 and 7; wildlife habitat group G)

Karro Series

The Karro series consists of well-drained soils that formed in old alluvium from mixed igneous and sedimentary rocks on alluvial fans on uplands. Slopes are 0 to 3 percent. Associated soils are in the Jal, Mohave, Stellar, Berino, and Pintura series. In Hidalgo County, Karro soils are mapped only in an association with Jal soils.

In a representative profile, the surface layer is light brownish-gray and pale-brown heavy loam and silt loam about 11 inches thick. The subsoil is light brownish-gray silty clay loam about 12 inches thick. The substratum, to a depth of 60 inches or more, is very pale brown and white clay loam that is high in content of lime.

Areas of Karro soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Karro soils are used for range, wildlife habitat, and watershed. The vegetation consists mainly of short and mid grasses, common mesquite, and allthorn.

Representative profile of a Karro silt loam from an area of Jal-Karro association, 100 feet northwest of the southeast corner of sec. 16, T. 22 S., R. 19 W.:

A11—0 to 4 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thick, platy structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many, fine, vesicular pores; strongly calcareous; moderately alkaline; clear, smooth boundary. 2 to 6 inches thick.

A12—4 to 11 inches, pale-brown (10YR 6/3) heavy loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many fine pores; strongly calcareous; moderately alkaline; clear, smooth boundary. 5 to 9 inches thick.

B2—11 to 23 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; common fine roots; common fine pores; few threads of lime; strongly calcareous; moderately alkaline; abrupt, wavy boundary. 9 to 17 inches thick.

C1ca—23 to 35 inches, very pale brown (10YR 7/3) clay loam, light brownish gray (10YR 6/2) when moist; weak, coarse, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; few fine roots; common fine pores; many soft masses of lime; strongly calcareous; strongly alkaline; clear, wavy boundary. 9 to 13 inches thick.

C2ca—35 to 60 inches, white (10YR 8/2) clay loam, very pale brown (10YR 7/3) when moist; massive; hard, friable when moist, sticky and plastic when wet; no roots; common fine pores; many soft masses of lime decreasing below a depth of 40 inches; strongly calcareous; strongly alkaline.

The A horizon has a value of 5 or 6 when dry and a chroma of 2 to 4. It ranges from silt loam to loam and silty clay loam in texture. The B horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. This horizon is clay loam or silty clay loam in texture. The Cca horizon is clay loam or silty clay loam. It ranges from soft to hard in consistence. In places there are layers within the Cca horizon that are weakly cemented. Depth to the Cca horizon is 16 to 24 inches.

Keno Series

The Keno series consists of well-drained soils that formed in old alluvium from basic igneous rocks on alluvial fans on uplands. This alluvium was deposited over older alluvium that formed from mixed igneous rocks. Slopes are 1 to 4 percent. Associated soils are in the Mimbres, Stellar, and Mohave series.

In a representative profile, the surface layer is brown cobbly clay loam about 4 inches thick. The subsoil is brown clay about 21 inches thick. The substratum, to a depth of about 60 inches, is light-brown gravelly clay loam.

Areas of Keno soils range from 4,200 to 5,000 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Keno soils are used for range, wildlife, and watershed. The vegetation consists mainly of short grasses, yucca, allthorn, broom snakeweed, and Mormon-tea.

Representative profile of Keno cobbly clay loam, 500 feet north of the southeast corner of sec. 20, T. 21 S., R. 21 W.:

A1—0 to 4 inches, brown (7.5YR 5/3) cobbly clay loam, dark brown (7.5YR 4/3) when moist; moderate, fine, granular structure; soft, very friable when moist, sticky and plastic when wet; many fine and very fine roots; many fine and very fine pores; 25 percent basalt gravel and cobblestones; disseminated lime; strongly calcareous; moderately alkaline; clear, smooth boundary. 2 to 6 inches thick.

B2—4 to 25 inches, brown (7.5YR 5/2) clay, dark brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, very sticky and plastic when wet; common fine and very

fine roots; many, fine and very fine, tubular pores; few slickensides; occasional cracks 1 to 1½ centimeters wide throughout this horizon when dry; disseminated lime; strongly calcareous; moderately alkaline; clear, wavy boundary. 18 to 34 inches thick.

IICca—25 to 60 inches, light-brown (7.5YR 6/4) gravelly clay loam, brown (7.5YR 4/4) when moist; massive; hard, friable when moist, sticky and plastic when wet; few fine and very fine roots; common, fine and very fine, tubular pores; about 20 percent rhyolite gravel; lime segregated as thin coatings on gravel; strongly calcareous; moderately alkaline.

The A horizon has a 15 to 40 percent cover of gravel, cobblestones, and occasional stones. This horizon has a value of 5 to 7 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. The A horizon ranges from clay loam to clay in texture. The B horizon ranges from 4 to 6 in value when dry and from 3 to 5 when moist. Chroma ranges from 2 to 5. The B horizon ranges from heavy clay loam to clay. The IICca horizon ranges from 5 to 7 in value when dry and from 4 to 6 when moist, and chroma is 3 or 4. This horizon ranges from gravelly loam to gravelly clay. The depth to the IICca horizon ranges from 20 to 40 inches.

Keno cobbly clay loam (1 to 4 percent slopes) (KC).—This soil occurs in the northwestern part of the low-intensity survey. Included with this soil in mapping are areas of Mimbres, Stellar, and Mohave soils.

This soil has very slow permeability. Runoff is medium. The available water holding capacity is 7 to 9 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 60 inches. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group A)

Lehmans Series

The Lehmans series consists of well-drained soils that formed in material weathered from acid igneous rock, mainly rhyolite, on hills. Bedrock is at a depth of 15 to 20 inches. Slopes are 1 to 25 percent. Associated soils are in the Nickel, Tres Hermanos, and Forrest series.

In a representative profile, the surface layer is yellowish-red stony loam about 4 inches thick. The subsoil is reddish-brown stony heavy clay loam that contains some accumulation of lime in the lower part. It is about 14 inches thick. Rhyolite bedrock is at a depth of about 18 inches.

Areas of Lehmans soils range from 4,200 to 6,000 feet in elevation. The average annual air temperature is 58° to 60° F. The average annual precipitation is 11 to 13 inches. The frost-free season is about 170 to 200 days.

Lehmans soils are used for range, wildlife habitat, and watershed. The vegetation is short and mid grasses, yucca, and century plant.

Representative profile of a Lehmans stony loam from an area of Lehmans extremely rocky loam, 10 to 25 percent slopes, 800 feet south and 600 feet east of the west quarter corner of sec. 4, T. 34 S., R. 16 W.:

A1—0 to 4 inches, yellowish-red (5YR 5/6) stony loam, dark reddish brown (5YR 3/4) when moist; moderate, fine, granular structure; soft, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many, fine, interstitial pores; about 15 percent stones; noncalcareous; mildly alkaline; abrupt, smooth boundary. 2 to 6 inches thick.

B2t—4 to 13 inches, reddish-brown (5YR 5/4) stony heavy clay loam, dark reddish brown (5YR 3/4) when moist; moderate, medium, subangular blocky structure; soft, friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; common patchy clay films on peds and stones; noncalcareous; mildly alkaline; clear, wavy boundary. 6 to 12 inches thick.

B3ca—13 to 18 inches, reddish-brown (5YR 5/4) stony heavy clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium, subangular blocky structure; soft, friable when moist, sticky and plastic when wet, common fine roots; common, fine, tubular pores; thin clay films on top of stones; thin accumulations of calcium carbonate on bottom of stones; strongly calcareous; moderately alkaline; abrupt, wavy boundary. 2 to 5 inches thick.

R—18 inches, fractured rhyolite bedrock, lime coated.

The A horizon has a value of 4 or 5 when dry and 3 or 4 when moist. Chroma ranges from 3 to 6. This horizon is stony or very stony loam in texture. The B horizon has a value of 4 or 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. This horizon ranges from stony heavy clay loam to stony clay. Depth to underlying bedrock ranges from 15 to 20 inches.

Lehmans extremely rocky loam, 10 to 25 percent slopes (LH).—This soil is throughout the low-intensity survey. A few small tracts are intermingled with other soils in the high-intensity survey. It has the profile described as representative for the series. Rock outcrops make up 30 to 45 percent of the mapping unit.

This soil has moderately slow permeability. Runoff is rapid. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 5 to 6 inches. Effective rooting depth is 15 to 20 inches. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Hills range site, zone 6, and Hills range site, zone 7; wildlife habitat group E)

Lehmans-Nickel association, 1 to 9 percent slopes (LN).—This association is throughout the low-intensity survey. It consists of about 50 percent Lehmans stony loam and about 40 percent Nickel gravelly sandy loam. The gently rolling Lehmans soil occupies the domes of hills, and the gently sloping Nickel soil occupies the areas around and between the domes.

Included in mapping are areas of soils that are similar to the Nickel soil, except that they are underlain by bedrock at a depth of 20 to 40 inches. Also included are areas of Upton and Tres Hermanos soils. Typically, the inclusions comprise about 10 percent of the association. In the area south of Hachita, these inclusions make up as much as 40 percent of the association in places.

The Lehmans soil has a profile similar to the one described as representative for the Lehmans series. It has moderately slow permeability. Runoff is medium. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 5 to 6 inches. Effective rooting depth is 15 to 20 inches. Hazard of erosion is moderate.

The Nickel soil has a profile similar to the one described as representative for the Nickel series. It has moderately slow permeability. Runoff is medium. The available water holding capacity is 1 to 2 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of erosion is moderate.

This association is used for range, wildlife habitat, and watershed. (Lehmans soil in dryland capability subclass

VIIe, Hills range site, zone 6, and Hills range site, zone 7, and wildlife habitat group E; Nickel soil in dryland capability subclass VIIe, Limy range site, zones 6 and 7, and wildlife habitat group J)

Maricopa Series

The Maricopa series consists of well-drained soils that formed in mixed alluvium from mixed igneous rocks on alluvial fans. Slopes are 0 to 3 percent. Associated soils are in the Mohave, Stellar, Ubar, Hondale, and Mimbres series.

In a representative profile, the surface layer is light brownish-gray loamy sand about 3 inches thick. The underlying layer is grayish-brown sandy loam about 19 inches thick. The substratum is grayish-brown loamy sand to a depth of 60 inches or more.

Areas of Maricopa soils range from 4,200 to 5,500 feet in elevation. The average annual air temperature is 60° to 62° F. The average precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Maricopa soils are used mainly for range, wildlife habitat, and watershed. A few acres are used for irrigated cropland. The vegetation is mid grasses, common mesquite, yucca, Mormon-tea, broom snakeweed, and allthorn.

Representative profile of Maricopa loamy sand, 60 feet west of road and west center of NE¼ sec. 26, T. 32 S., R. 17 W.:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry and moist, nonsticky and nonplastic when wet; many fine roots; many, fine, interstitial pores; noncalcareous; mildly alkaline; abrupt, smooth boundary. 2 to 5 inches thick.

C1—3 to 22 inches, grayish-brown (10YR 5/2) sandy loam, very dark grayish brown (10YR 3/2) when moist; massive; hard, very friable when moist, slightly sticky and nonplastic when wet; many fine roots; common, fine, tubular pores; slightly calcareous; mildly alkaline; gradual, wavy boundary. 15 to 35 inches thick.

IIC2—22 to 60 inches, grayish-brown (10YR 5/2) loamy sand, dark grayish brown (10YR 4/2) when moist; single grain; loose when dry and moist, nonsticky and nonplastic when wet; common fine roots to a depth of 40 inches, and few roots below; common, fine, interstitial pores; noncalcareous; mildly alkaline.

The A horizon has a value of 5 or 6 when dry and 4 or 5 when moist. Chroma is 2 or 3. This horizon ranges from sandy loam to loamy sand in texture. The C horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 or 3. The C1 horizon is sandy loam or light loam. The profile is noncalcareous to slightly calcareous. Depth to the IIC horizon ranges from 20 to 36 inches.

Maricopa loamy sand (0 to 3 percent slopes) (Ma).—This soil is in the high-intensity survey. Included with this soil in mapping are areas of Mohave, Stellar, Ubar, Hondale, and Mimbres soils.

This soil has moderately rapid permeability. Runoff is slow. The available water holding capacity is 5 to 6 inches. The water-supplying capacity is about 7 to 8 inches. Effective rooting depth is 60 inches. Hazard of soil blowing is moderate.

This soil is used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. (Irrigated capability unit IIIe-1; dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group F)

Mimbres Series

The Mimbres series consists of well-drained soils that formed in old alluvium from mixed igneous and sedimentary rocks on alluvial bottoms and fans. Slopes are 0 to 1 percent. Associated soils are in the Verhalen, Glendale, Stellar, Hondale, and Mohave series.

In a representative profile, the surface layer is pale-brown silty clay loam about 2 inches thick. The subsoil is light-brown and brown clay loam about 24 inches thick. The substratum, to a depth of 36 inches, is pinkish-gray loam. Below this, to a depth of 60 inches or more, is brown and pale-brown sandy clay loam and clay loam.

Areas of Mimbres soils range from 4,000 to 5,500 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

Mimbres soils are used for irrigated cropland, range, wildlife habitat, and watershed. The vegetation is short and mid grasses and broom snakeweed.

Representative profile of a Mimbres silty clay loam from an area of Mimbres and Glendale silty clay loams, 175 feet north and 2,970 feet east of the west quarter corner of sec. 2, T. 26 S., R. 20 W.:

A1—0 to 2 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, platy structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; noncalcareous; mildly alkaline; clear, smooth boundary. 1 to 5 inches thick.

B21—2 to 13 inches, light-brown (7.5YR 6/3) light clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; noncalcareous; mildly alkaline; clear, smooth boundary. 7 to 16 inches thick.

B22—13 to 26 inches, brown (7.5YR 5/4) clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; noncalcareous; mildly alkaline; abrupt, smooth boundary. 6 to 16 inches thick.

Cca—26 to 36 inches, pinkish-gray (10YR 6/2) loam, brown (10YR 4/2) when moist; massive; very hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; few small threads of soft lime; strongly calcareous; moderately alkaline; clear, irregular boundary. 6 to 18 inches thick.

ACb—36 to 50 inches, brown (10YR 5/3) heavy sandy clay loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; few fine roots; few, fine, tubular pores; slightly calcareous on ped surfaces, noncalcareous within peds; moderately alkaline; clear, smooth boundary. 0 to 20 inches thick.

Cb—50 to 60 inches, pale-brown (10YR 6/3) light clay loam, brown (10YR 4/3) when moist; massive; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few, fine, tubular pores; noncalcareous; mildly alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. This horizon ranges from loam to silty clay loam or clay loam in texture. The B horizon has a value of 3 or 4 when moist. It ranges from

clay loam to silty clay loam. The Cca horizon has few to common threads or soft masses of lime.

Mimbres and Glendale loams (0 to 1 percent slopes) (Mb).—These soils are only in the high-intensity survey. Areas of this undifferentiated group consist of Mimbres loam, or of Glendale loam, or of both. About 60 percent of the total acreage of this mapping unit is Mimbres loam, and about 30 percent is Glendale loam. Included with these soils in mapping are areas of Mimbres and Glendale silty clay loams, which make up about 10 percent of this mapping unit. Also included are minor areas of Verhalen soils.

The Mimbres soil has a profile similar to that described as representative for the Mimbres series, except that it has a loam surface layer about 8 inches thick. It has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 12 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. The water from additional runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The Glendale soil has a profile similar to that described as representative for the Glendale series, except that it has a loam surface layer about 8 inches thick. It has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 12 inches. The water-supplying capacity is 15 to 20 inches from precipitation and additional runoff. Additional runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit I–1; dryland capability subclass VIIc; Bottomland range site, zones 6 and 7; wildlife habitat group H)

Mimbres and Glendale silty clay loams (0 to 1 percent slopes) (Mc) (MD).—This undifferentiated group occurs in both the low-intensity and high-intensity surveys.

The Mimbres soil has the profile described as representative for the Mimbres series. This soil is on slightly elevated, broad alluvial fans and bottoms. The Glendale soil has a profile similar to the one described as representative for the Glendale series. It is on long, narrow alluvial bottoms and in broad alluvial swales.

In the high-intensity survey, this undifferentiated group consists of about 60 percent Mimbres silty clay loam and 30 percent Glendale silty clay loam. Some areas, however, are dominantly Mimbres silty clay loam, and other areas are dominantly Glendale silty clay loam. Included in mapping are areas of Verhalen soils and Mimbres silty clay loam, 1 to 2 percent slopes, which make up about 10 percent of the acreage.

In the low-intensity survey, this undifferentiated group consists of about 60 percent Mimbres silty clay loam and 25 percent Glendale silty clay loam. Some areas, however, are all Mimbres silty clay loam, and other areas are all Glendale silty clay loam. Included in mapping are areas of Verhalen soils, of soils that have a clay or silty clay substratum, and of Mimbres silty clay loam, 1 to 2 percent slopes, which make up about 15 percent of the acreage.

The Mimbres soil has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 12 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. The water from additional runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The Glendale soil has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 12 inches. The water-supplying capacity is 15 to 20 inches from precipitation and additional runoff. The water from additional runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The soils in this group are used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit I–2; dryland capability subclass VIIc; Bottomland range site, zones 6 and 7; wildlife habitat group H)

Mimbres and Glendale silty clay loams, alkali (0 to 1 percent slopes) (Me).—These soils are only in the high-intensity survey. Areas of this undifferentiated group consist of Mimbres silty clay loam, alkali, or of Glendale silty clay loam, alkali, or of both. About 60 percent of the total acreage of this mapping unit is Mimbres silty clay loam, alkali, and about 30 percent is Glendale silty clay loam, alkali. Included with these soils in mapping are areas of Mimbres and Glendale loams, alkali, which make up about 10 percent of this mapping unit. Also included are minor areas of Verhalen soils.

The Mimbres soil has a profile similar to that described as representative for the Mimbres series, except that it has a moderate amount of alkali in the surface layer and subsoil. It has moderately slow permeability. Runoff is slow. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and additional runoff. The water from additional runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The Glendale soil has a profile similar to that described as representative for the Glendale series, except that it has a moderate amount of alkali in the surface layer and subsoil. It has slow permeability. Runoff is slow. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 15 to 20 inches from precipitation and runoff. Runoff is generally diverted away from cropland. Effective rooting depth is 60 inches or more.

The soils in this unit have severe limitations because of the alkali content. Reclamation by leaching is difficult because no drainage outlets are in these enclosed basins.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IVs–4; dryland capability subclass VIIs; Salty Bottomland range site, zone 7; wildlife habitat group I)

Mimbres and Glendale silty clay loams, strongly alkali (0 to 1 percent slopes) (Mg).—These soils are only in the high-intensity survey. Areas of this undifferentiated group consist of Mimbres silty clay loam, strongly alkali, of Glendale silty clay loam, strongly alkali, or of both. About 60 percent of the total acreage of this mapping unit is Mimbres silty clay loam, strongly alkali, and about 30 percent is Glendale silty clay loam, strongly alkali. Included with these soils in mapping are areas of other Mimbres and Glendale soils, which make up about 10 percent of this mapping unit. Also included are minor areas of Verhalen soils.

The Mimbres soil has a profile similar to that described as representative for the Mimbres series, except that the surface layer is moderately to strongly affected by alkali and the subsoil is strongly affected. It has moderately slow permeability. Runoff is slow. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is about 15 to 20 inches from precipitation and runoff. Hazard of erosion is slight.

The Glendale soil has a profile similar to that described as representative for the Glendale series, except that the surface layer is moderately to strongly affected by alkali and the subsoil is strongly affected. It has slow permeability. The available water holding capacity is 2 to 3 inches. The water-supplying capacity is 15 to 20 inches from precipitation and runoff. Hazard of erosion is slight.

These soils are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Salty Bottomland range site, zone 7; wildlife habitat group I)

Mohave Series

The Mohave series consists of well-drained soils that formed in old alluvium from mixed igneous rocks on old alluvial fans on uplands. Slopes are 0 to 5 percent. Associated soils are in the Stellar, Forrest, Mimbres, and Glendale series.

In a representative profile, the surface layer is reddish-brown sandy clay loam about 4 inches thick. The subsoil is reddish-brown and light reddish-brown sandy clay loam and clay loam about 38 inches thick. It is high in content of lime in the lower part. The substratum is light reddish-brown gravelly sandy loam.

Areas of Mohave soils range from 4,200 to 5,500 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 170 to 210 days.

Mohave soils are used for irrigated cropland, range, wildlife habitat, and watershed. The vegetation consists of short and mid grasses, filaree, yucca, and common mesquite.

Representative profile of Mohave sandy clay loam, 0 to 1 percent slopes, 50 feet west and one-fourth mile south of the northeast quarter corner of sec. 1, T. 24 S., R. 17 W.:

A11—0 to 2 inches, reddish-brown (5YR 5/3) sandy clay loam, dark reddish brown (5YR 3/3) when moist; weak, medium, platy structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many, fine, vesicular pores; some scattered mixed igneous gravel on the surface; noncalcareous; mildly alkaline; abrupt boundary. 0 to 4 inches thick.

A12—2 to 4 inches, reddish-brown (5YR 5/3) sandy clay loam, dark reddish brown (5YR 3/3) when moist; weak, thick, platy structure parting to moderate, medium, granular structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; many, fine, vesicular pores; noncalcareous; mildly alkaline; abrupt boundary. 2 to 6 inches thick.

B21t—4 to 7 inches, reddish-brown (5YR 4/3) sandy clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; few thin patchy clay films on ped surfaces; noncalcareous; mildly alkaline; clear, smooth boundary. 2 to 6 inches thick.

B22t—7 to 19 inches, reddish-brown (5YR 5/3) clay loam, dark reddish brown (5YR 3/3) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; thin, nearly continuous clay films; noncalcareous; mildly alkaline; clear, irregular boundary. 4 to 18 inches thick.

B23tca—19 to 22 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; few fine roots; common, fine, tubular pores; thin patchy clay films; strongly calcareous; moderately alkaline; clear, irregular boundary. 0 to 8 inches thick.

B3ca—22 to 31 inches, reddish-brown (5YR 5/4) clay loam, reddish brown (5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; common, fine, tubular pores; common, medium to coarse, prominent segregations of soft calcium carbonate; strongly calcareous; moderately alkaline; clear, smooth boundary. 6 to 14 inches thick.

B2bca—31 to 42 inches, light reddish-brown (5YR 6/3) clay loam, reddish brown (5YR 4/4) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; common, fine, tubular pores; moderately thick, nearly continuous clay films on peds; common threads of lime; strongly calcareous; moderately alkaline; clear, smooth boundary. 6 to 18 inches thick.

IIC—42 to 60 inches, light reddish-brown (5YR 6/4) gravelly sandy loam, reddish brown (5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; no roots; few, fine, tubular pores; strongly calcareous; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. This horizon ranges from sandy clay loam to loam in texture. The B horizon has a value of 4 to 6 when dry. It ranges from loam or sandy clay loam to clay loam. Depth to the IIC horizon is 30 to 50 inches.

Mohave sandy clay loam, 0 to 1 percent slopes (Mh).—This soil is throughout the high-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are areas of Stellar and Forrest soils. Also included are minor areas of other Mohave soils. Inclusions make up about 15 percent of this mapping unit.

This soil has moderately slow permeability. Runoff is slow. The available water holding capacity is 9 to 11 inches. The water-supplying capacity is about 7 to 8 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit I–1; dryland capability subclass VIIc; Loamy range site, zone 7; wildlife habitat group C)

Mohave sandy clay loam, 1 to 3 percent slopes (Mk).—This soil is only in the high-intensity survey. Included with this soil in mapping are small areas of Forrest and Stellar soils.

This soil has moderately slow permeability. Runoff is medium. The available water holding capacity is 9 to 11 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more. Hazard is slight for soil blowing and moderate for water erosion.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IIe–3; dryland capability subclass VIIc; Loamy range site, zone 7; wildlife habitat group C)

Mohave sandy clay loam, 0 to 5 percent slopes (MO).—This soil is throughout the low-intensity survey. Included with this soil in mapping are small tracts of Stellar and Yturbide soils.

This soil has moderately slow permeability. Runoff is medium. The available water holding capacity is 9 to 11 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more. Hazard of water erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Loamy range site, zone 7; wildlife habitat group C)

Nickel Series

The Nickel series consists of well-drained soils that formed in very gravelly old alluvium from mixed igneous and limestone rocks on piedmont slopes. Slopes are 0 to 60 percent. Associated soils are in the Lehmans, Eba, Tres Hermanos, Mohave, Forrest, and Stellar series.

In a representative profile, the surface layer is light brownish-gray gravelly sandy loam about 3 inches thick. The next layer is pale-brown gravelly loam about 11 inches thick. The substratum, to a depth of 60 inches or more, is white, weakly cemented caliche of very gravelly loam texture.

Areas of Nickel soils range from 4,200 to 6,000 feet in elevation. The average annual air temperature is 59° to 61° F. Average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

Nickel soils are used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. The vegetation consists of short and mid grasses, creosotebush, and broom snakeweed.

Representative profile of Nickel gravelly sandy loam, 3 to 9 percent slopes, 10 feet north of road, west center of NE¼SE¼ sec. 26, T. 22 S., R. 19 W.:

A1—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly sandy loam, dark grayish brown (10YR 4/2) when moist; moderate, thin, platy structure and moderate, fine, granular structure; soft, very friable when moist, slightly sticky and nonplastic when wet; many fine and very fine roots; many, fine and very fine, interstitial pores; 20 percent gravel; slightly calcareous; moderately alkaline; smooth boundary. 2 to 4 inches thick.

AC—3 to 14 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 5/3) when moist; massive; soft, very friable when moist, slightly sticky and nonplastic when wet; many fine and very fine roots; many, fine and very fine, interstitial pores; 20 percent gravel; strongly calcareous; moderately alkaline; abrupt, wavy boundary. 10 to 16 inches thick.

Cca—14 to 60 inches, white (10YR 8/1) weakly cemented caliche of very gravelly loam texture, pinkish white (7.5YR 8/2) when moist; discontinuous, thick, platy structure and massive; very hard when dry, firm when moist, slightly sticky and nonplastic when wet; pockets of soil material similar to the AC horizon; many fine and very fine roots in the cracks and crevices of the caliche, but no roots in the caliche; 55 percent gravel and cobblestones; cementation and lime content decreases with depth; strongly calcareous; moderately alkaline.

The A horizon has a value of 6 or 7 when dry and ranges from 4 to 6 when moist. Chroma ranges from 2 to 4. This horizon ranges from gravelly sandy loam to gravelly loam in texture. The AC horizon has a value of 6 or 7 when dry and ranges from 4 to 6 when moist. Chroma ranges from 2 to 4. The AC horizon ranges from gravelly loam to very gravelly sandy loam. The Cca horizon is very gravelly loam or very cobbly loam. It is weakly cemented or has interbedded layers of weakly cemented and soft caliche. Depth to the Cca horizon ranges from 10 to 20 inches.

Nickel gravelly sandy loam, 3 to 9 percent slopes (NC).—This soil is throughout the low-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are minor areas of Mohave, Tres Hermanos, Stellar, and Forrest soils.

This soil has moderately slow permeability. Runoff is medium. The available water holding capacity is 1 to 2 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Limy range site, zones 6 and 7; wildlife habitat group J)

Nickel gravelly loam, 1 to 5 percent slopes (Ng).—This soil is in the high-intensity survey. It has a profile similar to that described as representative for the series, except that it has a gravelly loam surface layer about 5 inches thick. Included with this soil in mapping are small tracts of Yturbide, Gila, Hondale, and Mimbres soils.

This soil has moderately slow permeability. Runoff is medium. The available water holding capacity is 1 to 2 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. A small acreage has been used for irrigated cropland. (Irrigated capability unit IVe–2; dryland capability subclass VIIe; Limy range site, zones 6 and 7; wildlife habitat group J)

Nickel-Turney association, 0 to 5 percent slopes (NT).—This association is in the Hachita Valley in the low-intensity survey. It consists of about 45 percent Nickel gravelly sandy loam and about 40 percent Turney fine sandy loam. The undulating Nickel soil is on ridges, and the Turney soil is in the flatter swales between the ridges. Included in mapping are minor areas of Upton soils and of other soils, which make up about 15 percent of the association.

The Nickel soil has moderately slow permeability. Runoff is medium. The available water holding capacity is 1 to 2 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 10 to 20 inches. Hazard of erosion is moderate.

The Turney soil has moderate permeability. Runoff is medium. The available water holding capacity is 3 to 4 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 20 to 36 inches. Hazard of soil blowing is moderate.

The soils in this association are used for range, wildlife habitat, and watershed. (Nickel soil in dryland capability subclass VIIe, Limy range site, zones 6 and 7, and wildlife habitat group J; Turney soil in dryland capability subclass VIIs, Sandy range site, zones 6 and 7, and wildlife habitat group J)

Pima Series

The Pima series consists of well-drained soils that formed in alluvium from mixed igneous rocks on alluvial bottoms. Slopes are 1 to 3 percent. Associated soils are in the Hawkeye, Lehmans, Eba, Cloverdale, and Eicks series.

In a representative profile, the surface layer is dark grayish-brown heavy loam about 6 inches thick. The subsoil is dark grayish-brown light clay loam about 30 inches thick. The substratum is highly stratified, brown loam.

Areas of Pima soils range from 5,000 to 6,500 feet in elevation. The average annual air temperature is 57° to 59° F. The average annual precipitation is 13 to 15 inches. The frost-free season is 150 to 180 days.

Pima soils are used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. The vegetation is mainly short and mid grasses, annual grasses, and weeds.

Representative profile of a Pima loam from an area of Pima-Hawkeye complex, 50 feet west of road and 0.4 mile east and 1,500 feet south of the northwest corner of sec. 2, T. 31 S., R. 20 W.:

A1—0 to 6 inches, dark grayish-brown (10YR 4/2) heavy loam, very dark brown (10YR 2/3) when moist; moderate, medium, granular structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many, fine, tubular pores; approximately 3 percent organic matter; noncalcareous; mildly alkaline; clear, smooth boundary. 3 to 9 inches thick.

B21—6 to 24 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure and weak, medium, subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; many fine roots; common wormholes and worm casts; noncalcareous; mildly alkaline; gradual, wavy boundary. 10 to 22 inches thick.

B22—24 to 36 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark brown (10YR 2/2) when moist; weak, medium, prismatic structure and weak, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; common wormholes; noncalcareous; mildly alkaline; clear, wavy boundary. 6 to 30 inches thick.

C—36 to 60 inches, brown (7.5YR 5/4) loam; highly stratified with sand, silt, clay, and fine gravel; dark brown (7.5YR 3/2) when moist; massive; soft, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common, fine, tubular pores; noncalcareous; mildly alkaline.

The A horizon has a value of 3 or 4 when dry and 2 or 3 when moist. It ranges from heavy sandy loam to light clay loam in texture. The B horizon has a value of 3 or 4 when dry and 2 or 3 when moist. Chroma is 1 or 2. This horizon ranges from light clay loam to light silty clay loam. The C horizon has a value of 4 or 5 when dry and 3 or 4 when moist. It ranges from loam to fine sandy loam.

Pima-Hawkeye complex (0 to 3 percent slopes) (PH).—This complex is mainly in the Upper Animas Valley in southwestern Hidalgo County. It consists of about 40 percent Pima loam, 30 percent Hawkeye gravelly loam, and 20 percent stream alluvium. Included with this complex in mapping are areas of Mimbres, Gila, and Yturbide soils that make up about 10 percent of the complex.

The Pima soil has the profile described as representative for the Pima series. It has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 12 inches. The water-supplying capacity is 15 to 20 inches from precipitation and additional runoff. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The Hawkeye soil has the profile described as representative for the Hawkeye series. It has rapid permeability. Runoff is slow. The available water holding capacity is 3 to 4.5 inches. The water-supplying capacity is 10 to 12 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This complex is used for range, wildlife habitat, and watershed. A few acres, mainly of the Pima soil, have been used for irrigated cropland. (Dryland capability subclass VIc; Bottomland range site, zones 6 and 7; wildlife habitat group C)

Pinaleno Series

The Pinaleno series consists of well-drained soils that formed in very gravelly alluvium from mixed igneous rocks on alluvial fans on uplands. Slopes are 1 to 5 percent. Associated soils are in the Mimbres, Glendale, Forrest, and Frye series.

In a representative profile, the surface layer is brown gravelly loamy sand about 5 inches thick. The subsoil is a reddish-brown very gravelly sandy clay loam about 9 inches thick. The substratum is brown and pink, stratified very gravelly loamy sand and very gravelly sand. It is high in content of lime in the upper part, but lime content decreases with depth.

Areas of Pinaleno soils range from 3,800 to 4,500 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 10 to 12 inches. The frost-free season is 190 to 220 days.

Pinaleno soils are used for range, wildlife habitat, and watershed. The vegetation is mainly mid grasses, broom snakeweed, and Mormon-tea.

Representative profile of a Pinaleno gravelly loamy sand from an area of Pinaleno-Mimbres association, 0 to 5 percent slopes, 85 feet south of farm road in the north-central part of SE¼SE¼ sec. 24, T. 27 S., R. 22 W.:

A1—0 to 5 inches, brown (7.5YR 5/4) gravelly loamy sand, dark brown (7.5YR 4/4) when moist; weak, medium, platy structure parting to weak, medium, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common, fine, interstitial pores; 20 percent rounded to semiangular, mixed, acid igneous gravel and cobblestones; noncalcareous; mildly alkaline; clear, smooth boundary. 2 to 10 inches thick.

B21t—5 to 10 inches, reddish-brown (5YR 4/4) very gravelly sandy clay loam, dark reddish brown (5YR 3/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, interstitial pores; 50 percent rounded to semiangular, mixed, acid igneous gravel and cobblestones; patchy clay films on gravel and ped surfaces; noncalcareous; mildly alkaline; clear, wavy boundary. 3 to 12 inches thick.

B22t—10 to 14 inches, reddish-brown (5YR 5/4) very gravelly sandy clay loam, reddish brown (5YR 4/4) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, interstitial pores; 65 percent rounded to semiangular acid igneous gravel and cobblestones; patchy clay films on surfaces of gravel and cobblestones; strongly calcareous; moderately alkaline; clear, irregular boundary. 2 to 8 inches thick.

IIC1ca—14 to 23 inches, brown (7.5YR 5/4) very gravelly loamy sand, dark brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; no roots; common, fine, interstitial pores; 75 percent or more rounded to semiangular, mixed, acid igneous gravel and cobblestones; pockets of weakly cemented caliche, thin patchy lime coatings on surfaces of gravel; strongly calcareous; moderately alkaline; clear, wavy boundary. 4 to 24 inches thick.

IIC2ca—23 to 60 inches, pink (7.5YR 7/4) very gravelly sand, brown (7.5YR 5/4) when moist; single grain; loose when dry and moist, nonsticky when wet; no roots; many, fine, interstitial pores; 75 percent rounded to semiangular gravel and cobblestones; thin lime coatings on gravel; moderately calcareous; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. This horizon ranges from gravelly sandy loam to gravelly loamy sand in texture. The B horizon has a hue of 7.5YR or 5YR and a chroma of 3 or 4. It ranges from very gravelly sandy clay loam to very gravelly light clay loam.

Pinaleno-Mimbres association (0 to 5 percent slopes) (PM).—This association is only in the San Simon Valley in the low-intensity survey. It consists of about 40 percent Pinaleno gravelly loamy sand, 1 to 5 percent slopes, and about 40 percent Mimbres loam, 0 to 1 percent slopes. The gently sloping Pinaleno soil is on elongated ridges, and the nearly level Mimbres soil is in swales between the ridges. Included in mapping are areas of Yturbide, Forrest, and Glendale soils that make up about 20 percent of the association.

The Pinaleno soil has the profile described as representative for the Pinaleno series. It has moderately slow permeability. Runoff is medium. The available water holding capacity is 3 to 4 inches. The water-supplying capacity is 6 to 7 inches. Effective rooting depth is about 60 inches. Hazard of erosion is moderate.

The Mimbres soil has a profile similar to that described as representative for the Mimbres series, except that it has a loam surface layer. It has moderately slow permeability. Runoff is slow. The available water holding capacity is 10 to 11.5 inches. The water-supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

The soils in this association are used for range, wildlife habitat, and watershed. (Pinaleno soil in dryland capability subclass VIIe, Gravelly range site, zone 7, and wildlife habitat group B; Mimbres soil in dryland capability subclass VIIc, Loamy range site, zone 7, and wildlife habitat group H)

Pintura Series

The Pintura series consists of somewhat excessively drained soils that formed in wind-laid sands. Slopes are 0 to 3 percent. Associated soils are in the Berino, Mohave, Stellar and Mimbres series.

In a representative profile, the soil, to a depth of 60 inches or more, is reddish-brown loamy fine sand.

Areas of Pintura soils range from 4,200 to 5,000 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Pintura soils are used for range, wildlife habitat, and watershed. The vegetation is mainly common mesquite, mid grasses, and yucca.

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Representative profile of a Pintura loamy fine sand from an area of Pintura-Berino complex, eroded, 25 feet west of the road, 780 feet north and 15 feet west of the south quarter corner of sec. 25, T. 29 S., R. 15 W.:

C—0 to 60 inches, reddish-brown (5YR 5/4) loamy fine sand, dark reddish brown (5YR 3/4) when moist; single grain; loose when dry and moist, nonsticky and nonplastic when wet; common medium and few fine roots; fine interstitial pores; slightly calcareous; moderately alkaline.

The C horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 4 to 6. This horizon ranges from loamy fine sand to fine sand in texture. Buried horizons are common at a depth below 40 inches.

Pintura-Berino complex, eroded (0 to 3 percent slopes) (PR).—This complex is in the southeastern and north-central parts of the county in the low-intensity survey. It consists of about 60 percent Pintura loamy fine sand and about 30 percent Berino sandy clay loam, eroded. The undulating Pintura soil is on sand dunes, and the nearly level Berino soil is in the eroded areas between the dunes. Included with this complex in mapping are small areas of Mohave, Stellar, Jal, Nickel, and Yturbide soils that make up 10 percent of the complex.

The Pintura soil has the profile described as representative for the Pintura series. It has rapid permeability. Runoff is slow. The available water holding capacity is 3 to 6 inches. The water-supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. Hazard of soil blowing is severe.

The Berino soil has a profile similar to that described as representative for the Berino series, except that the sandy loam surface layer has been eroded away, exposing the sandy clay loam subsoil. This soil has moderate permeability. Runoff is medium. The available water holding capacity is about 5 to 7.5 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 30 to 40 inches. Hazard of soil blowing is moderate, and hazard of water erosion is slight to moderate.

The soils in this complex are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Sand Hills range site, zone 7; wildlife habitat group B)

Playas

Playas (PY) consist of barren, flat, generally dry, undrained basins. This land type is mainly in the low-intensity survey, but a few areas are in the high-intensity survey. It consists mainly of clay and silty clay sediments that have been deposited by water. Slopes are 0 to 1 percent. Included with this land type in mapping are a few small tracts of Hondale, Karro, and Jal soils.

Playas occasionally contain water of shallow depth for short periods. They are subject to periodic flooding. Playas are very strongly alkaline and are nonsaline to slightly saline.

The hazard of soil blowing is moderate during periods of high winds. Dust blowing from the playas located along highways can be a serious traffic hazard.

This land type is an occasional source of water for livestock and wildlife. It is barren of vegetation, except for a few annual forbs and grasses. Clumps of alkali

sacaton grow around the edges of the playas in places. (Dryland capability subclass VIIIw; wildlife habitat group M)

Riverwash

Riverwash (Rh) consists of deposits along the bottom of the Gila River and on the bottom of wide, intermittent drainageways. It is made up mainly of strata of sand, silt, and clay that contain varying amounts of gravel, cobblestones, and stones. Slopes are 0 to 1 percent.

Elevation ranges from 3,900 to 4,200 feet. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

This land type is mainly a river channel, but during the dry season some areas are used for limited livestock grazing. It is used as a source of water for irrigation and livestock. It is barren of most vegetation, except for scattered cottonwood and sycamore trees, common mesquite, willows, annual grasses, and forbs. (Dryland capability subclass VIIIw; wildlife habitat group N)

Rock Land

Rock land (RL) consists of rolling to hilly areas made up of two kinds of bedrock.

One kind of bedrock consists of acid igneous rock outcrop, mainly rhyolite, that is mainly around the Pyramid, Peloncillo, and Animas Mountains. Slopes are 10 to 25 percent. About 30 to 85 percent of the surface consists of exposed bedrock, stones, and cobblestones. These are surrounded by a thin mantle of soil material similar to that of the Lehmans soils.

Elevation ranges from 4,200 to 7,000 feet. The average annual air temperature is 58° to 60° F. The average annual precipitation ranges from about 12 inches at the lower elevations to about 18 inches at the higher elevations. The frost-free season is 150 to 210 days.

The vegetation consists of mid grasses, shrub live oak, juniper, century plant, and common mesquite.

The other kind of bedrock consists of limestone rock outcrop that is mainly in the Apache Hills, Little Hatchet Mountains, and Big Hatchet Mountains. About 50 to 95 percent of the surface consists of exposed limestone bedrock, stones, and cobblestones. These are surrounded by pockets of calcareous gravelly loam.

Elevation ranges from 4,200 to 7,000 feet. The average annual air temperature is 58° to 60° F. The average annual precipitation is about 10 inches at the lower elevations and about 17 inches at the higher elevations. The frost-free season is 150 to 210 days.

The vegetation consists of mid grasses, ocotillo, creosotebush, yucca, century plant, and cactus.

Runoff is rapid. The water-supplying capacity varies, but it is mainly 5 to 8 inches. The hazard of water erosion is moderate.

This land type is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Hills range site, zone 6, and Hills range site, zone 7; wildlife habitat group K)

Rough Broken Land

Rough broken land (RO) is a land type consisting mainly of exposures of the Gila geological formation. These exposures are in the form of upland breaks. Rough broken land is steep and very steep, and it occupies terrace breaks along the Gila River and the major drainage channels of intermittent streams. The Gila geological formation consists of unconsolidated, old valley fill. It is made up mainly of strata of sands, silts, and clays, but there are a few strata of gravel. Slopes range from 15 to 75 percent.

Elevation ranges from 4,000 to 5,000 feet. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

Runoff is rapid, and the hazard of erosion is severe. The water-supplying capacity is 3 to 5 inches.

This land type is used for range, wildlife habitat, and watershed. Vegetation is sparse and consists mainly of creosotebush, common mesquite, yucca, cactus, and mid grasses. (Dryland capability subclass VIIe; River Breaks range site, zone 7; wildlife habitat group J)

Rough Broken Land and Rock Land

Rough broken land and rock land (RU) is a steep and very steep land type that occurs throughout the highest and steepest mountainous parts of the county. In the Little Hatchet and Big Hatchet Mountains, limestone is the dominant bedrock. In the Pyramid, Peloncillo, and Animas Mountains, the bedrock is acid igneous. In the mountains in the northeastern corner of the county, the bedrock is granitic. Throughout areas of this land type are pockets of soil material that differs considerably in texture, depth, and reaction. Nearly everywhere this material is cobby and stony. Slopes range from 25 to 75 percent.

Elevation ranges from about 4,200 feet at the base of some of the mountains to about 8,500 feet at the peaks of the highest mountains. The average annual air temperature is 58° to 60° F. The average annual precipitation ranges from 10 to 18 inches. The frost-free season is 150 to 200 days.

Runoff is rapid to very rapid. The erosion hazard ranges from moderate to severe. The water-supplying capacity varies widely but is generally 5 to 8 inches. Where there is soil material, the effective rooting zone is generally 10 to 30 inches.

The vegetation varies widely with elevation. It is sparse but consists of mid grasses, agave, shrub live oak, juniper, and pinyon. Some pine grows around the Animas and Big Hatchet Peaks, but it is not used for commercial timber, because stands are sparse and inaccessible.

This land type is used mainly for watershed and wildlife habitat. It is used for grazing in some areas where it is accessible to livestock. The very steep slopes and rockiness greatly limit accessibility. Some trees are cut and used locally for fuel and fenceposts. (Rough broken land in dryland capability subclass VIIe, Rock land in dryland capability subclass VIIs; both in Hills range site, zone 6, and Hills range site, zone 7, and wildlife habitat group K)

Sonoita Series

The Sonoita series consists of well-drained soils that formed in old alluvium from granitic rocks on alluvial fans on uplands. Slopes are 0 to 5 percent. Associated soils are in the Hap and Yturbide series.

In a representative profile, the surface layer is brown gravelly sandy loam about 3 inches thick. The subsoil is brown gravelly light sandy clay loam about 27 inches thick. The substratum is strong-brown gravelly loamy sand.

Areas of Sonoita soils range from 4,200 to 5,500 feet in elevation. The average annual air temperature is 60° to 62° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Sonoita soils are used for range, wildlife habitat, and watershed. The vegetation is mainly short and mid grasses, broom snakeweed, yucca, and Mormon-tea.

Representative profile of a Sonoita gravelly sandy loam from an area of Sonoita-Yturbide complex in the SE¼ sec. 7, T. 22 S., R. 17 W.:

A1—0 to 3 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; moderate, medium, platy structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; common, fine, tubular pores; noncalcareous; mildly alkaline; clear, smooth boundary. 2 to 5 inches thick.

B2t—3 to 30 inches, brown (7.5YR 5/4) gravelly light sandy clay loam, dark brown (7.5YR 3/4) when moist; massive; very hard, very friable when moist, slightly sticky and nonplastic when wet; many fine roots; many, fine, tubular pores; thin clay films in pores; noncalcareous; mildly alkaline; abrupt, wavy boundary. 20 to 35 inches thick.

IIC—30 to 60 inches, strong-brown (7.5YR 5.6) gravelly loamy sand, dark brown (7.5YR 4/4) when moist; single grain; loose when dry and moist, nonsticky and nonplastic when wet; few fine roots in upper part; common, fine, interstitial pores; few threads of lime; slightly calcareous; mildly alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. This horizon ranges from gravelly sandy loam or sandy loam to gravelly loamy sand in texture. The B horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 4 to 6. This horizon ranges from gravelly heavy sandy loam to gravelly sandy clay loam. The IIC horizon has a value of 5 or 6 when dry and 4 or 5 when moist. It is dominantly gravelly loamy sand, but it contains thin strata as fine as gravelly loam in places. Gravel content throughout the profile ranges from 15 to 30 percent. The gravel consists of very fine, angular pebbles of granitic rocks that are high in content of feldspar.

Sonoita soils, as mapped in this county, have a subsoil that is slightly finer textured than is allowed within the Sonoita series. This difference does not alter their usefulness or behavior.

Sonoita sandy loam (0 to 3 percent slopes) (Sn).—This soil is northeast of Lordsburg in the high-intensity survey. It has a profile similar to that described as representative for the Sonoita series, except that it has a sandy loam surface layer about 7 inches thick. Included with this soil in mapping are small areas of Yturbide, Hap, and Mohave soils.

This soil has moderate permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more. The hazard of soil blowing is moderate.

This soil is used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. (Irrigated capability unit IIe–2; dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group C)

Sonoita-Yturbide complex (0 to 5 percent slopes) (SO).—This complex is mainly in the northeastern part of the low-intensity survey. It consists of about 65 percent Sonoita gravelly sandy loam and about 25 percent Yturbide loamy sand. The Sonoita soils are nearly level to undulating and are between intermittent streams. The Yturbide soils are nearly level to gently sloping and are along intermittent streams and terminal fans of the streams. Included in mapping are areas of Hap and Mohave soils that make up about 10 percent of the complex.

The Sonoita soil has the profile described as representative for the Sonoita series. It has moderate permeability. Runoff is medium. The available water holding capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more. The hazard of erosion is moderate to severe.

The Yturbide soil has a profile similar to the one described as representative for the Yturbide series. It has rapid permeability. Runoff is medium to slow. The available water holding capacity is 2.5 to 3.5 inches. The water-supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or more. The hazard of soil blowing is severe.

This complex is used for range, wildlife habitat, and watershed. (Sonoita soil in dryland capability subclass VIIe, Sandy range site, zones 6 and 7, and wildlife habitat group C; Yturbide soil in dryland capability subclass VIIe, Deep Sand range site, zones 6 and 7, and wildlife habitat group B)

Stellar Series

The Stellar series consists of well-drained soils that formed in material from mixed igneous rocks on old alluvial fans. Slopes are 0 to 3 percent. Associated soils are in the Forrest, Cloverdale, Mohave, and Mimbres series.

In a representative profile (fig. 9), the surface layer is pinkish-gray sandy clay loam about 5 inches thick. The upper part of the subsoil is reddish-brown clay about 18 inches thick. The lower part of the subsoil is light reddish-brown loam that is about 15 inches thick and is high in content of lime. The substratum is pink gravelly clay loam that is high in content of lime.

Areas of Stellar soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is about 10 inches at Lordsburg and about 14 inches at Cloverdale. The frost-free season is 180 to 210 days.

Stellar soils are used for irrigated cropland, range, wildlife, and watershed. The vegetation is mainly short and mid grasses, Morman-tea, common mesquite, and yucca.

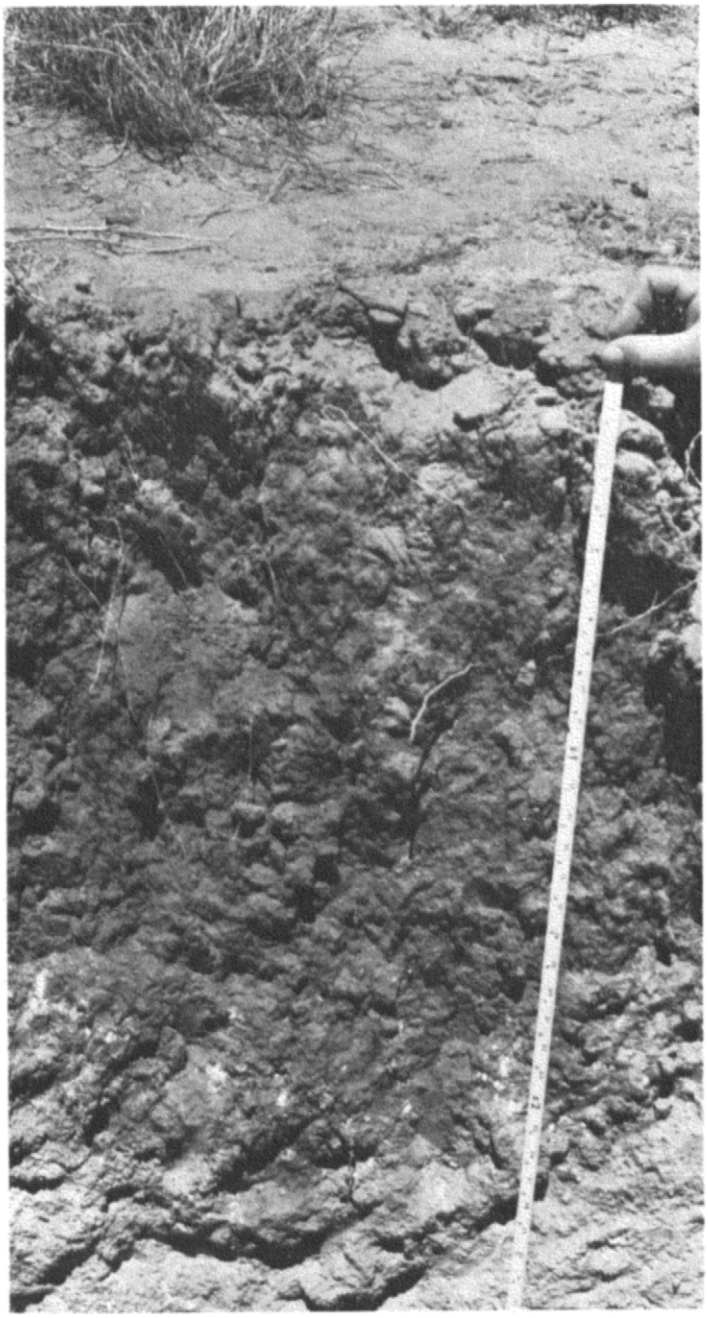

Figure 9.—**Profile of Stellar sandy clay loam. Common lime segregations are in the lower part of the subsoil, beginning at a depth of about 23 inches.**

Representative profile of Stellar sandy clay loam, 3½ miles northeast of Animas, 500 feet east of highway marker No. 338, 500 feet east of the west quarter corner of sec. 6, T. 27 S., R. 19 W.:

A1—0 to 2 inches, pinkish-gray (7.5YR 6/2) sandy clay loam, dark brown (7.5YR 4/2) when moist; weak, thick, platy structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; many fine roots; many vesicular pores; noncalcareous; mildly alkaline; clear, wavy boundary. 1 to 4 inches thick.

A12—2 to 5 inches, pinkish-gray (5YR 6/2) sandy clay loam, dark reddish gray (5YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable when moist, slightly sticky and slightly plastic when wet; many fine roots; many, fine, tubular pores; noncalcareous; mildly alkaline; gradual boundary. 0 to 4 inches thick.

B21t—5 to 10 inches, reddish-brown (5YR 5/3) clay, reddish brown (5YR 4/3) when moist; strong, medium, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; common fine roots; common, fine, tubular pores; thin, nearly continuous clay films on peds; noncalcareous; mildly alkaline; gradual, wavy boundary. 4 to 12 inches thick.

B22t—10 to 23 inches, reddish-brown (5YR 5/3) clay, reddish brown (5YR 4/3) when moist; strong, medium, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; common fine roots; common, fine, tubular pores; moderately thick nearly continuous clay films on ped surfaces; slightly calcareous; moderately alkaline; clear, smooth boundary. 0 to 16 inches thick.

IIB3ca—23 to 38 inches, light reddish-brown (5YR 6/4) loam, reddish brown (5YR 5/4) when moist; moderate, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; few fine roots; common, fine, tubular pores; common lime segregations; strongly calcareous; moderately alkaline; clear, wavy boundary. 8 to 20 inches thick.

IIICca—38 to 60 inches, pink (7.5YR 7/4) gravelly clay loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few, fine, tubular pores; lime coatings on pebbles; strongly calcareous; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 or 3. This horizon ranges from loam, sandy clay loam, or silty clay loam to gravelly clay loam or cobbly silty clay loam in texture. The B2t horizon has a value of 4 or 5 when dry and 3 or 4 when moist. Chroma is 3 or 4. This horizon is dominantly clay, but it ranges to heavy clay loam. The IIICca horizon has a value of 6 or 7 when dry and 4 or 5 when moist. Chroma is 3 or 4. This horizon ranges from clay loam to clay and contains 5 to 25 percent gravel.

Stellar sandy clay loam (0 to 1 percent slopes) (Sr) (SS).—This soil is nearly level in the high-intensity survey. Here, the surface layer ranges from sandy clay loam to loam. Included in mapping in the high-intensity survey are areas of Forrest, Mohave, and Mimbres soils that make up about 10 percent of the acreage.

This soil is mainly nearly level but ranges to gently sloping in the low-intensity survey. Here, the surface layer is mainly sandy clay loam or loam. Included in mapping in the low-intensity survey are small tracts of Stellar sandy loam. Also included are areas of Vekol, Mohave, and Forrest soils that make up about 15 percent of the acreage.

This soil has the profile described as representative for the Stellar series. It has slow permeability. Runoff is slow. The available water holding capacity is 8 to 9.5 inches. The water-supplying capacity is about 10 inches at the higher elevations and about 8 inches at the lower elevations. In a few areas that receive runoff, the water-supplying capacity is as much as 15 inches. Effective rooting depth is 60 inches or more. The hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Sr: irrigated capability unit IIs-2, dryland capability subclass VIs, Clayey range site,

zone 6. SS: dryland capability subclasses VIs, zone 6, and VIIs, zone 7; Clayey range site, zone 6, and Clayey range site, zone 7; both soils in wildlife habitat group L)

Stellar silty clay loam (0 to 1 percent slopes) (St).—This soil is in the high-intensity survey. It has a profile similar to that described as representative for the series, except that it has a silty clay loam or clay loam surface layer about 5 inches thick. Included in mapping are small tracts of Stellar silt loam and Forest and Mohave soils.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 8 to 9.5 inches. The water-supplying capacity is about 10 inches at the higher elevations and about 8 inches at the lower elevations. In a few areas that receive runoff, the water-supplying capacity is as much as 15 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IIs-6; dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group L)

Stellar cobbly silty clay loam (0 to 1 percent slopes) (Su).—This soil is only in the Lower Animas Valley in the high-intensity survey. It has a profile similar to that described as representative for the series, except that it has a cobbly silty clay loam surface layer about 9 inches thick. About 10 percent of the surface is covered with basalt cobblestones up to 10 inches in diameter. Included with this soil in mapping are small tracts of Forrest and Mohave soils.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 8 to 9.5 inches. The water-supplying capacity is about 10 inches at the higher elevations and about 8 inches at the lower elevations. In a few areas that receive runoff, the water-supplying capacity is as much as 15 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. It is not suitable for cropland, because irrigation water is not available. (Dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group A)

Terino Series

The Terino series consists of well-drained soils that formed in material from mixed igneous and limestone rocks on old alluvial fans on uplands. Indurated caliche is at a depth of 10 to 19 inches. Slopes are 1 to 5 percent. Associated soils are in the Turney, Mohave, Karro, and Ubar series.

In a representative profile, the surface layer is yellowish-red very gravelly sandy clay loam about 2 inches thick. The subsoil is yellowish-red very gravelly sandy clay loam about 11 inches thick. The substratum, at a depth of about 13 inches, is indurated caliche that contains gravel and cobblestones. It becomes less dense and less cemented with depth. It is several feet thick.

Areas of Terino soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Terino soils are used for range, wildlife habitat, and watershed. The vegetation is mainly short and mid grasses, yucca, creosotebush, graythorn, and common mesquite.

Representative profile of a Terino very gravelly sandy clay loam from an area of Terino-Turney association, one-eighth mile east of the north quarter corner of sec. 7, T. 30 S., R. 14 W.:

A1—0 to 2 inches, yellowish-red (5YR 5/6) very gravelly sandy clay loam, yellowish red (5YR 4/6) when moist; weak, medium, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; common, fine, vesicular pores; 20 percent mixed, acid, igneous gravel and cobblestones; noncalcareous; mildly alkaline; clear, wavy boundary. 0 to 5 inches thick.

AB—2 to 6 inches, yellowish-red (5YR 5/6) very gravelly sandy clay loam, dark red (2.5YR 3/6) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; 40 percent gravel and cobblestones; noncalcareous; mildly alkaline; clear, wavy boundary. 0 to 6 inches thick.

B2t—6 to 13 inches, yellowish-red (5YR 5/6) very gravelly heavy sandy clay loam, dark red (2.5YR 3/6) when moist; weak, medium, subangular blocky structure; slightly hard, very friable when moist, sticky and plastic when wet; common fine roots; common, fine, tubular pores; patchy clay films on the surface of peds, gravel, and cobblestones; noncalcareous except in lower 2 inches; moderately alkaline; abrupt, wavy boundary. 5 to 8 inches thick.

Ccam—13 inches, indurated caliche that is laminar in upper part of the horizon; cemented gravel and cobblestones in caliche; less dense and less cemented as depth increases.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 4 to 6. This horizon is gravelly or cobbly sandy loam or very gravelly sandy clay loam. The B2t horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 4 to 6. This horizon is very gravelly sandy clay loam or very cobbly sandy clay loam. Depth to the Ccam horizon ranges from 10 to 19 inches.

Terino-Turney association (1 to 5 percent slopes) (TE).—This association is only in the Hachita Valley in the low-intensity survey. It consists of about 70 percent Terino very gravelly sandy clay loam and about 20 percent Turney fine sandy loam. The Terino soil is undulating on gravelly ridges, and the Turney soil is gently sloping in swales between the ridges. Included in mapping are small areas of Nickel and Upton soils that make up about 10 percent of the association.

The Terino soil has a profile similar to the one described as representative for the Terino series. It has moderately slow permeability. Runoff is medium. The available water holding capacity is 1 to 1.5 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 10 to 19 inches. Hazard of erosion is moderate.

The Turney soil has the profile described as representative for the Turney series. It has moderate permeability. Runoff is medium. The available water holding capacity is 3 to 4 inches. The water-supplying capacity is about 5 to 7 inches. Effective rooting depth is 18 to 28 inches. Hazard of erosion is moderate.

This association is used for range, wildlife habitat, and watershed. (Terino soil in dryland capability subclass VIIe, Shallow range site, zones 6 and 7, and wildlife habitat group J; Turney soil in dryland capability

subclass VIIe, Sandy range site, zones 6 and 7, and wildlife habitat group J)

Tres Hermanos Series

The Tres Hermanos series consists of well-drained soils that formed in material from mixed igneous and limestone rocks on old alluvial fans. Slopes are 0 to 5 percent. Associated soils are in the Nickel, Mohave, Forrest, Lehmans, and Upton series.

In a representative profile (fig. 10), the surface layer is light-brown gravelly clay loam about 3 inches thick. The subsoil is reddish-brown gravelly clay loam that grades to pink gravelly clay loam. It is about 24 inches thick and is high in content of lime in the lower part. The substratum is pink very gravelly loam that has thin strata of sand and gravel below a depth of about 40 inches.

Areas of Tres Hermanos soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is about 60° to 62°F. The average annual precipitation is about 9 to 11 inches. The frost-free season is 190 to 210 days.

Figure 10.—**Profile of Tres Hermanos gravelly clay loam. This soil has a strong lime zone in the lower part of the subsoil, beginning at a depth of about 16 inches.**

Tres Hermanos soils are used mainly for range, wildlife, and watershed. A few acres near Lordsburg are used for irrigated cropland. The vegetation consists mainly of creosotebush, tarbush, short and mid grasses, and annuals.

Representative profile of Tres Hermanos gravelly clay loam, east of the town of Lordsburg, one-fourth mile north of the south quarter corner of sec. 34, T. 22 S., R. 18 W., on the north side of railroad tracks and about 100 yards east of road;

A1—0 to 3 inches, light-brown (7.5YR 6/3) gravelly clay loam, brown (7.5YR 5/2) when moist; moderate, medium, platy structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; common, very fine and fine, tubular and interstitial pores; disseminated lime; slightly calcareous; mildly alkaline; abrupt, smooth boundary. 2 to 6 inches thick.

B21t—3 to 10 inches, reddish-brown (5YR 5/4; 5YR 4/4 when moist) gravelly clay loam; weak, fine, subangular blocky structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine roots; common, very fine and fine, tubular and interstitial pores; few thin clay films, mostly in pores and on pebble surfaces; disseminated lime; slightly calcareous; mildly alkaline; gradual, smooth boundary. 4 to 8 inches thick.

B22tca—10 to 16 inches, reddish-brown (5YR 5/4; 5YR 4/4 when moist) gravelly clay loam; weak, fine, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; common very fine and fine roots; common, very fine and fine, tubular and interstitial pores; thin patchy clay films on peds, in pores, and on pebble surfaces; disseminated and segregated lime in many fine to medium soft masses and as hard coating on undersides of gravel; moderately calcareous; mildly alkaline; gradual, smooth boundary. 4 to 8 inches thick.

B3tca—16 to 27 inches, pink (5YR 7/3) gravelly clay loam, reddish brown (5YR 5/4) when moist; weak, fine, subangular blocky structure; hard, firm when moist, sticky and plastic when wet; few very fine roots; few, very fine, tubular pores; thin, patchy clay films on peds, in pores, and on pebble surfaces in the upper 3 inches; few thin clay films in rest of horizon; disseminated and segregated lime as common soft masses and as hard coating on undersides of gravel; strongly calcareous; moderately alkaline; gradual, smooth boundary. 8 to 14 inches thick.

IIC1—27 to 40 inches, pink (5YR 8/3) very gravelly loam, light reddish brown (5YR 6/3) when moist; massive; hard, friable when moist, slightly sticky and slightly plastic when wet; no roots; few, very fine, tubular pores; lime disseminated and as coatings on gravel; strongly calcareous; moderately alkaline; abrupt, wavy boundary. 5 to 18 inches thick.

IIIC2—40 to 60 inches, very gravelly loam with thin strata of sand and gravel; about 55 percent gravel.

The A horizon has a value of 5 to 7 when dry and 3 to 5 when moist. Chroma ranges from 2 to 4. This horizon ranges from loam, gravelly sandy clay loam, and gravelly sandy loam to gravelly light clay loam. The B2 horizon has a value of 5 or 6 when dry and 4 or 5 when moist. Chroma ranges from 3 to 5. This horizon ranges from gravelly heavy loam to gravelly clay loam. The IIC horizon is very gravelly loam to cobbly clay loam and is 15 to 50 percent gravel and cobblestones.

Tres Hermanos gravelly clay loam (0 to 3 percent slopes) (Th) (TR).—This soil is nearly level to gently sloping in the high-intensity survey. It has the profile described as representative for the series. Included with this soil in

mapping in the high-intensity survey are areas of Nickel, Mohave, and Forrest soils that make up about 15 percent of the acreage.

This soil is gently sloping to undulating in the low-intensity survey. It has a profile similar to that described as representative for the series, except that the surface layer is 1 to 2 inches thick and is gravelly sandy clay loam underlain by 2 to 4 inches of gravelly clay loam. Included in mapping in the low-intensity survey are areas of Nickel soils that make up 15 percent and of Forrest and Mohave soils that make up 10 percent of the acreage.

This soil has moderately slow permeability. Runoff is medium to slow. The available water holding capacity is 4 to 5 inches. The water-supplying capacity is about 6 to 8 inches. Effective rooting depth is about 40 inches; it is restricted by the strata of sand and gravel. The hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. (Irrigated capability unit IIIs–1; dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group B)

Turney Series

The Turney series consists of well-drained soils that formed in material from mixed igneous and limestone rocks on old alluvial fans on uplands. Slopes are 0 to 5 percent. Associated soils are in the Nickel, Pintura, Terino, Mohave, and Ubar series. Turney soils are mapped only in an association with Terino soils.

In a representative profile, the surface layer is light yellowish-brown and light-brown fine sandy loam about 6 inches thick. The subsoil is light-brown sandy clay loam about 9 inches thick. The substratum, to a depth of about 22 inches, is pink sandy clay loam and is high in content of lime. Below this, to a depth of 60 inches and more, it is pinkish-white, weakly cemented caliche.

Areas of Turney soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 60° to 62°F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Turney soils are used for range, wildlife, and watershed. The vegetation is mainly creosotebush, tarbush, and short and mid grasses.

Representative profile of a Turney fine sandy loam from an area of Terino-Turney association, 1/8 mile south and 1/4 mile east of the northwest corner of sec. 11, T. 30 S., R. 15 W.:

A11—0 to 1 inches, light yellowish-brown (10YR 6/4) fine sandy loam, brown (7.5YR 4/4) when moist; weak, thick, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; common, very fine, vesicular pores; 10 percent limestone and acid igneous gravel; strongly calcareous; moderately alkaline; abrupt, irregular boundary. 0 to 3 inches thick.

A12—1 to 6 inches, light-brown (7.5YR 6/4) fine sandy loam, brown (7.5YR 4/4) when moist; weak, thick, platy structure; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; common, very fine, vesicular pores; 5 percent fine limestone and acid igneous gravel; strongly calcareous; moderately alkaline; clear, wavy boundary. 3 to 8 inches thick.

B2—6 to 15 inches, light-brown (7.5YR 6/4) sandy clay loam, brown (7.5YR 4/4) when moist; weak, coarse, subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; common fine roots; common, fine, tubular pores; 5 percent limestone and acid igneous gravel; strongly calcareous; moderately alkaline; clear, wavy boundary. 8 to 14 inches thick.

C1ca—15 to 22 inches, pink (7.5YR 7/4) sandy clay loam, strong brown (7.5YR 5/6) when moist; weak, coarse, subangular blocky structure; soft, very friable when moist, slightly sticky and slightly plastic when wet; few fine roots; common, fine, tubular pores; 10 percent limestone and acid igneous gravel; strongly calcareous; moderately alkaline; abrupt, irregular boundary. 5 to 18 inches thick.

C2ca—22 to 60 inches, pinkish-white (7.5YR 8/2) weakly cemented caliche of sandy clay loam texture, pink (7.5YR 7/4) when moist; massive; very hard, friable when moist, sticky and plastic when wet; no roots; few, fine, tubular pores; 15 percent limestone and acid igneous gravel; lime decreases at depths below 48 inches; strongly calcareous; strongly alkaline.

The A horizon has a value of 6 or 7 when dry and 4 through 6 when moist. Chroma is 3 or 4. This horizon ranges from fine sandy loam to loam. The B horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. This horizon ranges from heavy sandy loam to sandy clay loam. The depth to the weakly cemented Cca horizon is 18 to 28 inches.

Ubar Series

The Ubar series consists of well-drained soils that formed in sediments from mixed igneous and limestone rocks on old alluvial fans. Slopes are 0 to 5 percent. Associated soils are in the Hondale, Turney, Mohave, and Verhalen series.

In a representative profile, the surface layer is light brownish-gray silt loam about 3 inches thick. The subsoil is about 43 inches thick. The upper 7 inches of the subsoil is pale-brown silty clay loam; the next 8 inches is light yellowish-brown light silty clay; and the lower 28 inches is brown light silty clay. The substratum is very pale brown clay.

Areas of Ubar soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Ubar soils are used for range, wildlife habitat, and watershed. A few acres in the Playas Valley have been used for irrigated cropland. The vegetation is mainly short grasses, allthorn, tarbush, common mesquite, and creosotebush.

Representative profile of Ubar silt loam, northeast of the south quarter corner of sec. 27, T. 31 S., R. 16 W.:

A1—0 to 3 inches, light-brownish gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure in upper 1 to 2 inches and weak, medium, granular structure in the lower part; slightly hard, very friable when moist, sticky and slightly plastic when wet; many fine and very fine roots; many, fine, vesicular pores; disseminated lime; strongly calcareous; moderately alkaline; clear, smooth boundary. 2 to 6 inches thick.

B21—3 to 10 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure; hard, very friable when moist, sticky and plastic when wet; many fine and very fine roots; many, fine and very fine, tubular

pores; disseminated lime; strongly calcareous; moderately alkaline; clear, smooth boundary. 4 to 10 inches thick.

B22—10 to 18 inches, light yellowish-brown (10YR 6/4) light silty clay, dark yellowish brown (10YR 3/4) when moist; weak, medium, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; many fine and very fine roots; many, fine and very fine, tubular pores; disseminated lime; strongly calcareous; moderately alkaline; clear, smooth boundary. 6 to 12 inches thick.

B23ca—18 to 46 inches, brown (7.5YR 5/4) light silty clay, dark yellowish brown (10YR 3/4) when moist; weak, fine, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; few fine and very fine roots in upper part; many, fine and very fine, tubular pores; disseminated lime; strongly calcareous; moderately alkaline; clear, irregular boundary. 8 to 30 inches thick.

Cca—46 to 60 inches, very pale brown (10YR 7/4) clay, yellowish brown (10YR 5/4) when moist; massive; very hard, friable when moist, very sticky and very plastic when wet; no roots; many, fine and very fine, tubular pores; disseminated and segregated lime in few fine soft masses; strongly calcareous; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma ranges from 2 to 4. This horizon ranges from silt loam to silty clay loam. The B horizon has a value of 3 or 4 when moist. It ranges from silty clay loam to silty clay or clay. The Cca horizon has a value of 5 to 7 when dry and 4 to 6 when moist. Chroma is 3 or 4. This horizon ranges from clay loam to silty clay or clay.

Ubar silt loam (0 to 1 percent slopes) (Ua).—This soil is in the Playas and Lower Animas Valleys in the high-intensity survey. It has the profile described as representative for the series. Included with this soil in mapping are minor areas of Hondale and Verhalen soils.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 9.5 to 10.5 inches. The water-supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. A few acres have been used for irrigated cropland. (Irrigated capability unit IIs-2; dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group L)

Ubar soils (0 to 5 percent slopes) (UC).—These soils are mainly in the Hachita and Playas Valleys in the low-intensity survey. This mapping unit consists of about 55 percent Ubar silty clay loam and silt loam and about 35 percent Ubar loam and sandy clay loam. These soils have a profile similar to that described as representative for the series, except that they have a surface layer of silty clay loam, sandy clay loam, loam, or silt loam about 6 inches thick. Included in mapping are areas of Hondale and Verhalen soils that make up about 10 percent of this mapping unit.

These soils have slow permeability. Runoff is slow to medium. The available water holding capacity is 9.5 to 10.5 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more. The hazard of erosion is slight.

These soils are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group L)

Upton Series

The Upton series consists of well-drained soils that formed in gravelly alluvium from limestone rocks on piedmont slopes. Indurated caliche is at a depth of 4 to 12 inches. Slopes are 1 to 9 percent. Associated soils are in the Nickel, Tres Hermanos, and Lehmans series.

In a representative profile the surface layer is brown gravelly loam about 8 inches thick and is high in content of lime. The substratum is white, indurated caliche.

Areas of Upton soils range from 4,000 to 5,500 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 170 to 210 days.

Upton soils are used for range, wildlife habitat, and watershed. The vegetation is mainly creosotebush, tarbush, and short and mid grasses.

Representative profile of Upton gravelly loam, 1 to 9 percent slopes, one-fourth mile west and 100 feet north of the southeast corner of sec. 18, T. 25 S., R. 20 W.:

A1—0 to 8 inches, brown (10YR 5/3) gravelly loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, platy structure in upper two inches, massive below; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; common, fine, tubular pores; strongly calcareous; moderately alkaline; abrupt boundary, 4 to 12 inches thick.

Ccam—8 inches, white (10YR 8/2), indurated caliche that is laminar in upper part of the horizon; imbedded limestone gravel and stones.

The A horizon has a value of 5 to 7 when dry and 4 or 5 when moist. Chroma ranges from 2 to 4. Texture ranges from gravelly sandy loam to gravelly heavy loam. The Ccam horizon is weakly to strongly cemented in the lower part.

Upton gravelly loam, 1 to 5 percent slopes (Ug).—This soil is in the high-intensity survey. Included in mapping are areas of Nickel and Tres Hermanos soils that make up about 10 percent of the acreage mapped as this Upton soil.

This soil has moderate permeability. Runoff is medium. The available water holding capacity is 0.5 to 1 inch. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 4 to 12 inches. Hazard of erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Shallow range site, zones 6 and 7; wildlife habitat group J)

Upton gravelly loam, 1 to 9 percent slopes (UP).—This soil is in the low-intensity survey. It has the profile described as representative for the series. Included in mapping are minor areas of Nickel and Tres Hermanos soils.

This soil has moderate permeability. Runoff is medium. The available water holding capacity is 0.5 to 1 inch. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 4 to 12 inches. Hazard of erosion is moderate.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Shallow range site, zones 6 and 7; wildlife habitat group J)

Vekol Series

The Vekol series consists of well-drained soils that formed in sediments from mixed igneous rocks on broad,

nearly level alluvial plains. Slopes are 0 to 1 percent. Associated soils are in the Mohave, Verhalen, Glendale, and Stellar series.

In a representative profile (fig. 11), the surface layer is pinkish-gray silt loam and silty clay loam about 7 inches thick. The subsoil is brown and pinkish-gray light clay and heavy silty clay loam about 30 inches thick. The substratum is light-gray silty clay loam.

Areas of Vekol soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 170 to 200 days.

Vekol soils are used for irrigated cropland, range, wildlife habitat, and watershed. The vegetation consists of short grasses, Mormon-tea, yucca, and common mesquite.

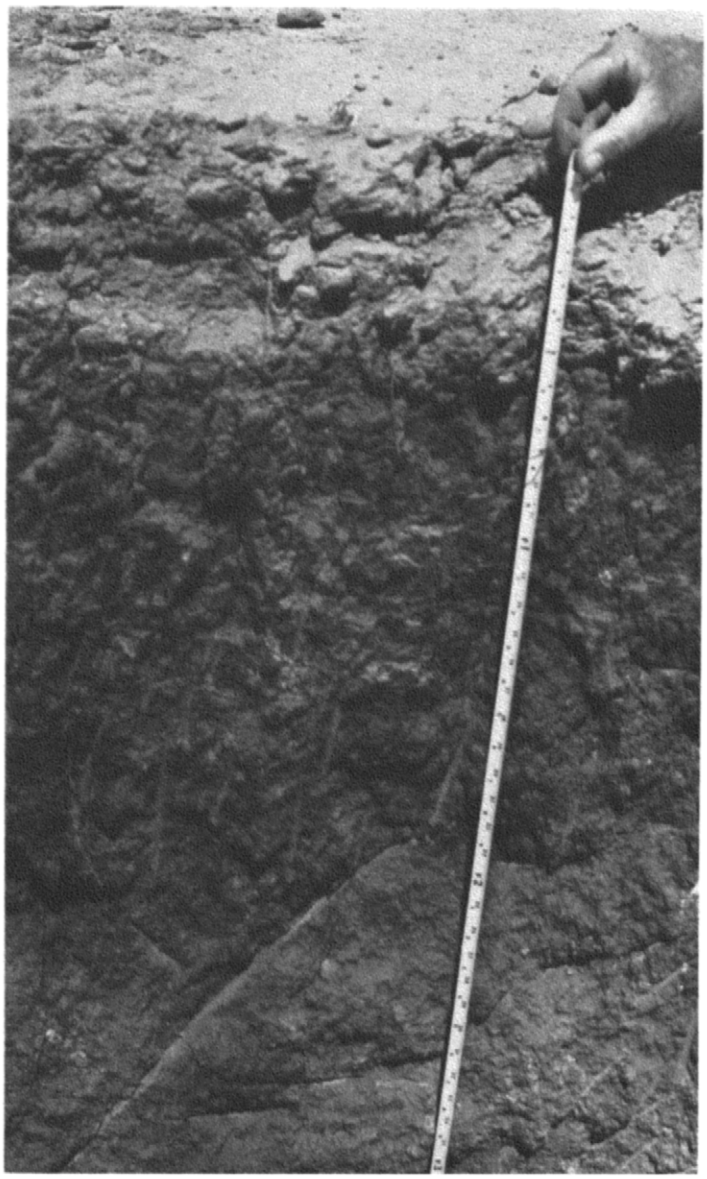

Figure 11.—**Profile of Vekol silty clay loam showing the surface layer and subsoil.**

465-705—73——4

Representative profile of Vekol silty clay loam, 500 feet northwest of the southeast corner of sec. 7, T. 27 S., R. 19 W.:

A11—0 to 2 inches, pinkish-gray (7.5YR 6/2) silty clay loam, brown (7.5YR 4/2) when moist; moderate, medium, platy structure; slightly hard, friable when moist, slightly sticky and slightly plastic when wet; common very fine roots; common, very fine and fine, tubular and interstitial pores; noncalcareous; neutral; clear, smooth boundary. 0 to 4 inches thick.

A12—2 to 7 inches, pinkish-gray (7.5YR 6/2) silty clay loam, brown (7.5YR 4/2) when moist; weak, thick, platy structure; hard, friable when moist, sticky and plastic when wet; few fine roots; many, very fine and fine, vesicular pores; common bleached sand grains; noncalcareous; mildly alkaline; abrupt, smooth boundary. 2 to 10 inches thick.

B2t—7 to 24 inches, brown (7.5YR 5/2) light clay, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure and moderate, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; common very fine roots; common, very fine and fine, tubular pores; many thin clay films on ped surfaces and lining pores; common bleached sand grains coating tops of prisms; noncalcareous; mildly alkaline; gradual, smooth boundary. 15 to 24 inches thick.

B3t—24 to 37 inches, pinkish-gray (7.5YR 6/2) heavy silty clay loam, brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; very hard, firm when moist, sticky and plastic when wet; few very fine roots; few, very fine, tubular pores; disseminated lime; strongly calcareous; moderately alkaline; gradual, smooth boundary. 10 to 18 inches thick.

C—37 to 60 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 5/3) when moist; massive; very hard, firm when moist, sticky and plastic when wet; few very fine roots; few, very fine, tubular pores; disseminated and segregated lime in few fine filaments; strongly calcareous; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 2 or 3. Texture ranges from silt loam or sandy clay loam to silty clay loam. The B horizon has a chroma of 2 or 3. It ranges from heavy silty clay loam to silty clay or clay.

Vekol sandy clay loam (0 to 1 percent slopes) (Vc).—This soil is in the high-intensity survey. It has a profile similar to that described as representative for the series, except that it has a sandy clay loam surface layer about 7 inches thick. Included with this soil in mapping are small areas of Vekol silty clay loam and Verhalen, Stellar, and Mimbres soils.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 9 to 11 inches. The water-supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. The hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IIs-2; dryland capability subclass VIIs; Loamy range site, zone 7; wildlife habitat group H)

Vekol silty clay loam (0 to 1 percent slopes) (Ve).—This soil is in the high-intensity survey, mainly in the Lower Animas and Playas Valleys. It has the profile described as representative for the series. Included with this soil in mapping are minor areas of Verhalen, Stellar, and Mimbres soils.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 9 to 11 inches. The

water-supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. The hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IIs-6; dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group H)

Vekol soils (0 to 1 percent slopes) (VK).—These soils are in the low-intensity survey. They have a profile similar to that described as representative for the series, except that they have a surface layer of sandy clay loam about 3 inches thick or of heavy silt loam and silty clay loam about 7 inches thick. Included with this soil in mapping are areas of Verhalen, Stellar, and Mimbres soils that make up about 15 percent of the area mapped as these Vekol soils.

These soils have slow permeability. Runoff is slow. The available water holding capacity is 9 to 11 inches. The water-supplying capacity is 7 to 8 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

These soils are used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIs; Clayey range site, zone 7; wildlife habitat group H)

Verhalen Series

The Verhalen series consists of moderately well drained soils that formed in fine-textured alluvium on alluvial bottoms. Slopes are 0 to 1 percent. Associated soils are in the Mimbres, Glendale, Mohave, and Stellar series.

In a representative profile, the surface layer is pinkish-gray and brown silty clay loam and clay loam about 7 inches thick. The next layer is brown clay about 11 inches thick. Below this is pinkish-gray silty clay about 6 inches thick. The substratum extends to a depth of 60 inches. The upper 8 inches of the substratum is pinkish-gray silty clay; the next 8 inches is light brownish-gray heavy clay loam; and the lower 20 inches is brown heavy silt loam.

Areas of Verhalen soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days.

Verhalen soils are used for irrigated cropland, range, wildlife habitat, and watershed. The vegetation is mainly short grasses and common mesquite.

Representative profile of Verhalen silty clay loam, 660 feet north of the southeast corner of sec. 29, T. 27 S., R. 19 W.:

A11—0 to 4 inches, pinkish-gray (7.5YR 6/2) silty clay loam, dark brown (7.5YR 4/2) when moist; weak, medium, platy structure and weak, fine, granular structure; hard, friable when moist, sticky and plastic when wet; common fine roots; few, fine, tubular pores; noncalcareous; mildly alkaline; abrupt, smooth boundary. 1 to 6 inches thick.

A12—4 to 7 inches, brown (7.5YR 5/2) clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; common fine roots; few, fine, tubular pores; noncalcareous; mildly alkaline; clear, smooth boundary. 2 to 5 inches thick.

AC1—7 to 18 inches, brown (7.5YR 5/2) clay, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure; very hard, friable when moist, very sticky and very plastic when wet; few fine roots; few, fine, tubular pores; few slickensides; noncalcareous; mildly alkaline; gradual boundary. 6 to 18 inches thick.

AC2—18 to 24 inches, pinkish-gray (7.5YR 6/2) silty clay, dark brown (7.5YR 4/2) when moist; weak, coarse, subangular blocky structure; very hard, firm when moist, very sticky and very plastic when wet; few fine roots; few, fine, tubular pores; few slickensides; noncalcareous; mildly alkaline; gradual, irregular boundary. 4 to 10 inches thick.

C1—24 to 32 inches, pinkish-gray (7.5YR 6/2) silty clay, dark brown (7.5YR 4/2) when moist; massive; very hard, firm when moist, very sticky and very plastic when wet; no roots; very few, fine, tubular pores; slightly calcareous; mildly alkaline; clear, wavy boundary. 4 to 14 inches thick.

C2—32 to 40 inches, light brownish-gray (10YR 6/2) heavy clay loam; dark grayish brown (10YR 4/2) when moist; massive; hard, friable when moist, sticky and plastic when wet; no roots; very few, fine, tubular pores; disseminated lime; strongly calcareous; moderately alkaline; clear, wavy boundary. 4 to 16 inches thick.

IIC3—40 to 60 inches, brown (7.5YR 5/2) heavy silt loam, dark brown (7.5YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable when moist, sticky and plastic when wet; no roots; very few, fine, tubular pores; common, medium, distinct, soft lime masses; strongly calcareous; moderately alkaline.

The A horizon has a value of 5 to 7 when dry and a chroma of 2 or 3. It ranges from clay loam to silty clay loam or clay. The AC horizon has a chroma of 2 or 3. The C horizon has a value of 5 or 6 when dry and 3 or 4 when moist and a chroma of 2 or 3. The IIC horizon ranges from silt loam to clay loam.

Verhalen silty clay loam (0 to 1 percent slopes) (Vm) (VN).—This soil has the profile described as representative for the series.

This soil is slightly undulating in the high-intensity survey. Here, the surface layer ranges from silty clay loam to clay loam. Included in mapping in the high-intensity survey are areas of Mimbres and Glendale soils that make up about 10 percent of the acreage.

This soil is nearly level and has slight gilgai microrelief in the low-intensity survey. Here, the surface layer ranges from silty clay loam or clay loam to clay. Included in mapping in the low-intensity survey are areas of Mimbres and Glendale soils and Verhalen loam that make up about 15 percent of the acreage.

This soil has slow permeability. Runoff is slow. The available water holding capacity is 10 to 11.5 inches. The water-supplying capacity is 15 to 20 inches from precipitation and additional runoff. Water from additional runoff is commonly diverted away from cropland. Effective rooting depth is 60 inches or more. The hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. (Irrigated capability unit IIIs-3; dryland capability subclass VIIs; Bottomland range site, zones 6 and 7; wildlife habitat group L)

Verhalen silty clay loam, alkali (0 to 1 percent slopes) (Vs) (VT).—This soil has a profile similar to that described as representative for the series, except that it is moderately affected by alkali.

This soil is nearly level and has slight gilgai microrelief in the high-intensity survey. Here, the surface layer ranges from silty clay loam to clay loam. Included in mapping in the high-intensity survey are areas of Mimbres and Glendale silty clay loams, alkali and strongly alkali, which make up about 10 percent of the acreage.

This soil is nearly level and has slight gilgai relief in the low-intensity survey. Here, the surface layer ranges from silty clay loam or clay loam to clay. Included in mapping in the low-intensity survey are areas of Mimbres and Glendale silty clay loams, alkali and strongly alkali, which together make up about 10 percent, and of Verhlen loam, alkali, which makes up about 10 percent of the acreage.

This soil has slow permeability. Runoff is slow. The available water holding capacity is about 2 or 3 inches. The water-supplying capacity is 15 to 20 inches from precipitation and additional runoff. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, and watershed. A few acres of this soil have been used for irrigated cropland. (Irrigated capability unit IVs–5; dryland capability unit VIIs; Salty Bottomland range site, zone 7; wildlife habitat group I)

Whitlock Series

The Whitlock series consists of well-drained soils that formed in mixed alluvium from acid igneous and limestone rocks on alluvial fans. Slopes are 5 to 10 percent. Associated soils are in the Mohave, Verhalen, Glendale, and Stellar series.

In a representative profile, the surface layer is light-brown gravelly loam about 4 inches thick. The substratum, to a depth of about 25 inches, is pink loam. Below this, to a depth of 60 inches or more, the substratum is pinkish-white gravelly loamy sand and is high in content of lime.

Areas of Whitlock soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

Whitlock soils are used for range, wildlife habitat, and watershed. The vegetation is mainly short and mid grasses and yucca.

Representative profile of Whitlock gravelly loam, 5 to 10 percent slopes, 400 feet southwest of the north quarter corner of sec. 30, T. 33 S., R. 16 W.:

A1—0 to 4 inches, light-brown (7.5YR 6/4) gravelly loam, brown (7.5YR 4/4) when moist; weak, fine, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; few medium and many fine roots; common very fine and fine pores; few pebbles and small cobblestones on the surface; strongly calcareous; moderately alkaline; clear, smooth boundary. 0 to 10 inches thick.

C1—4 to 11 inches, pink (7.5YR 7/4) loam, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few medium and very fine roots; common very fine and fine pores; few lime-coated pebbles; strongly calcareous; moderately alkaline; gradual boundary. 4 to 12 inches thick.

C2ca—11 to 25 inches, pink (7.5YR 7/4) loam, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few medium and very fine roots; common very fine and fine pores, and few medium pores; few, small, soft calcium carbonate masses; strongly calcareous; moderately alkaline; clear, irregular boundary. 5 to 15 inches thick.

IIC3ca—25 to 60 inches, pinkish-white (7.5YR 8/2) gravelly loamy sand, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few medium and many fine roots; common very fine pores; very finely divided calcium carbonate; strongly calcareous; moderately alkaline.

The A horizon has a value of 6 or 7 when dry and 4 or 5 when moist. Chroma is 3 or 4. Texture ranges from gravelly sandy loam to gravelly loam. The C horizon has a value of 6 or 7 when dry and 4 or 5 when moist. It is loam or gravelly loam. The IIC horizon has a value of 7 or 8 when dry and 4 to 6 when moist. It is loamy sand or gravelly loamy sand.

Whitlock gravelly loam, 5 to 10 percent slopes (Wh).—This soil is in Playas Valley in the high-intensity survey. Included with this soil in mapping are minor areas of Mohave soils that make up less than 15 percent of the area mapped as this Whitlock soil.

This soil has the profile described as representative for the series. It has moderately rapid permeability. Runoff is medium. The available water holding capacity is 5 to 6.5 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 60 inches. The hazard of erosion is severe.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group G)

Yana Series

The Yana series consists of well-drained soils that formed in mixed alluvium from acid igneous rocks on alluvial fans. Slopes are 1 to 9 percent. Associated soils are in the Frye, Mohave, Stellar, and Jal series.

In a representative profile, the surface layer is pale-brown gravelly sandy loam about 3 inches thick. The underlying material, to a depth of 60 inches or more, is brown gravelly loam.

Areas of Yana soils range from 4,000 to 5,000 feet in elevation. The average annual air temperature is 58° to 60° F. The average annual precipitation is 10 to 12 inches. The frost-free season is 180 to 210 days.

Yana soils are used for range, wildlife habitat, and watershed. The vegetation is mainly short and mid grasses, yucca, mesquite, Mormon-tea, and sacahuista.

Representative profile of Yana gravelly sandy loam, 1 to 9 percent slopes, 0.4 mile south and 0.3 mile east of the northwest corner of sec. 1, T. 30 S., R. 22 W.:

A—0 to 3 inches, pale-brown (10YR 6/3) gravelly sandy loam, brown (10YR 4/3) when moist; weak, thick, platy structure in the upper 1 inch grading to weak, medium, granular structure; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; common very fine pores; 20 percent fine to medium, sub-rounded, mixed igneous gravel; noncalcareous; neutral; clear, smooth boundary. 2 to 6 inches thick.

AC—3 to 14 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; many, fine and very fine, interstitial pores; 25 percent fine to medium, sub-rounded, mixed igneous gravel; noncalcareous; mildly alkaline; clear, smooth boundary. 8 to 20 inches thick.

C1—14 to 32 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; massive; slightly hard, very friable when moist, slightly sticky and slightly plastic when wet; common fine and very fine roots; many, fine and very fine, interstitial pores; 30 percent sub-rounded mixed igneous gravel up to 2 inches in diameter; noncalcareous; mildly alkaline; clear, smooth boundary. 10 to 30 inches thick.

C2—32 to 60 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; few fine and very fine roots; many, fine and very fine, interstitial pores; 40 percent sub-rounded mixed igneous gravel; disseminated lime and few, very fine, segregated flecks of carbonate on undersides of gravel; slightly calcareous; mildly alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. Texture ranges from a gravelly sandy loam to gravelly loam. The AC horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. Texture ranges from gravelly sandy loam to gravelly loam. The C horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. Texture ranges from gravelly sandy loam to gravelly loam in the upper part and from gravelly loam to very gravelly sandy loam in the lower part.

Yana gravelly sandy loam, 1 to 9 percent slopes (YA).—This soil is mainly in the San Simon Valley in the low-intensity survey. Included in mapping are areas of Mohave and Stellar soils that make up about 20 percent of the area mapped as this Yana soil.

This soil has moderate permeability. Runoff is slow to medium. The available water holding capacity is 5.5 to 6.5 inches. The water-supplying capacity is 5 to 7 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is moderate to severe.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group G)

Yturbide Series

The Yturbide series consists of excessively drained soils that formed in coarse-textured alluvium on alluvial fans. Slopes are 0 to 9 percent. Associated soils are in the Sonoita, Mimbres, Maricopa, Gila, Hondale, Mohave, and Stellar series.

In a representative profile, the surface layer is brown loamy sand about 8 inches thick. The substratum, to a depth of about 21 inches, is brown gravelly loamy sand. Below this, to a depth of 60 inches or more, it is strong-brown gravelly coarse sand.

Areas of Yturbide soils range from 4,000 to 5,500 feet in elevation. The average annual air temperature is 59° to 61° F. The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

The Yturbide soils are used for range, wildlife habitat, and watershed. They are also used as a source of construction material. A few acres have been used for irrigated cropland. The vegetation is mainly mid grasses, yucca, and common mesquite.

Representative profile of a Yturbide loamy sand from an area of Yturbide soils, 500 feet southeast of the northwest corner of sec. 16, T. 22 S., R. 17 W.:

A1—0 to 8 inches, brown (7.5YR 5/4, 7.5YR 4/4 when moist) loamy sand; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common fine roots; many, fine and very fine, interstitial pores; 10 percent fine gravel; noncalcareous; mildly alkaline; clear, wavy boundary. 4 to 10 inches thick.

C1—8 to 21 inches, brown (7.5YR 5/4, 7.5YR 4/4 when moist) gravelly loamy sand; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; many, fine and very fine, interstitial pores; 20 percent fine gravel; noncalcareous; mildly alkaline; clear, wavy boundary. 8 to 15 inches thick.

C2—21 to 30 inches, strong-brown (7.5YR 5/6) gravelly coarse sand, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; many, fine and very fine, interstitial pores; 20 percent fine gravel; noncalcareous; mildly alkaline; gradual, wavy boundary. 6 to 15 inches thick.

C3—30 to 60 inches, strong-brown (7.5YR 5/6) gravelly coarse sand, brown (7.5YR 4/4) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; few very fine roots; many, fine and very fine, interstitial pores; 25 percent gravel; few faint veins of lime; noncalcareous between veins; moderately alkaline.

The A horizon has a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. Texture ranges from loamy sand or loamy fine sand to gravelly loamy sand. The C horizon has a value of 5 or 6 when dry and 3 or 4 when moist. It is gravelly loamy sand or gravelly fine sand to gravelly coarse sand with 15 to 30 percent gravel. The profile ranges from noncalcareous to moderately calcareous throughout.

Yturbide gravelly loamy sand (0 to 3 percent slopes) (Yb).—This soil is in the high-intensity survey. It has a profile similar to that described as representative for the series, except that it is about 25 percent gravel in the surface layer. Included with this soil in mapping are small areas of Yturbide soils that have a gravelly sandy loam or a gravelly fine sand surface layer.

This soil has rapid permeability. Runoff is slow. The available water holding capacity is 2.5 to 3.5 inches. The water-supplying capacity is 6 to 8 inches. Effective rooting depth is 60 inches or deeper. The hazard of soil blowing is severe.

This soil is used as a source of sand and gravel and for range, wildlife habitat, and watershed. A few acres that occur in fields that are dominantly of other soils have been used for irrigated cropland. (Irrigated capability unit IVe-1; dryland capability subclass VIIe; Deep Sand range site, zones 6 and 7; wildlife habitat group B)

Yturbide soils (0 to 5 percent slopes) (YU).—These soils are in small areas throughout the county in the low-intensity survey. They have the profile described as representative for the series, but the texture of the surface layer ranges from loamy sand to loamy fine sand or gravelly loamy sand. Loamy sand is the most common texture. Included with these soils in mapping are areas of Hondale, Sonoita, Mohave, and Gila soils.

Yturbide soils have rapid permeability. Runoff is slow to medium. The available water holding capacity is 2.5 to 3.5 inches. The water-supplying capacity is 6 to 8

inches. Effective rooting depth is 60 inches or deeper. Hazard of soil blowing is severe.

These soils are used as a source of sand and gravel and for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Deep Sand range site, zones 6 and 7; wildlife habitat group B)

Yturbide Series, Heavy Subsoil Variant

The Yturbide series, heavy subsoil variant, consists of well-drained soils that formed in alluvium on alluvial fans. Slopes are 0 to 3 percent. Associated soils are in the Gila, Hondale, Sonoita, Mimbres, Maricopa, Mohave, Stellar, and Yturbide series.

In a representative profile, the surface layer is pale-brown loamy sand about 10 inches thick. The next layer is pale-brown loamy sand about 10 inches thick. The underlying material extends to a depth of 60 inches. The upper 14 inches of this material is mottled white, light brownish-gray, and dark grayish-brown sandy clay; the next 6 inches is light-gray sandy clay loam; and the lower 20 inches is light reddish-brown heavy clay loam.

Areas of Yturbide soils, heavy subsoil variant, range from 4,000 to 5,500 feet in elevation. The average annual air temperature is 59° to 61° F. The average precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days.

The Yturbide soils, heavy subsoil variant, are used for range, wildlife habitat, and watershed. The vegetation is mainly mid grasses, sand sagebrush, yucca, and common mesquite.

Representative profile of Yturbide loamy sand, heavy subsoil variant, 0.2 mile south of center of sec. 2, T. 33 S., R. 20 W.:

A11—0 to 2 inches, pale-brown (10YR 6/3) loamy sand, dark brown (10YR 3/3) when moist; massive; soft, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; many, fine and very fine, interstitial pores; noncalcareous; mildly alkaline; clear boundary. 0 to 6 inches thick.

A12—2 to 10 inches, pale-brown (10YR 6/3) loamy sand, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; many, fine and very fine, interstitial pores; noncalcareous; mildly alkaline; abrupt boundary. 8 to 20 inches thick.

C—10 to 20 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 4/3) when moist; massive; slightly hard, very friable when moist, nonsticky and nonplastic when wet; common fine and very fine roots; many, fine and very fine, interstitial pores; noncalcareous; mildly alkaline; abrupt boundary. 8 to 20 inches thick.

IIA2b—20 to 22 inches, white (2.5YR 8/2) heavy sandy loam, grayish brown (2.5YR 5/2) when moist; weak, thick, platy structure; very hard, friable when moist; nonsticky and nonplastic when wet; few very fine roots; many, fine and very fine, vesicular pores; weakly cemented by silica; noncalcareous; mildly alkaline; clear boundary. 0 to 6 inches thick.

IIB2tb—22 to 34 inches, highly mottled white, light brownish-gray and dark grayish-brown (2.5Y 8/2, 6/2, 4/2) sandy clay, grayish brown, dark grayish brown, and very dark grayish brown (2.5Y 5/2, 4/2, 3/2) when moist; weak, medium, prismatic structure and moderate, coarse, subangular blocky structure; weak, thin, platy structure on rounded caps of prisms; very hard, firm when moist, sticky and plastic when wet; few very fine roots; few, very fine, tubular pores; thick, patchy clay films on ped surfaces; noncalcareous; mildly alkaline; clear boundary. 6 to 20 inches thick.

IICb—34 to 40 inches, light-gray (2.5Y 7/2) sandy clay loam, grayish brown (2.5Y 5/2) when moist; massive; very hard, firm when moist, nonsticky and nonplastic when wet; few very fine roots; few, fine, tubular pores; slightly cemented with silica; noncalcareous; mildly alkaline; clear boundary. 4 to 10 inches thick.

IIIB2b—40 to 60 inches, light reddish-brown (5YR 6/4) heavy clay loam, reddish brown (5Y 4/4) when moist; common, fine, prominent mottles of very pale brown (10YR 7/3) and brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; very hard, friable when moist, sticky and plastic when wet; few very fine roots; few, fine, tubular pores; noncalcareous; mildly alkaline.

The A and C horizons have a value of 5 or 6 when dry and 3 or 4 when moist. Chroma is 3 or 4. Texture ranges from sand to loamy sand. The IIA, IIB, and IIC horizons range from 2.5Y to 5YR in hue. The IIB and IIC horizons range from sandy clay loam to clay in texture.

Yturbide loamy sand, heavy subsoil variant (0 to 3 percent slopes) (YY).—This soil is mostly in the low-intensity survey. A few areas are intermingled in the high-intensity survey. Included in mapping are areas of Yturbide soils that make up about 20 percent of the area mapped as this Yturbide variant.

This soil has moderate to moderately slow permeability. Runoff is slow. The available water holding capacity is 7.0 to 8.5 inches. The water-supplying capacity is 7 to 8.5 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is severe.

This soil is used for range, wildlife habitat, and watershed. (Dryland capability subclass VIIe; Sandy range site, zones 6 and 7; wildlife habitat group C)

Use and Management of the Soils

This section discusses the behavior and potential of the soils of Hidalgo County. The first part describes the general management of irrigated soils. This includes discussions of conservation cropping systems, managing crop residue, minimum tillage, use of fertilizer, and alkali soils. This subsection is followed by an explanation of the system of capability grouping and management of the soils by capability units. Next, there is a discussion and table on predicted yields of crops for the soils of the county. Finally, the management of the soils for range, woodland, and wildlife and the use of the soils in engineering are discussed.

General Management of Irrigated Soils [3]

This section deals with the major management practices used in growing crops on the soils of Hidalgo County. These practices are used to protect the soil from erosion and to maintain tilth and plant nutrients that are necessary for long-term, high-level production.

[3] By Jack G. Douglas, conservation agronomist, Soil Conservation Service.

The cultivated soils of the county are in a semidesert region. All tilled crops need irrigation because of limited rainfall. The irrigated soils are mainly in the Upper and Lower Animas, Playas, and Virden Valleys. Other small areas are in the Pyramid, Lordsburg, and San Simon Valleys.

The primary object of soil management is to increase and maintain productivity and to control erosion. Among the practices used to obtain these objectives are conservation cropping systems, minimum tillage, residue management, fertilizing, cover crops, grasses and legumes in a long-term rotation, irrigation water management, and treatment of special soil problems.

The most effective way of meeting soil management goals is the selection of the right combination of practices. The good farmer applies the needed conservation practices in accordance with the needs of the soils.

Conservation cropping systems

Conservation cropping systems are used to meet the soil needs for improvement or maintenance of tilth, control of erosion, and control of weeds, insects, and diseases.

A conservation cropping system consists of a rotation or sequence of crops in which soil-improving crops balance soil-depleting crops in their effect on the soil. How often a soil-improving crop is grown depends on the severity of the erosion hazard and on other soil limitations. Grabe loam, for example, does not need a soil-improving crop so frequently as Comoro fine sandy loam. Legumes, such as alfalfa, and grasses are soil-improving crops if they are properly managed and fertilized and if a large amount of plant residue is returned to the soil during the last year of a rotation.

Nonlegume crops, such as small grain and sorghum, can be used to meet the requirements of a soil-improving crop if large quantities of residue are returned to the soil, if nitrogen is applied to aid in decomposition, and if a large amount of residue is mixed with the soil as a green manure.

Cover crops are sometimes grown in conservation cropping systems. They are used primarily to protect and improve the soil. Cover crops are close-growing crops grown between periods of regular crop production. Some suitable cover crops for Hidalgo County are small grain, vetch, winter peas, and sweetclover.

Some soils in Hidalgo County are infected with verticillium wilt. This is a soil-borne fungus that mainly affects cotton. Verticillium wilt is most serious on soils that have slow to very slow permeability, such as Hondale silt loam and Stellar silty clay loam. The use of a conservation cropping system of cotton frequently rotated with a high-residue crop, such as barley or grain sorghum, is one method of management for the control of verticillium wilt.

Among the more important irrigated crops suited to the soils and climate of Hidalgo County are cotton, sorghum, barley, beans, and alfalfa.

Managing crop residue

Conserving crop residue by working it into the surface layer is a desirable practice on all the soils in Hidalgo County. Crop residue contains part of the nutrients the plants removed from the soil when they were growing. When the residue is returned to the soil, microorganisms decompose it and return to the soil some of the nutrients removed by the crop.

Some of the beneficial effects of returning crop residue to the soil are improving tilth, increasing the infiltration rate, controlling erosion, improving environment for bacterial life, increasing soil pore space for more air and water, and reducing crusting.

Soils such as Berino sandy loam and Maricopa loamy sand are susceptible to soil blowing in spring if not properly managed. Grain sorghum residue on these soils should not be plowed into the soil following harvest but should be maintained on the surface until time for seedbed preparation for preirrigation and planting.

Minimum tillage

Minimum tillage is an important management practice in Hidalgo County. When soils are cropped, they must be worked to prepare a seedbed, to control weeds or other competitive vegetation, and to provide a favorable place for plants to grow. Excessive tillage destroys soil structure. It forces soil particles close together and reduces pore space. The soil tends to puddle and crust at the surface and takes in less water and air, which results in reduced plant growth. Excessive tillage also causes compaction of the surface soil, particularly on soils that have a loam surface layer (fig. 12). This can be avoided by

Figure 12.—General view of tillage pan on Vekol sandy clay loam.

reducing the number of tillage operations, by not tilling when the soil is wet, and by varying the depth of tillage to reduce the formation of plowpans.

Use of fertilizer

Good management of irrigated cropland requires the use of commercial fertilizer or applications of barnyard manure. Plants need nutrients to produce high yields. Plant nutrients are also needed to produce large quantities of residue to improve or maintain tilth and to protect the soil from erosion. Fertilizer supplements other conservation practices if properly used.

Most soils in Hidalgo County are deficient in nitrogen and phosphorus. Potassium is generally available to plants in sufficient quantities. Some soils of Hidalgo County are deficient in available iron, particularly those soils, such as Jal loam, that are high in content of lime. A low supply of iron is normally accompanied by yellowing of plant leaves. It shows particularly on grain sorghum, garden crops, lawns, and fruit trees.

Barnyard manure provides nutrients that plants need, and it also improves the condition of the soil. It is in short supply in Hidalgo County, but some is available from home and commercial feedlots.

Areas from which part or all of the surface layer has been removed by leveling should receive heavy applications of barnyard manure, or they should be well fertilized and planted to a soil-improving crop the first year after being leveled.

The amount and kind of fertilizer to apply should be based primarily on the kind of soil, plant needs, previous cropping history, and a soil test.

Alkali soils

Alkali soils are soils that have 15 percent or more sodium on the surface of the clay particles. They are generally strongly alkaline or very strongly alkaline (pH 8.5 or higher).

There are about 130,000 acres of alkali-affected soils in Hidalgo County. Of these, about 76,000 acres are moderately alkali affected. There are about 26,000 acres of moderately alkali-affected soils in the high-intensity survey. These soils are referred to as alkali soils and are suitable for cultivation if irrigated, but they have limitations for use. These soils are in the Hondale, Mimbres, Glendale, and Verhalen series. A moderately alkali-affected soil is one that contains sufficient sodium to affect plant growth and the physical condition of the soil. Alkali soils are often recognized by spots in the field that appear slick, puddled, and glazed; by spotted stands; and by stunted and irregular growth.

Beans, pecans, and fruit trees are sensitive to sodium and should not be grown on alkali soils, but alfalfa, cotton, and barley are sodium-tolerant crops. The spotty stands and irregular growth of sodium-tolerant crops is primarily caused by the physical condition of the soil rather than by the alkali (*8*).

Improvement of a moderately alkali-affected soil consists of adding chemical amendments, such as gypsum, sulfur, or sulfuric acid, followed by leaching. Leaching consists of flushing the soil with irrigation water. As the water passes through the soil, the soluble sodium salts are moved downward from the root zone.

Alkali soils are commonly improved by the use of tall wheatgrass. It has an abundance of deep, fibrous roots that add organic matter and improve soil aggregation and general soil condition. Planting of tall wheatgrass works well in conjunction with the application of gypsum or other amendments.

It is desirable to follow treatment of alkali soils with an application of barnyard manure or seeding of drilled fibrous-rooted crops, such as adapted small grain or grasses, or both.

On soils where irrigation water or soil properties do not permit the reduction of sodium to desirable levels, an alternative use should be considered.

Capability Grouping

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

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

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

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

Class I soils have few limitations that restrict their use.

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

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

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

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife. (None in Hidalgo County.)

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

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

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

CAPABILITY SUBCLASSES are soil groups within one class; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

CAPABILITY UNITS are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–2 or IIIe–1. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Climatic zones

New Mexico is divided into numbered climatic zones (*4*). Only zones 6 and 7 are in Hidalgo County (fig. 13). Zone 6 is in the higher areas; zone 7 is in the lower areas. The differences in climate influence the kind and amount of vegetation. Zone 6, for example, receives considerably more precipitation than zone 7, and consequently yields are greater in zone 6 than in zone 7.

These climatic zones were developed to correlate areas that have definite climatic limitations with the system of capability classification used by the Soil Conservation Service. They are used to predict the climatic limitations on rangeland and dry cropland. They are not considered for irrigated soils.

In general, the higher the climatic zone number the more severe the climatic limitation for crop or forage production. For example, zone 1 has no climatic limitations. The only limitations in this zone are those factors other than climate. Zone 7 has severe climatic limitations even if all other factors are favorable for crop production.

Zone 6 has such severe climatic limitations that it is unsuited to cultivation unless irrigated. It has an average annual precipitation of about 14 inches. It can be managed for increased forage production as pasture or native rangeland. Unless otherwise limited, soils in this zone respond to range or pasture improvements if needed. Such practices as seeding, fertilizing, or water control, such as by use of diversions or water spreaders, are practical.

Zone 7 has very severe climatic limitations. It is unsuited to cultivation unless irrigated. It has an average annual precipitation of about 10 inches. It is impractical to apply such pasture or range improvements as seeding or fertilizing. Unless otherwise limited, the soils in this zone can be used for grazing under proper management. If the rangeland in this zone is allowed to deteriorate, it is almost impossible to reclaim, even under intensive management.

Management by capability units [4]

In the following pages the capability units in Hidalgo County are described and suggestions for the use and management of the soils are given. Of the eight classes in the capability system, only classes I, II, III, and IV are discussed. Placement of the soils in classes VI, VII, and VIII in capability subclasses is shown in the "Guide to Mapping Units."

The capability units discussed in the following pages are not all numbered consecutively. This is because the grouping is statewide, and not all the units in the State are represented in this county.

IRRIGATED CAPABILITY UNIT I–1

This unit consists of soils of the Gila, Glendale, Grabe, Mimbres, and Mohave series. These soils are well drained and have a loam or sandy clay loam surface layer underlain by loam, sandy clay loam, clay loam, or silty clay loam. They formed in mixed recent to old alluvium from igneous and limestone sources on alluvial bottoms, on alluvial fans, and in swales. Slopes are 0 to 1 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 170 to 210 days. Permeability is moderate to moderately slow. Runoff is slow. The available water holding capacity is 7.5 to 12 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. All crops suited to the county can be grown. The main crops are cotton, sorghum, barley, and alfalfa.

Good management includes efficient use of irrigation water and maintenance of soil fertility. A crop that leaves a large amount of residue or a crop that improves the soil should be grown 1 year in 4. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown. Deep-rooted legumes or perennial grasses can be grown.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. These soils are suited to gravity or sprinkler irrigation. A properly designed irrigation system is needed for efficient use of irrigation water.

[4] JACK G. DOUGLAS, conservation agronomist, Soil Conservation Service, helped to prepare this subsection.

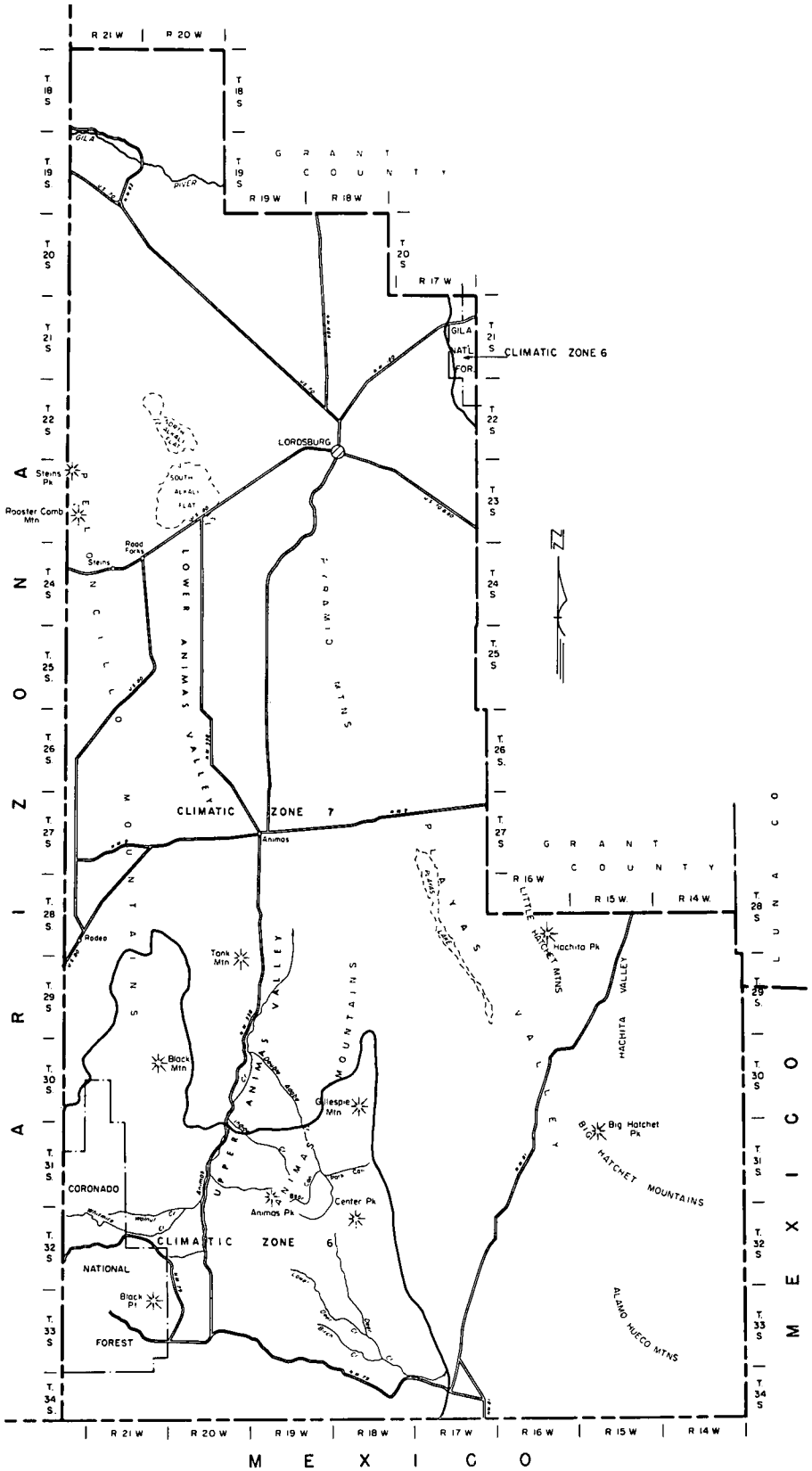

***Figure 13.*—Climatic zones in Hidalgo County.**

IRRIGATED CAPABILITY UNIT I-2

This unit consists of soils of the Glendale, Grabe, and Mimbres series. These soils are well drained and have a silty clay loam surface layer underlain by silty clay loam, clay loam, or loam. They formed in mixed alluvium on alluvial bottoms, in swales, and on fans. Slopes are 0 to 2 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days. Permeability is moderately slow to moderate. Runoff is slow. Available water holding capacity is 9 to 12 inches. Effective rooting depth is 60 inches or more. Hazard of water erosion is slight.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. All crops suited to the county can be grown. The main crops are cotton, sorghum, barley, and alfalfa.

Good management includes tilling only when the soil is sufficiently dry to prevent formation of a tillage pan, efficient use of irrigation water, and maintenance of soil fertility. A crop that leaves a large amount of residue or a crop that improves the soil, such as fertilized grain sorghum or barley, should be grown 1 year in 4. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown 1 year in 4. Deep-rooted legumes, such as alfalfa, or perennial grasses can be grown in a long-term rotation to keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain productivity and soil fertility. Most crops respond to application of nitrogen fertilizer. Alfalfa responds to application of phosphorus. These soils are suited to gravity irrigation. A properly designed irrigation system is needed for efficient use of water.

IRRIGATED CAPABILITY UNIT IIe-2

This unit consists of soils of the Berino, Comoro, and Sonoita series. These soils are well drained and have a sandy loam or fine sandy loam surface layer underlain by sandy loam, sandy clay loam, or gravelly sandy clay loam. They formed in recent or old alluvium on alluvial bottoms or alluvial fans. Slopes are 0 to 3 percent.

The average annual precipitation is about 9 to 12 inches. The frost-free season is 185 to 215 days. Permeability is moderate to moderately rapid. Runoff is slow to medium. The available water holding capacity is 5 to 8 inches. Effective rooting depth is 60 inches. Berino soils have a strong lime zone at a depth of 30 to 40 inches. Hazard of soil blowing is moderate.

These soils are used for range, irrigated cropland, wildlife habitat, and watershed. All crops suited to the county can be grown. The main crops are cotton, sorghum, and alfalfa.

Good management includes control of soil blowing, efficient use of irrigation water, and maintenance of soil fertility. A crop that leaves a large amount of residue or one that improves the soil, such as fertilized grain sorghum or barley, should be grown 1 year in 3. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown. Deep-rooted legumes, such as alfalfa, or perennial grasses can be grown in a long-term rotation to control soil blowing and keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain productivity and soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. These soils are suited to gravity or sprinkler irrigation. A properly designed irrigation system is needed to make efficient use of irrigation water.

IRRIGATED CAPABILITY UNIT IIe-3

This unit consists of soils of the Comoro and Mohave series. These soils are well drained and have a gravelly loam or sandy clay loam surface layer underlain by sandy loam or sandy clay loam and clay loam. They formed in mixed recent or old alluvium on alluvial bottoms or alluvial fans. Slopes are 1 to 3 percent.

The average annual precipitation is 9 to 12 inches. The frost-free season is 170 to 215 days. Permeability is moderately rapid or moderately slow. Runoff is medium. The available water holding capacity is 6 to 8 inches. Effective rooting depth is about 60 inches. Hazard of water erosion is moderate.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. All crops suited to the county can be grown. The main crops are cotton, sorghum, barley, and alfalfa.

Good management includes efficient use of irrigation water, control of runoff and erosion, and maintenance of soil fertility. A crop that leaves a large amount of residue or a crop that improves the soil should be grown 1 year in 3. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown. Deep-rooted legumes or perennial grasses can be grown in a long-term rotation to keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. These soils are better suited to a surface irrigation system than to sprinkler irrigation. A properly designed irrigation system is needed to control runoff and erosion.

IRRIGATED CAPABILITY UNIT IIs-2

This unit consists of soils of the Stellar, Ubar, and Vekol series. These soils are well drained and have a sandy clay loam or silt loam surface layer underlain by clay or silty clay to heavy silty clay loam. They formed in mixed alluvium on old alluvial fans or plains. Slopes are 0 to 1 percent.

The average annual precipitation is 9 to 14 inches. The frost-free season is 170 to 210 days. Permeability is slow. Runoff is slow. The available water holding capacity ranges from 8 to 11 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. All crops suited to the county can be grown. The main crops are cotton, sorghum, barley, and alfalfa.

Good management includes tilling only when the soil is sufficiently dry to prevent formation of a tillage pan, maintaining or improving water infiltration, efficient use of irrigation water, and maintenance of fertility. A crop that leaves a large amount of residue or a crop that improves the soil should be grown 1 year in 3. If the cropping system does not include a high-residue crop, a

mulch of a suitable residue can be used or a cover crop can be grown. Deep-rooted legumes or perennial grasses can be grown to keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. These soils are suited to a gravity irrigation system. A properly designed irrigation system is needed for efficient use of water.

IRRIGATED CAPABILITY UNIT IIs–6

This unit consists of soils of the Stellar and Vekol series. These soils are well drained and have a silty clay loam surface layer underlain by clay or silty clay to heavy silty clay loam. They formed in mixed alluvium on old alluvial fans or plains. Slopes are 0 to 1 percent.

The average annual precipitation is 9 to 14 inches. The frost-free season is 170 to 210 days. Permeability is slow. Runoff is slow. The available water holding capacity ranges from 8 to 11 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. All crops suited to the county can be grown. The main crops are cotton, sorghum, barley, alfalfa, and beans.

Good management includes tilling only when the soil is sufficiently dry to prevent formation of a tillage pan, increasing water infiltration, efficient use of irrigation water, and maintenance of soil fertility. A crop that leaves a large amount of residue or a crop that improves the soil should be grown 1 year in 3. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown. Deep-rooted legumes or perennial grasses can be used in the cropping system to keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. These soils are suited to gravity irrigation systems. A properly designed irrigation system is needed for efficient use of water.

IRRIGATED CAPABILITY UNIT IIIe–1

Maricopa loamy sand is the only soil in this unit. This soil is well drained and has a loamy sand surface layer underlain by sandy loam and loamy sand. It formed in mixed alluvial materials on alluvial fans. Slopes are 0 to 3 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days. Permeability is moderately rapid. Runoff is slow. The available water holding capacity is 5 to 6 inches. The effective rooting depth is 60 inches or more. Hazard of soil blowing is moderate.

This soil is used for range, wildlife habitat, watershed, and irrigated cropland. The main crops are sorghum, alfalfa, cotton, barley, and beans.

Good management includes control of soil blowing, efficient use of irrigation water, and maintenance of soil fertility. A crop that leaves a large amount of residue or one that improves the soil, such as fertilized grain sorghum or barley, should be grown 1 year in 2. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown. Deep-rooted legumes, such as alfalfa, and perennial grasses can be grown in a long-term rotation to control soil blowing and keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain productivity and soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. These soils are suited to gravity or sprinkler irrigation. A properly designed irrigation system is needed to make efficient use of irrigation water.

IRRIGATED CAPABILITY UNIT IIIe–4

Frye sandy loam, hummocky, is the only soil in this unit. This soil is well drained and has a sandy loam surface layer, a heavy clay loam subsoil, and a silica pan at a depth of 20 to 36 inches. It formed in valley fill from mixed igneous sources on old alluvial fans. Slopes are 0 to 3 percent.

The average annual precipitation is 10 to 12 inches. The frost-free season is 160 to 220 days. Permeability is slow. Runoff is slow. The available water holding capacity is 4 to 5 inches. Effective rooting depth is 20 to 36 inches. Hazard of soil blowing is severe.

This soil is used for range, wildlife habitat, watershed, and irrigated cropland. The main crops are sorghum and barley.

Good management includes control of soil blowing, efficient use of irrigation water, and maintenance of soil fertility. A crop that leaves a large amount of residue or a crop that improves the soil, such as fertilized grain sorghum or barley, should be grown 1 year in 2. If the cropping system does not include a high-residue crop, a mulch of suitable residue can be used or a cover crop can be grown. Perennial grasses can be used in a long-term cropping system to control soil blowing and keep the soil in good condition.

Barnyard manure or commercial fertilizer is necessary to maintain productivity and soil fertility. Most crops respond to application of nitrogen. These soils are suited to gravity or sprinkler irrigation systems. A properly designed irrigation system is needed for efficient use of water. Deep cuts should be avoided when leveling.

IRRIGATED CAPABILITY UNIT IIIs–1

Tres Hermanos gravelly clay loam is the only soil in this unit. This soil is well drained and has a gravelly clay loam surface layer and subsoil. It formed in material from mixed igneous and limestone rocks on old alluvial fans. Slopes range from 0 to 5 percent, but they are mainly 1 to 3 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days. Permeability is moderately slow. Runoff is medium to slow. The available water holding capacity is 4 to 5 inches. Effective rooting depth is about 40 inches. Hazard of erosion is slight.

This soil is used for range, wildlife habitat, watershed, and irrigated cropland. Most crops suited to the county can be grown.

Good management includes efficient use of irrigation water, control of runoff and erosion, and maintenance of soil fertility. A crop that leaves a large amount of residue or a crop that improves the soil should be grown 1 year in 3. If the cropping system does not include a

high-residue crop, a mulch of suitable residue can be used or a cover crop can be grown. Deep-rooted legumes or perennial grasses can be grown in a long-term rotation to keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. These soils are suited to a surface irrigation system, but sprinkler irrigation can be used. A properly designed irrigation system is needed to control runoff and erosion. Deep cuts should be avoided when leveling because very gravelly material is below a depth of about 27 inches.

IRRIGATED CAPABILITY UNIT IIIs–3

Verhalen silty clay loam is the only soil in this unit. This soil is moderately well drained and has a silty clay loam surface layer underlain by clay and silty clay. It formed in fine-textured alluvium on alluvial bottoms. Slopes are 0 to 1 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days. Permeability is slow. Runoff is slow. Seasonal overflow is moderate to severe if the soil is not protected by dikes or levees. The available water holding capacity is 10 to 11.5 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed.

Good management includes tilling only where the soil is sufficiently dry to prevent formation of a tillage pan, efficient use of irrigation water, and maintenance of soil fertility. A crop that leaves large amounts of residue should be grown 1 year in 2. A soil-improving crop should be grown 1 year in 3. If the cropping system does not include a high-residue crop, a mulch of suitable residue can be used. Deep-rooted legumes or perennial grasses can be grown in a long-term rotation to keep the soil in good condition and to increase permeability.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen. Alfalfa responds to application of phosphorus. This soil is suited to surface irrigation systems. A properly designed irrigation system is needed for efficient use of water.

IRRIGATED CAPABILITY UNIT IIIs–6

Frye loam (0 to 1 percent slopes) is the only soil in this unit. This soil is well drained and has a loam surface layer, a heavy clay loam subsoil, and a silica pan at a depth of 20 to 36 inches. It formed in valley fill from mixed igneous sources on old alluvial fans. Slopes are 0 to 1 percent.

The average annual precipitation is 10 to 12 inches. The frost-free season is 160 to 220 days. Permeability is slow. Runoff is slow. The available water holding capacity is 4 to 5 inches. Effective rooting depth is 20 to 36 inches. Hazard of erosion is slight.

This soil is used for irrigated cropland, range, wildlife habitat, and watershed. The main crops are barley, sorghum, cotton, beans, and alfalfa.

Good management includes efficient use of irrigation water and maintenance of soil fertility. A crop that leaves a large amount of residue or one that improves the soil should be grown 1 year in 3. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown. Perennial grasses can be grown in a long-term rotation to keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen. Legumes respond to application of phosphorus. This soil is suited to gravity or sprinkler irrigation systems. A properly designed irrigation system is needed for efficient use of irrigation water. Deep cuts should be avoided when leveling because of the silica pan at a depth of 20 to 36 inches.

IRRIGATED CAPABILITY UNIT IVe–1

Yturbide gravelly loamy sand is the only soil in this unit. This soil is excessively drained and is gravelly loamy sand and gravelly sand. It formed in coarse-textured alluvium on alluvial fans. Slopes are 0 to 3 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days. Permeability is rapid. Runoff is slow. The available water holding capacity is 2.5 to 3.5 inches. Effective rooting depth is 60 inches or more. Hazard of soil blowing is severe.

This soil is used for range, wildlife habitat, watershed, and irrigated cropland. It is droughty and is poorly suited to cultivated crops. It commonly occurs as small areas in cultivated fields. Areas large enough to be managed separately are better suited to permanent pasture.

Good management includes control of erosion, efficient use of irrigation water, and maintenance of soil fertility. A crop that leaves a large amount of residue or a crop that improves the soil should be grown 2 years in 3. If the cropping system does not include a high-residue crop, a mulch of suitable residue can be used or a cover crop can be grown. Deep-rooted legumes or perennial grasses can be grown in a long-term rotation to control erosion and keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen and phosphorus. This soil is suited to gravity or sprinkler irrigation. A properly designed irrigation system is needed to control erosion and for efficient use of water.

IRRIGATED CAPABILITY UNIT IVc–2

Nickel gravelly loam, 1 to 5 percent slopes, is the only soil in this unit. This soil is well drained and has a gravelly loam surface layer underlain by gravelly loam caliche. It formed in very gravelly old alluvium from mixed igneous and limestone rocks. Slopes are 1 to 5 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days. Permeability is moderately slow. Runoff is medium. The available water holding capacity is about 1 to 2 inches. Effective rooting depth is 10 to 20 inches. Hazard of erosion is moderate.

This soil is used for range, wildlife habitat, watershed, and irrigated cropland. It is gravelly and droughty and is poorly suited to cultivated crops. It is suited to permanent pasture.

Good management includes efficient use of irrigation water, control of erosion, conserving water, and maintenance of soil fertility. A crop that leaves large amounts of residue or one that improves the soil should be grown 1 year in 2. If the cropping system does not include a high-residue crop, a mulch of suitable residue can be used or a cover crop can be grown. Perennial grasses can be used in the cropping system.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Most crops respond to application of nitrogen and phosphorus. Some crops, especially sorghums, have iron chlorosis, a result of iron deficiency. It can be helped by using iron sulfate, acid-forming amendments, or iron chelates. These soils are suited to sprinkler irrigation, but gravity systems can be used. A properly designed irrigation system is needed to control erosion and for efficient use of water. Deep cuts should be avoided when leveling because of the high content of lime and the gravelly underlying layers.

IRRIGATED CAPABILITY UNIT IVs-2

Arizo gravelly sandy loam is the only soil in this unit. This soil is excessively drained and has a gravelly sandy loam surface layer underlain by very gravelly loamy sand. It formed in sediments from mixed igneous rocks on recent alluvial fans. Slopes are 2 to 5 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 185 to 215 days. Permeability is very rapid. Runoff is slow. The available water holding capacity is 2 to 3.5 inches. The effective rooting depth is 60 inches or more. Hazard of erosion is slight.

This soil is used for irrigated cropland, pasture, and range. The soils are droughty and are better suited to permanent pasture or alfalfa than to cultivated crops.

Good management includes making efficient use of irrigation water and increasing soil fertility. A crop that leaves large amounts of residue or one that improves the soil should be grown 2 years in 3. If the cropping system does not include a high-residue crop, a mulch of a suitable residue can be used or a cover crop can be grown. Deep-rooted legumes, such as alfalfa, and perennial grasses can be grown in a long-term rotation to control soil blowing and keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain productivity and soil fertility. Most crops respond to application of nitrogen and phosphorus. This soil is suited to gravity or sprinkler irrigation. A properly designed irrigation system is needed to make efficient use of irrigation water.

IRRIGATED CAPABILITY UNIT IVs-4

This unit consists of soils of the Glendale and Mimbres series. These are well-drained, moderately alkali soils that have a silty clay loam surface layer underlain by clay loam and silty clay loam. They formed in alluvium on alluvial bottoms, on fans, and in swales. Slopes are 0 to 1 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 180 to 210 days. Permeability is moderately slow. Water infiltration is slow or very slow because of soil dispersion by the alkali. Runoff is slow. The available water holding capacity is 2 to 3 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

These soils are used for irrigated cropland, range, wildlife habitat, and watershed. They are suited to alkali-tolerant crops, such as permanent pasture, barley, cotton, sorghum, and alfalfa.

Good management includes efficient use of irrigation water, increasing the level of fertility, and reduction of alkali. Reduction of the alkali by leaching is difficult because there are no drainage outlets in these enclosed basins. A high-residue crop or a crop that improves the soil should be grown 2 years in 3. If the cropping system does not include a high-residue crop, a cover crop or green-manure crop can be grown in a long-term rotation to keep the soil in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Crops respond to application of nitrogen and phosphorus. Gypsum, sulphur, and sulfuric acid are used to reduce the concentration of alkali. A conservation irrigation system should be installed to irrigate efficiently. These soils are suited to gravity irrigation.

IRRIGATED CAPABILITY UNIT IVs-5

This unit consists of soils of the Hondale and Verhalen series. These are moderately well drained and well drained, alkali soils that have a sandy loam, loam, silt loam, and silty clay loam surface layer underlain by heavy silty clay loam, silty clay, and clay. These soils formed in valley fill and in fine-textured alluvium from mixed sources on broad alluvial flats or bottoms. Slopes are 0 to 1 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 210 days. Permeability is very slow or slow. Water infiltration is very slow because of soil dispersion by sodium. Runoff is slow. Available water holding capacity is 2 to 3 inches. Effective rooting depth is 60 inches or more. Hazard of erosion is slight.

These soils are used for range, wildlife habitat, watershed, and irrigated cropland. They are suited to alkali-tolerant crops, such as permanent pasture, barley, cotton, sorghum, and alfalfa.

Good management includes the use of soil amendments and leaching to reduce alkali content and improve soil structure, the efficient use of irrigation water, and the maintenance of soil fertility. A crop that leaves large amounts of residue or a crop that improves the soil should be grown 2 years in 3. If the cropping system does not include a high-residue crop, a mulch of suitable residue can be used or a cover crop can be grown. Perennial legumes and grasses can be grown in a long-term rotation to improve the soil and keep it in good condition.

Barnyard manure or commercial fertilizer is needed to maintain soil fertility. Crops respond to application of nitrogen fertilizers. Acid-producing fertilizers, such as ammonium sulfate, are more beneficial than are the alkaline-residue fertilizers, such as sodium nitrate. Soil amendments such as sulfuric acid or gypsum should be used to reduce the alkali content, improve soil structure, and increase permeability by water. Use of gypsum or other forms of soluble calcium should be followed by leaching to remove sodium salts. The soils in this unit are suited to surface irrigation systems. A properly designed irrigation system is needed for efficient use of water.

IRRIGATED CAPABILITY UNIT IVs-7

Jal loam is the only soil in this unit. This soil is well drained and is heavy loam underlain by caliche at a depth of 10 to 20 inches. It formed in old alluvium from mixed sources on alluvial fans. Slopes are 0 to 1 percent.

The average annual precipitation is 9 to 11 inches. The frost-free season is 190 to 200 days. Permeability is moderate. Runoff is medium. Available water holding capacity is 1.5 to 3.5 inches. Effective rooting depth is 10 to 20 inches. Hazard of soil blowing is moderate.

This soil is used for range, wildlife habitat, watershed, and irrigated cropland. It is suited to permanent pasture.

Good management includes use of commercial fertilizer or barnyard manure to increase fertility, use of crop residue to increase organic matter and control soil blowing, and efficient use of irrigation water. A crop that leaves large amounts of residue or a crop that improves the soil should be grown 2 years in 3. If the cropping system does not include a high-residue crop, a mulch of suitable residue can be used. Close-growing crops of legumes or perennial grasses can be grown in a long-term cropping system to keep the soils in good condition.

Barnyard manure or commercial fertilizer is needed to increase and maintain soil fertility. Most crops respond to application of nitrogen and phosphorus. Some crops have iron chlorosis, a result of iron deficiency. It can be helped by using iron sulfate, acid-forming amendments, or iron chelates. This soil is suited to sprinkler or gravity irrigation systems. A properly designed irrigation system is needed for efficient use of irrigation water.

Estimated Yields of Crops

Estimated yields per acre of the principal crops grown on the soils of Hidalgo County are shown in table 2. These are the highest yields that can be expected over a period of years. These yields are based on information from research and on interviews with farmers and other people who have knowledge of yields.

Not included in table 2 are soils that are used only for rangeland and soils that have such limited irrigated acreage that reliable data on yields are not available.

Under a high level of management, all of the following are assumed—

1. Conservation cropping systems are followed that include crops that produce a large amount of residue and crops that improve the soil.
2. Suitable crop varieties are selected, and seed is planted at the proper time and at the correct rates.
3. The right kind of fertilizer is applied in proper amounts and at the proper time.
4. The soils are tilled carefully at the right time and with the right kinds of implements so that crop residue is utilized, weeds are controlled, and excessive compaction is prevented.
5. Insect pests and plant diseases are controlled by chemicals and proper management.
6. Length and slope of irrigation runs are suitable.
7. Irrigation water is applied in accordance with crop needs and at proper times.
8. Crops are harvested at the proper times and with equipment that is properly operated.

Range Management

Most of Hidalgo County is rangeland. Most areas can be grazed all year, because winters generally are mild and accumulated snow remains on the surface for only short periods.

TABLE 2.—*Estimated average yields per acre of principal crops*

[Yields are those expected under optimum management. Absence of yield indicates the crop is not commonly grown on the soil. Only the soils used to a significant extent for the specified crops are listed]

Soil	Cotton	Grain sorghum	Barley	Beans	Alfalfa
	Lbs.	*Lbs.*	*Bu.*	*Lbs.*	*Tons*
Arizo gravelly sandy loam	750				5
Comoro fine sandy loam	1,300	6,000	70		8
Comoro gravelly loam	1,250	6,000	70		8
Frye loam	1,400	6,500	85	2,000	5
Gila loam	1,500	6,500	90	2,000	9
Glendale silty clay loam	1,750	7,500	100		9
Grabe loam	1,500	7,000	100		9
Grabe silty clay loam	1,500	7,000	100		9
Hondale complex	800	4,500	60		5
Jal loam	800	4,300	60		5
Maricopa loamy sand	1,100	5,000	60	1,500	7
Mimbres and Glendale loams	1,750	7,500	100	2,500	9
Mimbres and Glendale silty clay loams	1,750	7,500	100	2,500	9
Mimbres and Glendale silty clay loams, alkali	900	5,000	60		6
Mohave sandy clay loam, 0 to 1 percent slopes	1,500	7,000	115	2,000	8
Stellar sandy clay loam	1,450	6,000		1,800	8
Ubar silt loam	1,700	7,300	100	2,500	9
Vekol sandy clay loam	1,750	7,500	100	2,500	9
Vekol silty clay loam	1,500	7,000	100	2,500	9
Verhalen silty clay loam	1,400	5,600	80		7
Yturbide gravelly loamy sand	900	4,000			5

Livestock enterprises consist mainly of cow-calf-yearling operations. The ranches range in size from a few sections to several sections.

Good range management increases production of suitable native forage plants and conserves soil and water. Practices needed in Hidalgo County include the following:

Limitation of grazing.—This is of primary importance. Without it, all other practices are ineffective. Most of the nutrients that plants need in order to grow, flower, and reproduce are manufactured in the foliage. Livestock seek out the most palatable plants first. If they eat more than half the yearly growth, these plants cannot compete successfully with the less desirable plants, and the range deteriorates. Vegetation left on the surface increases the water-intake rate, improves the available water holding capacity, and helps to control erosion. Overgrazing is particularly harmful to sandy soils and to shallow soils.

Deferment of grazing.—The practice of excluding livestock from native grassland during all or part of a growing season gives desirable plants a chance to grow, seed, and spread. Some soils respond to this practice more quickly than others. Sandy and gravelly soils show more improvement after a year of rest than loamy and clayey soils.

Rotation of grazing.—Alternately resting and grazing parts of a range through a growing season give the vegetation in all parts a chance to reseed.

Fencing.—Fencing the range into effective management units makes it easier to keep livestock evenly distributed. Fences should follow soil boundaries or range site boundaries, so that areas of different potential are separated.

Seeding.—Seeding with native species increases yields and helps to control erosion and conserve moisture. To create an environment favorable for new grass seedlings, it generally is necessary to eliminate the low-value native plants. Seeding is difficult at the lower elevations because of the dry climate, and it is most effective on the deep and moderately deep, medium-textured and coarse-textured soils. It has not been effective on very shallow soils.

Brush control.—Eliminating or suppressing creosotebush, common mesquite, pinyon pine, one-seed juniper, and other nonforage-producing shrubs makes more moisture available for suitable plants. Brush control is practical where the soils are medium textured, deep or moderately deep, and nearly level or gently sloping. Sandy soils, steep soils, and unproductive soils are susceptible to erosion if cleared.

Water development.—An ample supply of good-quality water at suitable locations keeps livestock evenly distributed over the range. In many parts of Hidalgo County, the supply of water from existing wells, springs, or ponds is not adequate. Seeps and springs in mountainous areas have some potential for further development.

Water spreading.—This practice is regulated by State law (*3*). It involves diverting runoff from natural channels or gullies and spreading it over nearly level areas. Earthen diversions, net wire diversions, and rock and brush dams have been used. Water spreading is most effective where the soils are deep enough to hold a large amount of water and where the texture of the surface layer is such that water is absorbed quickly.

Contour furrowing and pitting.—Both of these practices help to control runoff and floodwater and to control erosion and increase infiltration. These practices are most effective on the deep, fine-textured soils. Basin pitting, not to be confused with pricking or hole punching, is effective in decreasing runoff and increasing productivity of existing vegetation. If competing perennials are not present, seeding in conjunction with basin pitting establishes desirable vegetation and hastens improvement of the range in places.

Range sites and condition classes

A range site is a distinctive kind of rangeland that differs from other kinds of rangeland in its potential to produce native plants.

Managers of rangeland need to know which plants are likely to grow best on a particular site. The kinds and amounts of herbage produced on each site depend mainly on the combined effects of the soils and the climate.

Range condition is the present state of vegetation of a range site in relation to the climax plant community for that site.

Range plants are classified as decreasers, increasers, and invaders. Decreasers are the plants most palatable to livestock, and they are sensitive indicators of overgrazing. Unless grazing is carefully regulated, these plants die and are replaced by increasers that ordinarily are less palatable than the decreasers. If the range condition continues to decline from overuse, the increasers also die and are replaced by invaders. Invaders are plants not present in the original (climax) vegetation.

Range condition is judged on the basis of the percentage of the original vegetation remaining. A range is in excellent condition if the percentage is between 76 and 100, in good condition if the percentage is between 51 and 75, in fair condition if the percentage is between 26 and 50, and in poor condition if the percentage is 25 or less.

Descriptions of range sites

The soils of Hidalgo County have been grouped into 18 range sites, which are described in the following paragraphs. In each description important soil characteristics, principal plants, estimates of total production, and suggestions for management are shown. The estimates of total production are for grasses, forbs, and browse.

Hidalgo County is divided into climatic zones 6 and 7, and these are used to classify the range sites. Further information on these zones is given in the subsection "Climatic Zones."

The names of the soil series represented are mentioned in the description of each range site, but the listing of the series name does not necessarily indicate that all the soils of a series are in the same range site. To find the range site for any given soil, refer to the "Guide to Mapping Units" at the back of this survey.

BOTTOMLAND RANGE SITE, ZONES 6 AND 7

This range site consists of soils of the Anamite, Arizo, Comoro, Gila, Glendale, Grabe, Hawkeye, Mimbres, Pima, and Verhalen series. These soils, except for the

Arizo and Hawkeye soils, have a sandy loam or gravelly loam to silty clay loam surface layer that is underlain by sandy loam to clay or silty clay. They are well drained. Slopes are 0 to 3 percent. These soils have moderately rapid to very slow permeability and medium to very slow runoff. Because these soils are in swales and on bottom lands, they generally receive some runoff from surrounding areas. The available water holding capacity is 6 to 12 inches, and the water-supplying capacity is 15 to 20 inches.

The Arizo soils have a loamy fine sand surface layer underlain by very gravelly loamy sand and are excessively drained. They have very rapid permeability and an available water holding capacity of 2 to 3.5 inches. The Hawkeye soils have a gravelly loam surface layer underlain by gravelly coarse loamy sand. They have rapid permeability, an available water holding capacity of 3 to 4.5 inches, and a water-supplying capacity of 10 to 12 inches.

The potential vegetation on sites in excellent condition consists of 60 percent or more decreaser species and of 40 percent increaser species. Sites in poor condition are dominated by increaser and invader species. The decreaser species are alkali sacaton, giant sacaton, vine-mesquite, and side-oats grama. The increaser species are tobosa, burrograss, buffalograss, and three-awn.

If the range is in excellent condition, the total annual production of all species is 2,500 pounds per acre, air-dry weight, in favorable years and 500 pounds in unfavorable years. Nearly all of this production is grazable forage for cattle.

These soils are suited to reseeding and mechanical brush control.

CLAYEY RANGE SITE, ZONE 6

This range site consists of well-drained soils of the Cloverdale and Stellar series. These soils have a surface layer of loam, sandy clay loam, gravelly clay loam, or clay loam and a subsoil of clay or clay over loam. Slopes are 0 to 3 percent. These soils have very slow permeability and medium runoff. The available water holding capacity is 7.5 to 9.5 inches, and the water-supplying capacity is 8 to 10 inches.

The potential vegetation on sites in excellent condition consists of 40 percent or more decreasers and of 60 percent or less increasers. Sites in poor condition are dominated by burrograss, tobosa, and ring muhly. The decreaser species are black grama, blue grama, and side-oats grama. The increaser species are tobosa, buffalograss, curly mesquite, and three-awn.

If the site is in excellent condition, the total annual production of all species of 700 pounds per acre, air-dry weight, in favorable years and 225 pounds in unfavorable years. Nearly all of this production is grazable forage for cattle.

These soils are suited to reseeding and mechanical brush control.

CLAYEY RANGE SITE, ZONE 7

This range site consists of well-drained soils of the Keno, Stellar, Tres Hermanos, Ubar, and Vekol series. These soils have a surface layer of silt loam, silty clay loam, clay loam, and sandy clay loam that is 0 to 30 percent gravel or cobblestones, and a subsoil of silty clay loam to silty clay or gravelly clay loam to clay. Slopes are 0 to 3 percent. These soils have moderately slow to very slow permeability and slow to medium runoff. The available water holding capacity is 4 to 11 inches, and the water-supplying capacity is 5 to 8 inches.

The decreaser species are black grama, blue grama, alkali sacaton, and bush muhly. The increaser species are tobosa, burrograss, three-awn, and broom snakeweed.

The potential vegetation on sites in excellent condition consists of 45 percent decreaser species and of 55 percent or less increaser species. Sites in poor condition are commonly dominated by creosotebush, common mesquite, American tarbush, allthorn, yucca, burrograss, and three-awn.

If the site is in excellent condition, the total annual production of all species is 475 pounds per acre, air-dry weight, in favorable years and 125 pounds in unfavorable years. About 90 percent of this production is grazable forage for cattle.

These soils are not suited to reseeding or mechanical brush control, because of the dry climate. Only in the most favorable years can one expect to get any return on the cost of applying such range improvement practices.

DEEP SAND RANGE SITE, ZONES 6 AND 7

This range site consists of excessively drained soils of the Yturbide series. These soils have a surface layer of loamy sand or gravelly loamy sand over gravelly loamy sand and gravelly coarse sand. Slopes are 0 to 9 percent. These soils have rapid permeability and slow to medium runoff. The available water holding capacity is 2.5 to 3.5 inches, and the water-supplying capacity is 6 to 8 inches.

The potential vegetation on sites in excellent condition consists of 60 percent decreaser species and of 40 percent increaser species. Sites in poor condition are dominated by common mesquite, a vigorous invader species. The decreaser species are black grama, bush muhly, side-oats grama, and giant dropseed. The increaser species are fourwing saltbush, mesa dropseed, sand sagebrush, spike dropseed, three-awn, and yucca.

If the site is in excellent condition, the total annual production of all species is 650 pounds per acre, air-dry weight, in favorable years and 150 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 500 pounds per acre in favorable years and 140 pounds in unfavorable years.

These soils are suited to reseeding and brush control only in exceptionally favorable years because of the dry climate.

GRAVELLY RANGE SITE, ZONE 6

This range site consists of well-drained soils of the Eba and Nickel series. These soils have a gravelly loam or very gravelly loam surface layer underlain by very gravelly loam to very gravelly clay. Slopes are 1 to 60 percent. These soils have moderately slow to very slow permeability and medium to rapid runoff. The available water holding capacity is 1 to 4 inches, and the water-supplying capacity is 5 to 11 inches.

The potential vegetation on sites in excellent condition consists of 60 percent or more decreaser species and of 40 percent or less increaser species. Sites in poor condition are dominated by increaser and invader species. Common mesquite is an invader when the site is in poor condition. The decreaser species are black grama, blue

grama, side-oats grama, and Texas bluestem. The increaser species are tobosa, three-awn, and fourwing saltbush.

If the site is in excellent condition, the total annual yield of all species is 1,125 pounds per acre, air-dry weight, in favorable years and 225 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 1,000 pounds per acre in favorable years and 200 pounds in unfavorable years.

These soils are not suited to reseeding or mechanical brush control, because of steepness of slopes and gravel on the surface.

GRAVELLY RANGE SITE, ZONE 7

This range site consists of well-drained to excessively drained soils of the Arizo, Eba, and Pinaleno series. These soils have a gravelly loamy sand to gravelly sandy loam or very gravelly loam to very gravelly clay loam surface layer underlain by very gravelly loamy sand to very gravelly clay. Slopes are 0 to 15 percent. These soils have very slow to very rapid permeability and medium to slow runoff. The available water holding capacity is 2 to 4 inches, and the water-supplying capacity is 5 to 8 inches.

The potential vegetation on sites in excellent condition consists of 50 percent or more decreaser species and of 50 percent or less increaser species. Sites in poor condition are dominated by common mesquite, creosotebush, broom snakeweed, catclaw, and three-awn. The decreaser species are bush muhly, side-oats grama, and black grama. The increaser species are tobosa, three-awn, and fluffgrass.

If the site is in excellent condition, the total annual production of all species is 375 pounds per acre, air-dry weight, in favorable years and 75 pounds in unfavorable years. Almost all of the production is grazable forage for cattle.

These soils are suited to reseeding or mechanical brush control only in very favorable years because of the dry climate.

HILLS RANGE SITE, ZONE 6

This range site consists of the soils of the Chiricahua, Cloverdale, and Lehmans series and of Rock land and Rough broken land and rock land. These soils have a cobbly, stony, or clay loam or loam surface layer and a clay to stony clay loam subsoil. They are well drained. Slopes are 3 to 75 percent. These soils have slow to moderately slow permeability and rapid runoff. The available water holding capacity is 2 to 6 inches, and the water-supplying capacity is 5 to 8 inches.

The potential vegetation in sites in excellent condition consists of 50 percent or more decreaser species and of 50 percent or less increaser species. The decreaser species are side-oats grama, black grama, bush muhly, and cane bluestem. The increaser species are blue grama, hairy grama, one-seed juniper, wolftail, curly mesquite, pinyon pine, sacahuista, tobosa, shrub live oak, and yucca.

If the site is in excellent condition, the total annual production of all species is 1,375 pounds per acre, air-dry weight, in favorable years and 400 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 1,000 pounds per acre in favorable years and 300 pounds in unfavorable years.

These soils are not suited to reseeding and mechanical brush control, because of slopes and coarse fragments. One-seed juniper, pinyon pine, and shrub live oak are cut for local use as fenceposts and firewood.

HILLS RANGE SITE, ZONE 7

This range site consists of soils of the Graham and Lehmans series and of Rock land and Rough broken land and rock land. These soils have a stony loam or clay loam surface layer and a clay or stony clay loam subsoil. They are well drained. Depth to bedrock is 0 to 20 inches. Slopes are 1 to 75 percent. These soils have moderately slow to slow permeability and rapid to medium runoff. The available water holding capacity is 2 to 3 inches, and the water-supplying capacity is 5 to 8 inches.

The potential vegetation on sites in excellent condition consists of 50 percent or more decreaser species and of 50 percent or less increaser species. Sites in poor condition are dominated by increaser species and common mesquite. The decreaser species are black grama, side-oats grama, blue grama, and bush muhly. The increaser species are agave, curly mesquite, three-awn, and tobosa.

If the site is in excellent condition, the total annual production of all species is 1,350 pounds per acre, air-dry weight, in favorable years and 350 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 1,000 pounds per acre in favorable years and 300 pounds in unfavorable years.

These soils are not suited to reseeding or mechanical brush control, because of slopes and rock outcrops.

LIMY RANGE SITE, ZONES 6 AND 7

This range site consists of well-drained soils of the Jal, Karro, and Nickel series. These soils have a loam, silt loam, gravelly loam, or gravelly sandy loam surface layer underlain by clay loam, silty clay loam, or very gravelly loam that is very high in content of lime. Slopes are 0 to 9 percent. These soils have moderate to moderately slow permeability and medium runoff. The available water holding capacity is 1 to 7 inches, and the water-supplying capacity is 5 to 7 inches.

The potential vegetation on sites in excellent condition consists of 60 percent decreaser species and of 40 percent increaser species. Sites in poor condition are dominated by increaser and invader species. The decreaser species are black grama, blue grama, and winterfat. The increaser species are three-awn, burrograss, allthorn, cactus, and annuals. Common mesquite and creosotebush are invaders.

If the site is in excellent condition, the total annual production of all species is 475 pounds per acre, air-dry weight, in favorable years and 50 pounds in unfavorable years. About 90 percent of this production is grazable forage for cattle.

These soils are suited to reseeding or brush clearing only in exceptionally favorable years because of the dry climate.

LOAMY RANGE SITE, ZONE 6

This range site consists of well-drained soils of the Eicks, Forrest, and Stellar series. These soils have a loam, gravelly loam, gravelly sandy loam, or sandy clay loam surface layer and a clay to very gravelly clay loam

subsoil. Slopes are 0 to 5 percent. These soils have slow to very slow permeability and slow to medium runoff. The available water holding capacity is 3 to 9.5 inches, and the water-supplying capacity is 8 to 12 inches.

The potential vegetation on sites in excellent condition consists of 60 percent or more decreaser species and of 40 percent or less increaser species. Sites in poor condition are dominated by increaser and invader species. The decreaser species are black grama, bush muhly, and sideoats grama. The increaser species are blue grama, three-awn, sand muhly, and tobosa.

If the site is in excellent condition, the total annual production of all species is 590 pounds per acre, air-dry weight, in favorable years and 175 pounds in unfavorable years. Nearly all of this production is grazable forage for cattle.

These soils are suited to reseeding and mechanical brush control.

LOAMY RANGE SITE, ZONE 7

This range site consists of well-drained soils of the Forrest, Frye, Mimbres, Mohave, Stellar, and Vekol series. These soils have a loam, gravelly loam, and sandy clay loam surface layer and a silty clay loam, sandy clay loam, clay loam, gravelly clay, and clay subsoil. Slopes are 0 to 5 percent. These soils have moderately slow to slow permeability and slow to medium runoff. The available water holding capacity is 3 to 11.5 inches, and the water-supplying capacity is 5 to 9 inches.

The potential vegetation on sites in excellent condition consists of 40 percent or more decreaser species and of 60 percent or less increaser species. Sites in poor condition consist of 60 percent increaser and invader species, including broom snakeweed, common mesquite, filaree, and yucca. The decreaser species are black grama and bush muhly. The increaser species are burrograss, three-awn, sand dropseed, tobosa, and six-weeks grama.

If the site is in excellent condition, the total annual production of all species is 575 pounds per acre, air-dry weight, in favorable years and 175 pounds in unfavorable years. Almost all of this production is grazable forage for cattle.

This soil is suited to reseeding and mechanical brush control only in the most favorable years because of dry climate.

MALPAIS RANGE SITE, ZONE 7

This range site consists of well-drained soils of the Graham series. These soils have a stony clay loam surface layer and a clay subsoil underlain by bedrock at a depth of 10 to 20 inches. Slopes are 0 to 9 percent. These soils have slow permeability and medium to rapid runoff. The available water holding capacity is about 2 to 3 inches, and the water-supplying capacity is about 4 to 7 inches.

The potential vegetation on sites in excellent condition consists of 60 percent or more decreaser species and of 40 percent or less increaser species. Sites in poor condition are dominated by increaser and invader species. The decreaser species are black grama, bush muhly, and sideoats grama. The increaser species are tobosa, mesa dropseed, sand dropseed, and spike dropseed.

If the site is in excellent condition, the total annual production of all species is 750 pounds per acre, air-dry weight, in favorable years and 225 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 675 pounds per acre in favorable years and 205 pounds in unfavorable years.

These soils are not suited to reseeding and mechanical brush control, because of the rock outcrops.

RIVER BREAKS RANGE SITE, ZONE 7

This range site consists only of Rough broken land. Slopes are 15 to 75 percent. Soil materials are stratified sand, silt, clay, and gravel. Runoff is rapid. The available water holding capacity is low, and the water-supplying capacity is 3 to 5 inches.

The potential vegetation on sites in excellent condition consists of 50 percent or more decreaser species and of 50 percent or less increaser species. Sites in poor condition are dominated by increaser and invader species. Common mesquite, cacti, and creosotebush are vigorous invaders. The decreaser species are black grama, sideoats grama, blue grama, and bush muhly. The increaser species are tobosa, three-awn, and yucca.

If the site is in excellent condition, the total annual production of all species is 775 pounds per acre, air-dry weight, in favorable years and 175 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 400 pounds per acre in favorable years and 100 pounds in unfavorable years.

Rough broken land is not suited to reseeding or mechanical brush control.

SALT FLATS RANGE SITE, ZONE 7

This range site consists of well-drained soils of the Hondale series. The soils have a surface layer of loamy sand to silty clay loam and a subsoil of heavy silty clay loam over heavy sandy clay loam. Slopes are 0 to 3 percent. These soils have very slow permeability and slow runoff. The available water holding capacity is 2 to 3 inches, and the water-supplying capacity is 10 to 12 inches. These soils are moderately to strongly alkali affected.

The potential vegetation on sites in excellent condition consists of 70 percent or more decreaser species and of 30 percent or less increaser species. Sites in poor condition consist of more than 30 percent increaser and invader species. Common mesquite is a vigorous invader. The decreaser species are alkali sacaton, fourwing saltbush, and vine-mesquite. The increaser species are tobosa, three-awn, allthorn, and tubercled saltbush.

If the site is in excellent condition, the total annual production of all species is 1,275 pounds per acre, air-dry weight, in favorable years and 125 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 1,100 pounds per acre in favorable years and 105 pounds in unfavorable years.

These soils are suitable for reseeding or mechanical brush control in most years.

SALTY BOTTOMLAND RANGE SITE, ZONE 7

This range site consists of well drained or moderately well drained soils of the Glendale, Mimbres, and Verhalen series. These soils have a silty clay loam surface layer underlain by clay loam, silty clay loam, or clay. Slopes are 0 to 1 percent. These soils have slow to moderately slow permeability and slow runoff. They are in

swales and on bottom lands, and they commonly receive some runoff from surrounding areas. The available water holding capacity is 2 to 3 inches, and the water-supplying capacity is 15 to 20 inches.

The potential vegetation on sites in excellent condition consists of 70 percent or more decreaser species and of 30 percent or less increaser species. Sites in poor condition consist of more than 30 percent increaser and invader species. Common mesquite is a vigorous invader. The decreaser species are alkali sacaton, vine-mesquite, and fourwing saltbush. The increaser species are tobosa and shadscale.

If the site is in excellent condition, the total annual production of all species is 2,000 pounds per acre, air-dry weight, in favorable years and 600 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 1,600 pounds per acre in favorable years and 480 pounds in unfavorable years.

These soils are not suited to reseeding and mechanical brush control in most years. In places where the soils receive runoff water from adjacent areas, seeding and brush control are feasible if adapted species and strains are used.

SAND HILLS RANGE SITE, ZONE 7

This range site consists of well-drained to somewhat excessively drained soils of the Pintura and Berino series. These soils have a loamy fine sand and sandy clay loam surface layer and underlying layer. Slopes are 0 to 3 percent. These soils have rapid to moderate permeability and slow to medium runoff. The available water holding capacity is 3 to 7.5 inches, and the water-supplying capacity is 5 to 8 inches.

The potential vegetation on sites in excellent condition consists of about 55 percent decreaser species. Sites in poor condition are dominated by common mesquite, broom dalea, yucca, three-awn, and western ragweed. The decreaser species are giant dropseed, little bluestem, sand bluestem, side-oats grama, and needle-and-thread. The increaser species are spike dropseed, mesa dropseed, sand dropseed, hairy grama, sand sagebrush, and yucca.

If the site is in excellent condition, the total annual production of all species is 750 pounds per acre, air-dry weight, in favorable years and 200 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 600 pounds per acre in favorable years and 150 pounds in unfavorable years.

These soils are not suited to range improvement practices, such as reseeding and brush control, because of soil blowing.

SANDY RANGE SITE, ZONES 6 AND 7

This range site consists of well-drained soils of the Berino, Comoro, Frye, Hap, Maricopa, Sonoita, Turney, Whitlock, and Yana series and the Yturbide series, heavy subsoil variant. These soils have a fine sandy loam, sandy loam, gravelly sandy loam, gravelly loam, or loamy sand surface layer underlain by sandy loam to clay loam. Slopes are 0 to 10 percent. These soils have moderately rapid to slow permeability and medium to slow runoff. The available water holding capacity is 3 to 8.5 inches, and the water-supplying capacity is 5 to 8 inches.

The potential vegetation on sites in excellent condition consists of 60 percent or more decreaser species and of 40 percent or less increaser species. Sites in poor condition are dominated by increaser and invader species. Common mesquite is a vigorous invader. The decreaser species are black grama, blue grama, and bush muhly. The increaser species are sand and mesa dropseed, three-awn, Mormon-tea, broom snakeweed, allthorn, and yucca.

If the site is in excellent condition, the total annual production of all species is 650 pounds per acre, air-dry weight, in favorable years and 175 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 600 pounds per acre in favorable years and 170 pounds in unfavorable years.

These soils are not suited to reseeding or brush clearing, because of the dry climate.

SHALLOW RANGE SITE, ZONES 6 AND 7

This range site consists of well-drained soils of the Terino and Upton series. These soils are gravelly loam and very gravelly sandy clay loam underlain by indurated caliche at a depth of 4 to 19 inches. Slopes are 0 to 9 percent. These soils have moderate to moderately slow permeability and medium runoff. The available water holding capacity is 0.5 to 1.5 inches, and the water-supplying capacity is 5 to 7 inches.

The potential vegetation on sites in excellent condition consists of 60 percent or more decreaser species and of 40 percent or less increaser species. Sites in poor condition are dominated by creosotebush. Tarbush, graythorn, allthorn, and common mesquite are invaders.

If the site is in excellent condition, the total annual production of all species is 550 pounds per acre, air-dry weight, in favorable years and 125 pounds in unfavorable years. The estimated annual production of grazable forage for cattle is 460 pounds per acre in favorable years and 105 pounds in unfavorable years.

These soils are not suited to reseeding and brush control, because of the dry climate.

Woodland

This section first discusses native trees, where they grow, and their importance. It then discusses adapted tree species and the suitability of the soils to support trees for windbreaks or farmstead plantings.

Native trees

Some ponderosa pine grows on the higher mountains in the southern part of Hidalgo County. The trees are so few and the stands are so open that they have very little value as commercial timber. Other noncommercial native trees in Hidalgo County include cottonwood, sycamore, desert willow, one-seed juniper, Rocky Mountain juniper, pinyon pine, and shrub live oak. The timbered area within the Coronado and Gila National Forests is classified as an unregulated cutting unit. This classification means that logging is not feasible at present.

Cottonwood, sycamore, and desert willow grow in open stands along the major drainageways and rivers. They are mainly along the Gila River, Animas River, and Deer Creek. The cottonwood and sycamore furnish some logs for rough construction timber but are only used locally. They are used only to a small extent by local

residents as fuelwood. These trees grow on mixed alluvial soils that receive runoff from surrounding areas.

Scattered, open stands of Rocky Mountain juniper and a few pinyon pine and shrub live oak are on most of the hills and mountains of Hidalgo County. The shrub live oak trees commonly are along drainageways within the mountainous areas. These trees are used locally as a source of fuelwood and fenceposts. These trees grow mainly on Rough broken land and Rock land.

Trees for windbreaks

Some trees are planted for windbreaks in Hidalgo County. These are grown mainly in climatic zone 7 (see fig. 13). Where windbreaks are grown in zone 7, they must be irrigated regularly to insure the growth and survival of the trees. Where irrigated regularly, nearly all the soils in zone 7, except those that are very limy, are well suited to adapted species of trees for windbreaks. Poorly suited soils are those of the Jal, Karro, and Nickel series.

Trees and shrubs that grow well on most of the soils in Hidalgo County are Arizona cypress, eastern redcedar, honeylocust, mulberry, Oriental arborvitae, Osage-orange, Rocky Mountain juniper, Russian-olive, Siberian elm, squawbush, and tamarisk. Table 3 shows the production of some selected species where the soils are regularly irrigated.

TABLE 3.—*Performance of selected trees on soils that are regularly irrigated*

Trees and soils	Age	Height	Vigor	Survival
	Years	*Feet*		*Percent*
Arizona cypress:				
Gila loam	16	34	Good	100
Mimbres and Glendale silty clay loams:				
Mimbres part	8	17	Good	92
Glendale part	13	22	Good	92
Mohave sandy clay loams	12	25	Good	100
Yturbide loamy sand	12	25	Good	100
Mulberry:				
Gila loam	18	31	Good	80
Oriental arborvitae:				
Gila loam	13	21	Good	100
Rocky Mountain juniper:				
Gila loam	13	15	Good	100

Wildlife

Hidalgo County has some high-quality wildlife habitat. It has excellent potential as habitat for antelope, deer, dove, and quail. Many sites for fish ponds can be

TABLE 4.—*Suitability of wildlife habitat groups for*

[Absence of ratings under "Ratings for kinds of wildlife" indicates

Wildlife habitat group	Elements of wildlife habitat						
	Mountain forests and grassland	Foothill trees and shrubs	Tall or short grass prairies	Semidesert shrubs and grasses	Domestic seed and grain fields	Domestic pastures and haylands	Bosque bottoms
A	Poor	Poor	Good	Poor	Poor	Poor	Poor
B	Poor	Poor	Good	Moderate	Moderate	Poor	Poor
C	Poor	Poor	Good	Poor	Good	Good	Poor
D	Poor	Moderate	Good	Poor	Poor	Poor	Poor
E	Poor	Moderate	Moderate	Moderate	Poor	Poor	Poor
F	Poor	Poor	Good	Poor	Good	Good	Poor
G	Poor	Poor	Moderate	Moderate	Moderate	Moderate	Poor
H	Poor	Poor	Good	Poor	Good	Good	Poor
I	Poor	Poor	Poor	Moderate	Moderate	Moderate	Poor
J	Poor	Poor	Poor	Good	Poor	Poor	Poor
K	Moderate	Good	Poor	Poor	Poor	Poor	Poor
L	Poor	Poor	Good	Poor	Moderate	Moderate	Poor
M	Poor	Poor	Poor	Poor	Poor	Poor	Poor
N	Poor	Poor	Poor	Poor	Poor	Poor	Poor

located, but locations for shallow water impoundments for waterfowl are limited. The irrigated soils offer potential for food for dove, duck, quail, and pheasant. If water for flooding is available and the soils are suitable for cultivation, duck fields can be developed.

The soils of the county were rated according to their potential to produce specific types of wildlife habitat. Soils having similar potential were grouped together into 14 wildlife habitat groups. In table 4 the wildlife habitat groups are rated for elements of wildlife habitat and for kinds of wildlife. The "Guide to Mapping Units" shows the placement of the soils in wildlife habitat groups.

The ratings in this section give landowners an idea of the potential of their soils for various types of wildlife habitat. They serve as a basic guide for improving conditions for wildlife in specific areas and in the county in general. They provide the wildlife technician with broad guidelines for land-use planning, habitat mapping, and land acquisition for refuges, management areas, and other uses. Before any wildlife planning is done, however, an onsite appraisal of existing conditions needs to be made.

The wildlife habitat groups in table 4 are rated *good*, *moderate*, or *poor* in their suitability for producing 10 elements of wildlife habitat.

The limitations associated with the various habitat elements were considered, and a suitability rating was assigned for each kind of wildlife. This suitability rating is expressed as *poor*, *good to fair*, or *excellent*. The rating is *poor* if the desired habitat is very expensive or impractical to create, improve, or maintain. The soils have severe limitations that require an intensive management to overcome or that are impractical to overcome.

The rating is *good to fair* if the needed habitat can be created, improved, or maintained. There are moderate soil limitations that affect the maintenance, establishment, or improvement of the habitat, but a moderate intensity of management and frequent attention achieves satisfactory results.

The rating is *excellent* if the needed habitat can generally be easily created, improved, or maintained. There are slight or no soil limitations that affect the maintenance, establishment, or improvement of the habitat.

A description of each of the 10 elements of wildlife habitat in table 4 is given in the following paragraphs.

Mountain forests and grassland.—These are areas of large trees and associated grasses, forbs, and shrubs, or of meadows and open parks. The plants are most commonly established by natural processes, but some are planted.

Foothill trees and shrubs.—These are areas of low, small, native trees and shrubs and associated grasses and forbs. They are on low mountains and the higher slopes.

elements of wildlife habitat and for kinds of wildlife

that the rating does not apply to that particular wildlife habitat group]

Elements of wildlife habitat—Continued			Ratings for kinds of wildlife		
Wetland plants	Shallow water impoundments	Deep water impoundments	Poor for—	Good to fair for—	Excellent for—
Poor	Good	Good	Deer, dove, pheasant, quail, turkey.		Antelope, duck, fish.
Poor	Poor	Poor	Deer, duck, fish, turkey	Dove, quail, pheasant	Antelope.
Poor	Moderate	Moderate	Deer, turkey	Duck, fish	Antelope, dove, quail, pheasant.
Poor	Poor	Poor	Dove, duck, fish, pheasant, quail, turkey.	Deer	Antelope.
Poor	Poor	Poor	Duck, fish, pheasant, turkey.	Antelope, dove, quail	Deer.
Poor	Poor	Poor	Deer, duck, fish, turkey		Antelope, pheasant, dove, quail.
Poor	Moderate	Moderate	Deer, turkey	Antelope, dove, duck, fish, pheasant, quail.	
Poor	Good	Good	Deer, turkey		Antelope, dove, duck, fish, pheasant, quail.
Poor	Good	Good	Antelope, deer, turkey	Dove, pheasant, quail	Duck, fish.
Poor	Poor	Poor	Antelope, deer, duck, fish, pheasant, turkey.		Dove, quail.
Poor	Poor	Poor	Antelope, dove, duck, fish, pheasant, quail.	Turkey	Deer.
Poor	Good	Good	Deer, turkey	Dove, pheasant, quail	Antelope, duck, fish.
Moderate	Good	Good	Antelope, deer, dove, pheasant, quail, turkey.		Duck, fish.
Poor	Poor	Poor	Antelope, deer, dove, duck, pheasant, quail, turkey, fish.		

Tall or short grass prairies.—These are areas of native grasses, shrubs, and forbs on the rolling plains and lower mountains. They generally are present naturally without planting.

Semidesert shrubs and grasses.—These are areas of native plants that are normally established by natural processes without planting. They are in arid areas that may be either hot or cool.

Domestic seed and grain fields.—These are cultivated fields of domestic grains and seed-producing annual herbaceous plants that are established and maintained by planting and irrigating.

Domestic pastures and haylands.—These are areas of domestic perennial grasses and herbaceous legumes that are established and maintained by planting and irrigating.

Bosque bottoms.—These are areas where native trees, grasses, and shrubs grow next to major streams and rivers because water is available. The areas are not excessively wet.

Wetland plants.—These are wetland plants, exclusive of submerged and floating aquatics, that are present in naturally moist to wet sites. The vegetation may or may not be salt tolerant.

Shallow water impoundments.—These are areas of impounded water that generally does not exceed 3 feet in depth but covers 3 acres or more.

Deep water impoundments.—These are areas of impounded water that generally exceeds 4 feet in depth.

Wildlife habitat groups

The following paragraphs discuss the wildlife habitat groups in the county. The discussions of the groups give information on the distribution of wildlife in the county and on the suitability of the soils for wildlife habitat. These groupings can be useful in broad land-use planning and in acquisition of land for wildlife programs. They may also serve as a general guide for making interpretations for use of local areas as wildlife habitat.

WILDLIFE HABITAT GROUP A

The soils in this group are suited to tall and short grass prairies that are excellent potential habitat for antelope. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are slight for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP B

The soils in this group are suited to tall and short grass prairies, semidesert shrubs and grasses, domestic seed and grain fields, and domestic pasture and hayland. These soils therefore are excellent potential habitat for antelope and good to fair potential habitat for pheasant, dove, and quail. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are severe for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP C

The soils in this group are suited to tall and short grass prairies, domestic seed and grain fields, and domestic pasture and hayland. These soils are therefore excellent potential habitat for antelope, pheasant, dove, and quail. Climatic limitations make this potentially poor habitat for other game species. Limitations are moderate for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP D

The soils in this group are suited to foothill trees and shrubs and tall and short grass prairies. These soils therefore are excellent potential habitat for antelope and good to fair potential habitat for deer. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are severe for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP E

The soils in this group are suited to foothill trees and shrubs, tall and short grass prairies, and semidesert shrubs and grasses. These soils therefore are excellent potential habitat for deer and good to fair potential habitat for antelope, dove, and quail. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are severe for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP F

The soils in this group are suited to tall and short grass prairies, domestic seed and grain fields, and domestic pasture and hayland. These soils therefore are excellent habitat for antelope, pheasant, dove, and quail. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are severe for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP G

The soils in this group are suited to tall and short grass prairies, semidesert shrubs and grasses, domestic seed and grain fields, and domestic pastures and haylands. These soils therefore are good to fair potential habitat for antelope, pheasant, dove, and quail. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are moderate for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP H

The soils in this group are suited to tall and short grass prairies, domestic seed and grain fields, and domestic pasture and hayland. These soils therefore are excellent potential habitat for antelope, pheasant, dove, and quail. Climatic limitations make this potentially poor habitat for other game species. Limitations are slight for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP I

The soils in this group are suited to semidesert shrubs and grasses, domestic seed and grain fields, and domestic pasture and hayland. These soils therefore are good to fair potential habitat for pheasant, dove, and quail. Soil

and climatic limitations make this potentially poor habitat for other game species. Limitations are slight for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP J

The soils in this group are suited to semidesert shrubs and grasses. These soils therefore are excellent potential habitat for dove and quail. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are severe for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP K

The soils in this group are suited to mountain forests and grassland and foothill trees and shrubs. These soils therefore are excellent potential habitat for deer and good to fair potential habitat for turkey. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are severe for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP L

The soils in this group are suited to tall and short grass prairies, domestic seed and grain fields, and domestic pasture and haylands. These soils therefore are excellent potential habitat for antelope and good to fair potential habitat for pheasant, dove, and quail. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are slight for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP M

The soils in this group are suited to wetland plants. These soils therefore are excellent potential habitat for duck. Soil and climatic limitations make this potentially poor habitat for other game species. Limitations are slight for shallow water impoundments for ducks and for deep water impoundments for fish.

WILDLIFE HABITAT GROUP N

The soils in this group are not suited to forage production. These soils are therefore poor potential habitat for most game species. Limitations are severe for wildlife use. Running water offers potential for fish where the streams are more than seasonal.

Engineering Uses of the Soils [5]

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, building foundations, pipelines, drainage systems, facilities for water storage, erosion control structures, sewage disposal systems, irrigation systems, and other related structures.

Among the soil properties and qualities most important to engineers are permeability, shear strength, compaction characteristics, drainage, shrink-swell characteristics, available water holding capacity, grain size, plasticity, and soil reaction (pH). Also important are topography, depth to bedrock or caliche, and depth to the water table.

The information in this section can be used to—

1. Make preliminary estimates of the soil properties and qualities that are important in planning agricultural drainage systems, farm ponds, irrigation systems, and diversion terraces.
2. Make preliminary evaluations of soil conditions that aid in selecting locations for highways, airports, pipelines, and cables and in planning detailed investigations at the selected locations.
3. Locate probable sources of sand, gravel, and structural material.
4. Make soil and land-use studies that aid in selecting and developing industrial, business, residential, and recreational sites.
5. Supplement information obtained from other published maps, reports, or aerial photographs for the purpose of making maps and reports that can be readily used by engineers.
6. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Much of the information in this section is given in tables 5, 6, and 7. It should be emphasized that these interpretations do not eliminate the need for sampling and testing at the site of specific engineering works involving heavy loads and where excavations are deeper than the depth of the layers here reported. The estimates generally are to depths of about 5 feet, and therefore interpretations normally do not apply to greater depths. Small areas of other soils are included in the mapping units. Even in these situations, however, the soil map at the back of this survey is useful in planning more detailed field investigations and for suggesting the kinds of problems that should be expected.

The characteristics of the soils in Hidalgo County are described in detail in the section "Descriptions of the Soils." Those characteristics that affect engineering are interpreted in this section. This section is for engineers and others concerned with use of soil material in construction.

Some of the terms used by soil scientists are not familiar to engineers, and some words have special meanings in soil science. Most of these terms, as well as other special terms that are used in this soil survey, are defined in the Glossary at the back of this survey.

Engineering classification systems

Soils are classified according to the textural classification used by the U.S. Department of Agriculture, the system used by the American Association of State Highway Officials (AASHO) (*1*), and the Unified system (*9*).

In the system used by scientists of the U.S. Department of Agriculture, the texture of the soil horizon depends on the proportional amounts of the different-sized mineral particles. The percentage of soil material smaller than 2.0 millimeters (classified as clay, silt, and sand) determines the textural classification.

[5] MYRON H. NAMKEN, civil engineer, Soil Conservation Service, assisted in preparing this section.

TABLE 5.—*Estimated*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils for referring to other series that appear in the first column of this

Soil series and map symbols	Depth to bedrock or indurated caliche	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
Anamite: AN	>5	0–60	Silty clay	CH	A–7
Arizo: Ar	>5	0–10	Gravelly sandy loam	SM	A–2
		10–60	Very gravelly loamy sand	GM or GP–GM	A–2
Berino: BA, Bb, BD	>5	0–10	Sandy loam or loamy sand	SM	A–2 or A–4
		10–36	Sandy clay loam	SC	A–6
		36–60	Weakly to strongly cemented caliche (sandy clay loam texture).	SC	A–6
*Chiricahua: CC	1½–3	0–4	Very cobbly clay loam	GC	A–2 or A–6
For properties of Comoro soils in this mapping unit, refer to Comoro series.		4–25	Heavy clay loam and light clay	CL or CH	A–7
		25	Gneiss.		
*Cloverdale: CD, CE, CL	>5	0–36	Clay	CH	A–7
For properties of Stellar soils in mapping unit CL, refer to Stellar series.		36–72	Gravelly clay	CL	A–6
Comoro:					
Cm	>5	0–12	Fine sandy loam	SM or ML	A–4
		12–60	Sandy loam	SM	A–2
Co	>5	0–60	Gravelly sandy loam	SM	A 2
*Eba: EB, EN	>5	0–6	Very gravelly loam and very gravelly clay loam.	GM or GC	A–2
For properties of Nickel soils in mapping unit EN, refer to Nickel series.		6–29	Very gravelly clay	GC	A–6
		29–60	Very gravelly clay loam	GC or GM	A–2
Eicks: ES	>5	0–15	Gravelly sandy clay loam	SC or SM	A–4 or A–6
		15–25	Gravelly clay	MH or CL	A–7
		25–60	Very gravelly clay loam and very gravelly loam.	GC or GM	A–2 or A–6
*Forrest: FE, FG, FL, FM	>5	0–4	Gravelly loam, gravelly sandy loam, or loam.	SM or ML	A–4 or A–6
For properties of Pinaleno soils in mapping unit FL, refer to Pinaleno series; for properties of Stellar soils in mapping unit FM, refer to Stellar series.		4–30	Gravelly clay and gravelly heavy clay loam.	MH	A–7
		30–60	Very gravelly clay loam	GC or SC	A–2 or A–4
Frye: Fn, Fr, FY	1½–3	0–5	Loam or sandy loam	ML or SM	A–2 or A–4
		5–28	Heavy clay loam	CL or CH	A–6 or A–7
		28	Strongly cemented silica hardpan.		
Gila: GA, Gb	>5	0–40	Loam	ML or CL	A–4
		40–60	Gravelly loamy sand	SM	A–2

engineering properties

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions table. The sign > means more than; the sign < means less than]

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water holding capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of untreated steel pipe
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
Percent				*Inches per hour*	*Inches per inch of soil*	*pH*	*Millimhos per cm. at 25°C.*		
	100	100	90–100	<0. 06	0. 15–0. 17	7. 9–8. 4	2–4	High	High.
	85–100	70–85	20–30	2. 0–6. 3	0. 07–0. 09	7. 4–7. 8	0–2	Low	Low.
	25–50	35–50	5–15	>20. 0	0. 05–0. 07	7. 9–8. 4	0–2	Low	Low.
	100	95–100	20–40	2. 0–20. 0	0. 05–0. 13	7. 4–7. 8	0–1	Low	Low.
	100	95–100	35–45	0. 63–2. 0	0. 14–0. 16	7. 4–8. 4	2–4	Moderate	Moderate.
	100	95–100	35–45	0. 63–2. 0		7. 9–8. 4	2–4	Low	Moderate.
25–35	40–50	35–45	25–45	0. 2–0. 63	0. 12–0. 14	7. 4–7. 8	0–2	Low	Moderate.
	100	85–100	70–80	0. 06–0. 2	0. 15–0. 19	7. 4–7. 8	0–2	High	High.
	100	100	75–95	<0. 06	0. 14–0. 16	6. 6–8. 4	0–2	High	High.
	85–95	60–70	50–65	0. 06–0. 20	0. 12–0. 14	7. 9–8. 4	2–4	Moderate	High.
	100	100	40–55	2. 0–6. 3	0. 13–0. 15	7. 9–8. 4	0–4	Low	Low.
	95–100	95–100	25–35	2. 0–6. 3	0. 11–0. 13	7. 9–8. 4	0–4	Low	Low.
	70–85	60–70	20–30	2. 0–6. 3	0. 07–0. 09	7. 9–8. 4	0–4	Low	Low.
5–15	40–50	35–50	20–35	0. 63–2. 0	0. 07–0. 09	6. 6–7. 3	0–4	Low	Low to moderate.
5–15	40–50	35–50	35–50	0. 06–0. 20	0. 07–0. 09	7. 4–8. 4	2–4	Moderate	High.
5–15	40–50	35–50	25–35	0. 06–0. 20		7. 9–8. 4	2–4	Low	High.
	85–95	60–70	35–50	0. 63–2. 0	0. 12–0. 14	6. 6–7. 8	0–2	Low	Moderate.
	85–95	60–70	50–65	0. 06–0. 20	0. 13–0. 15	7. 4–7. 8	0–2	Moderate	High.
	40–50	35–50	25–40	0. 20–0. 63	0. 10–0. 12	7. 9–8. 4	2–4	Low	Moderate.
	65–85	60–80	35–60	0. 63–2. 0	0. 12–0. 14	7. 4–7. 8	0–2	Low	Low.
	55–80	50–75	40–70	0. 06–0. 20	0. 12–0. 14	7. 4–8. 4	2–4	Moderate	High.
	45–60	35–50	25–40	0. 20–0. 63	0. 07–0. 09	7. 8–8. 4	2–4	Low	Moderate.
	95–100	95–100	30–70	0. 63–6. 3	0. 11–0. 18	7. 4–7. 8	2–4	Low	Low.
	100	95–100	70–80	0. 06–0. 20	0. 19–0. 21	7. 4–8. 4	2–4	High	Moderate.
	95–100	95–100	50–70	0. 63–2. 0	0. 16–0. 18	7. 4–8. 4	1–4	Low	Moderate.
	95–100	60–70	15–25	6. 3–20. 0	0. 05–0. 07	7. 9–8. 4	2–4	Low	Moderate.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to bedrock or indurated caliche	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
*Glendale:					
Gc, GD	>5	0–60	Silty clay loam	CL	A–6 or A–7
For properties of Arizo soils in mapping unit GD, refer to Arizo series.					
Me, Mg	>5	0–60	Silty clay loam	CL	A–6 or A–7
Mapped only in undifferentiated groups with Mimbres soils.					
Grabe:					
Ge	>5	0–60	Loam	ML or CL	A–4
Gm	>5	0–12	Silty clay loam	CL	A–6
		12–60	Loam	ML or CL	A–4
Graham: GO, Gr, GT	1–1½	0–3	Stony clay loam	CL	A–6
		3–16	Clay	CH	A–7
		16–19	Very cobbly clay loam	CL	A–6
		19	Basalt.		
*Hap: HA	>5	0–28	Gravelly sandy clay loam	SC	A–6
For properties of Yturbide soils in this mapping unit, refer to Yturbide series.		28–60	Soft to weakly cemented caliche (gravelly sandy clay loam texture).	SC	A–6 or A–2
Hawkeye	>5	0–12	Gravelly loam	ML or SM	A–4
Mapped only in a complex with Pima soils.		12–60	Gravelly loamy sand	SM	A–1
Hondale: Hd, HN, Hs	>5	0–8	Silt loam or loam	ML	A–4
		8–21	Heavy silty clay loam	CL or ML	A–6
		21–36	Heavy sandy clay loam	ML or CL	A–4
		36–60	Sandy loam to sand	SM	A–2 or A–1
*Jal: Ja, JL, JR	>5	0–12	Loam	ML or CL	A–4 or A–6
For properties of Karro soils in mapping unit JR, refer to Karro series.		12–60	Soft caliche (clay loam texture).	CL	A–6
Karro	>5	0–11	Silt loam or loam	ML or CL	A–4 or A–6
Mapped only in an association with Jal soils.		11–35	Silty clay loam or clay loam	CL	A–6 or A–7
		35–60	Clay loam	CL	A–6
Keno: KC	>5	0–4	Cobbly clay loam	CL	A–6
		4–25	Clay	CH	A–7
		25–60	Gravelly clay loam	CL	A–6
*Lehmans: LH, LN	1–1½	0–18	Stony clay loam	ML or CL	A–6 or A–7
For properties of Nickel soils in mapping unit LN, refer to Nickel series.		18	Rhyolite.		
Maricopa: Ma	>5	0–22	Sandy loam	SM	A–2 or A–4
		22–60	Loamy sand	SM	A–2

engineering properties—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water holding capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of untreated steel pipe
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
Percent				*Inches per hour*	*Inches per inch of soil*	*pH*	*Millimhos per cm. at 25°C.*		
----------	100	95–100	85–95	0. 20–0. 63	0. 19–0. 21	7. 4–8. 4	1–4	Moderate-----	Moderate.
----------	100	95–100	85–95	0. 06–0. 20	0. 04–0. 05	8. 5–9. 6	4–8	Moderate-----	High.
----------	100	95–100	60–75	0. 63–2. 0	0. 16–0. 18	7. 4–8. 4	0–2	Low----------	Low.
----------	100	95–100	85–95	0. 20–0. 63	0. 19–0. 21	7. 4–8. 4	0–2	Moderate-----	Moderate.
----------	100	95–100	60–75	0. 63–2. 0	0. 16–0. 18	7. 4–8. 4	0–2	Low----------	Low.
25–50	75–85	60–70	50–65	0. 63–2. 0	0. 13–0. 15	7. 4–7. 8	0–2	Moderate-----	Moderate.
0–10	100	100	75–95	0. 06–0. 20	0. 14–0. 16	7. 4–8. 4	0–2	High----------	High.
10–30	75–85	70–80	50–65	0. 20–0. 63	0. 07–0. 09	7. 9–8. 4	0–2	Low----------	Moderate.
----------	65–75	60–70	35–50	0. 63–2. 0	0. 12–0. 14	6. 6–7. 8	0–2	Low----------	Moderate.
----------	65–75	60–70	30–40	0. 63–2. 0	----------	7. 9–8. 4	2–4	Low----------	Moderate.
0–5	85–95	60–70	40–60	2. 0–6. 3	0. 12–0. 14	7. 4–7. 8	0–2	Low----------	Low.
0–5	60–70	55–65	10–20	6. 3–20. 0	0. 05–0. 07	7. 4–7. 8	0–2	Low----------	Low.
----------	100	85–100	50–90	0. 20–0. 63	0. 04–0. 05	8. 5–9. 0	2–4	Moderate-----	Moderate.
----------	100	95–100	65–95	<0. 06	0. 04–0. 05	>9. 0	4–8	High----------	High.
----------	100	85–95	55–70	0. 06–0. 20	0. 04–0. 05	>9. 0	4–8	Moderate-----	High.
----------	100	80–95	15–35	2. 0–20. 0	0. 03–0. 05	>9. 0	8–16	Low----------	High.
----------	100	95–100	60–75	0. 63–2. 0	0. 16–0. 18	7. 9–8. 4	0–2	Low----------	Low.
----------	100	95–100	70–80	0. 63–2. 0	----------	8. 5–9. 0	2–4	Low----------	Moderate.
----------	100	95–100	60–90	0. 20–0. 63	0. 16–0. 21	7. 9–8. 4	0–2	Low----------	Low.
----------	100	95–100	70–95	0. 20–0. 63	0. 19–0. 21	7. 9–9. 0	2–4	Moderate-----	Moderate.
----------	100	95–100	70–80	0. 20–0. 63	----------	8. 5–9. 0	2–4	Moderate-----	Moderate.
15–25	65–85	60–70	50–65	0. 20–0. 63	0. 15–0. 17	7. 9–8. 4	2–4	Low----------	Moderate.
----------	100	85–100	75–95	<0. 06	0. 14–0. 16	7. 9–8. 4	2–4	High----------	High.
----------	70–85	60–70	50–60	0. 20–0. 63	0. 15–0. 17	7. 9–8. 4	2–4	Low----------	Moderate.
10–20	60–75	55–65	50–60	0. 20–0. 63	0. 15–0. 17	7. 4–8. 4	0–2	Moderate-----	Moderate.
----------	95–100	95–100	30–40	2. 0–6. 3	0. 11–0. 13	7. 4–7. 8	0–4	Low----------	Low to moderate.
----------	95–100	95–100	15–30	6. 3–20. 0	0. 06–0. 08	7. 4–7. 8	0–4	Low----------	Low to moderate.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to bedrock or indurated caliche	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
*Mimbres:					
Mb, Mc, MD	>5	0–26	Clay loam	ML or CL	A–6
		26–60	Loam, sandy clay loam, or clay loam.	ML or CL	A–4 or A–6
For properties of Glendale soils in those mapping units, refer to mapping units Gc, GD in Glendale series.					
Me, Mg	>5	0–26	Clay loam	ML or CL	A–6
		26–60	Loam, sandy clay loam, or light clay loam.	ML or CL	A–4 or A–6
For properties of Glendale soils in these mapping units, refer to mapping units Me, Mg under Glendale series.					
Mohave: Mh, Mk, MO	>5	0–7	Sandy clay loam	SM or SC	A–4
		7–42	Clay loam	CL or SC	A–6 or A–4
		42–60	Gravelly sandy loam	SM	A–2
*Nickel: NC, Ng, NT	>5	0–14	Gravelly loam	SM	A–2
		14–60	Weakly cemented caliche (very gravelly loam texture).	GM	A–2
For properties of Turney soils in mapping unit NT, refer to Turney series.					
*Pima: PH	>5	0–36	Clay loam	CL	A–6
		36–60	Loam	ML or CL	A–4 or A–6
For properties of Hawkeye soils in this mapping unit, refer to Hawkeye series.					
*Pinaleno: PM	>5	0–5	Gravelly loamy sand	SM	A–2
		5–14	Very gravelly sandy clay loam	GC	A–2
		14–60	Very gravelly loamy sand	GM or GP–GM	A–2 or A–1
For properties of Mimbres soils in this mapping unit, refer to mapping units Mb, Mc, MD in Mimbres series.					
*Pintura: PR	>5	0–60	Loamy fine sand	SM	A–2
For properties of Berino soils in this mapping unit, refer to Berino series.					
Playas: PY	>5	0–60	Silty clay or clay	CH	A–7
Riverwash: Rh. Properties too variable to estimate.					
Rock land: RL. Properties too variable to estimate.					
Rough broken land: RO. Properties too variable to estimate.					
Rough broken land and rock land: RU. Properties too variable to estimate.					
*Sonoita: Sn, SO	>5	0–30	Gravelly sandy clay loam	SM or SC	A–2 or A–4
		30–60	Gravelly loamy sand	SM	A–1 or A–2
For properties of Yturbide soils in mapping unit SO; refer to Yturbide series.					
Stellar: Sr, SS, St, Su	>5	0–5	Sandy clay loam or silty clay loam (cobbly silty clay loam surface layer in Su).	SC or CL	A–6
		5–23	Clay	CH, CL or ML	A–7
		23–60	Gravelly clay loam and loam	ML or CL	A–6 or A–4

engineering properties—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water holding capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of untreated steel pipe
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
Percent				*Inches per hour*	*Inches per inch of soil*	*pH*	*Millimhos per cm. at 25°C.*		
----------	100	95–100	70–80	0. 20–0. 63	0. 18–0. 20	7. 4–8. 4	0–4	Moderate_____	Moderate.
----------	100	95–100	50–75	0. 63–2. 0	0. 13–0. 17	7. 9–8. 4	0–4	Moderate_____	Moderate.
----------	100	95–100	70–80	0. 20–0. 63	0. 04–0. 06	8. 5–9. 6	4–8	Moderate_____	High.
----------	100	95–100	50–75	0. 20–0. 63	0. 04 0. 06	8. 5–9. 6	4–8	Moderate_____	High.
----------	100	95–100	30–50	0. 63–2. 0	0. 14–0. 16	7. 4–7. 8	0–2	Low_____	Moderate.
----------	100	95–100	70–80	0. 20–0. 63	0. 17–0. 19	7. 4–8. 4	2–4	Moderate_____	Moderate.
----------	95–100	60–70	20–30	2. 0–6. 3	0. 07–0. 09	7. 9 8. 4	2–4	Low_____	Moderate.
----------	85–95	60–70	25–35	0. 63–2. 0	0. 12–0. 14	7. 9–8. 4	0–2	Low_____	Low.
5–15	35–50	35–50	20–35	0. 20–0. 63	----------	7. 9–8. 4	2–4	Low_____	Moderate.
----------	100	95–100	70–80	0. 20–0. 63	0. 19–0. 21	7. 4–7. 8	0–2	Moderate_____	Moderate.
----------	100	95–100	60–75	0. 63–2. 0	0. 16–0. 18	7. 4–7. 8	2–4	Low_____	Moderate.
5–15	80–95	60–70	15–25	6. 3–20. 0	0. 05–0. 07	7. 4–7. 8	0–2	Low_____	Low.
5–15	35–50	35–50	15–30	0. 20–0. 63	0. 09–0. 11	7. 4–8. 4	0–2	Low_____	Low.
5–15	35–50	35–50	5–15	6. 3–20. 0	0. 03–0. 05	7. 9–8. 4	0–2	Low_____	Low.
----------	100	95–100	15–30	6. 3–20. 0	0. 09–0. 10	7. 9–8. 4	0–2	Low_____	Low.
----------	100	95–100	90–95	<0. 06	0. 04–0. 05	>9. 0	8–16	High_____	High.
----------	60–75	55–70	25–40	0. 63–2. 0	0. 12–0. 14	7. 4–7. 8	0–2	Low_____	Low.
----------	60–75	55–70	10–20	6. 3–20. 0	0. 05–0. 07	7. 4–7. 8	2–4	Low_____	Moderate.
10–25 in Su.	100	95–100	40–60	0. 63–2. 0	0. 14–0. 21	7. 4–7. 8	2–4	Moderate_____	Moderate.
----------	100	95–100	70–95	0. 06–2. 0	0. 14–0. 16	7. 4–8. 4	2–4	High_____	High.
----------	65–95	60–90	50–70	0. 20–0. 63	0. 15–0. 19	7. 9–8. 4	2–4	Moderate_____	Moderate.

TABLE 5.—*Estimated*

Soil series and map symbols	Depth to bedrock or indurated caliche	Depth from surface	Classification		
			USDA texture	Unified	AASHO
	Feet	*Inches*			
*Terino: TE	1–1½	0–13	Very gravelly sandy clay loam	GC or CM	A–2
For properties of Turney soils in this mapping unit, refer to Turney series.		13	Indurated caliche.		
Tres Hermanos: Th, TR	>5	0–27	Gravelly clay loam	CL, ML, SC, or SM	A–6 or A–7
		27–60	Very gravelly loam	GM	A–2
Turney	>5	0–6	Fine sandy loam	ML or SM	A–4
		6–22	Sandy clay loam	SC	A–4 or A–6
Mapped only in associations with Nickel and Terino soils.		22–60	Weakly cemented caliche (clay loam texture).	CL	A–6
Ubar: Ua, UC	>5	0–10	Silty clay loam	CL	A–6 or A–7
		10–60	Silty clay and clay	CH	A–7
Upton: Ug, UP	0. 3–1	0–8	Gravelly loam	GC, GM or SM	A–4, A–2 or A–1
		8	Indurated caliche.		
Vekol: Vc, Ve, VK	>5	0–7	Silty clay loam	CL	A–6
		7–24	Light clay	CH or CL	A–6 or A–7
		24–60	Silty clay loam	CL	A–6
Verhalen: Vm, VN	>5	0–7	Silty clay loam and clay loam	CL or ML	A–6 or A–7
		7–32	Clay and silty clay	CH, CL or ML	A–7
		32–60	Clay loam and silt loam	ML or CL	A–6
Verhalen, alkali: Vs, VT	>5	0–7	Silty clay loam	ML or CL	A–6 or A–7
		7–32	Clay	CH	A–7
		32–40	Clay loam	ML or CL	A–6
		40–60	Silt loam	ML or CL	A–6
Whitlock: Wh	>5	0–25	Gravelly loam and loam	ML or SM	A–4
		25–60	Gravelly loamy sand	SM	A–1
Yana: YA	>5	0–60	Gravelly loam	SM	A–4
Yturbide: Yb, YU	>5	0–21	Gravelly loamy sand	SM	A–2
		21–60	Gravelly sand	SP–SM, SP or SW	A–1
Yturbide, heavy subsoil variant: YY	>5	0–20	Loamy sand	SM	A–2
		20–60	Clay loam, sandy clay, and sandy clay loam.	CL	A–6

engineering properties—Continued

Coarse fraction greater than 3 inches	Percentage passing sieve—			Permeability	Available water holding capacity	Reaction	Salinity	Shrink-swell potential	Corrosivity of untreated steel pipe
	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)						
Percent				*Inches per hour*	*Inches per inch of soil*	*pH*	*Millimhos per cm. at 25°C.*		
10–25	40–55	35–50	15–30	0. 20–0. 63	0. 07–0. 09	7. 4–8. 4	0–2	Low	Moderate.
	85–95	75–85	35–55	0. 20–0. 63	0. 15–0. 17	7. 4–8. 4	0–2	Moderate	Moderate.
	35–50	35–50	20–35	0. 63–2. 0	0. 06–0. 08	7. 9–8. 4	2–4	Low	Moderate.
	100	95–100	40–55	2. 0–6. 3	0. 13–0. 15	7. 9–8. 4	0–2	Low	Low.
	100	95–100	35–50	0. 63–2. 0	0. 14–0. 16	7. 9–8. 4	2–4	Moderate	Moderate.
	100	95–100	70–80	0. 63–2. 0		8. 5–9. 0	2–4	Low	Moderate.
	100	95–100	85–95	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	2–4	Moderate	Moderate.
	100	95–100	75–95	0. 06–0. 20	0. 15–0. 17	7. 9–8. 4	2–4	High	High.
0–10	45–75	40–70	20–50	0. 63–2. 0	0. 10–0. 14	7. 9–8. 4	0–2	Low	Low.
	100	100	70–90	0. 20–0. 63	0. 19–0. 21	6. 6–7. 8	0–2	Moderate	Moderate.
	100	100	75–95	0. 06–0. 20	0. 14–0. 16	7. 4–7. 8	0–2	High	High.
	100	100	80–90	0. 20–0. 63	0. 19–0. 21	7. 9–8. 4	2–4	Moderate	Moderate.
	100	95–100	85–95	0. 20–0. 63	0. 19–0. 21	7. 4–7. 8	0–2	Moderate	Moderate.
	100	95–100	75–95	0. 06–0. 20	0. 15–0. 17	7. 4–7. 8	2–4	High	High.
	100	95–100	70–80	0. 06–0. 20	0. 19–0. 21	7. 9–8. 4	2–4	Moderate	Moderate.
	100	95–100	85–95	0. 20–0. 63	0. 04–0. 06	>9. 0	2–4	Moderate	Moderate.
	100	95–100	75–95	0. 06–0. 20	0. 04–0. 06	>9. 0	4–8	High	High.
	100	95–100	70–90	0. 06–0. 20	0. 04–0. 06	>9. 0	4–8	Moderate	High.
	100	95–100	70–90	0. 06–0. 20	0. 04–0. 06	>9. 0	4–8	Moderate	High.
	65–75	60–70	35–60	2. 0–6. 3	0. 08–0. 10	7. 9–8. 4	0–2	Low	Low.
	65–75	60–70	15–30	6. 3–20. 0	0. 05–0. 07	7. 9–8. 4	0–2	Low	Low.
	80–95	60–70	35–50	0. 63–2. 0	0. 08–0. 10	6. 6–7. 8	0–2	Low	Low.
	75–85	60–70	10–20	6. 3–20. 0	0. 05–0. 07	7. 4–7. 8	0–2	Low	Low.
	80–95	70–85	0–10	6. 3–20. 0	0. 04–0. 06	7. 4–7. 8	0–2	Low	Low.
	95–100	90–100	15–30	6. 3–20. 0	0. 06–0. 08	7. 4–8. 4	0–2	Low	Low.
	95–100	95–100	70–80	0. 20–2. 0	0. 15–0. 19	7. 4–9. 0	0–2	Moderate	Moderate.

TABLE 6.—*Engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in for referring to other series that

Soil series and map symbols	Suitability as source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
Anamite: AN	Poor: high content of clay.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–7	Highly plastic
Arizo: Ar	Poor: high content of gravel.	Fair: gravelly	Fair if washed; less than 75 percent gravel.	Good	Slopes easily eroded.
Berino: BA, Bb, BD	Fair to poor: sandy loam to loamy sand.	Unsuitable: mainly fine-grained material.	Unsuitable: fine-grained material.	Fair: A–4 and A–6.	Moderate shrink-swell potential.
*Chiricahua: CC For interpretations of Comoro soils in this mapping unit, refer to Comoro series.	Poor: very cobbly.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material and cobblestones.	Poor: A–7	High shrink-swell potential; 5 to 25 percent slopes.
*Cloverdale: CD, CE, CL For interpretations of Stellar soils in mapping unit CL, refer to Stellar series.	Poor: high content of clay.	Unsuitable: fine-grained material.	Unsuitable: about 20 percent gravel below a depth of 3 feet.	Poor: high shrink-swell potential; A–7 and A–6.	High shrink-swell potential.
Comoro: Cm, Co	Good to fair: sandy loam and some gravel.	Poor: sandy loam material.	Poor: some pockets of gravel.	Good: A–2 below a depth of 1 foot.	Subject to flooding.
*Eba: EB, EN For interpretations of Nickel soils in mapping unit EN, refer to Nickel series.	Poor: very gravelly.	Unsuitable: very gravelly and fine-grained material.	Fair: about 60 percent gravel and cobblestones.	Fair: A–2 and A–6.	Moderate shrink-swell potential; slopes of 1 to 60 percent.
Eicks: ES	Poor: gravelly material.	Unsuitable: gravelly and fine-grained material.	Unsuitable: about 25 percent gravel; fine-grained material.	Poor: A–6 and A–7 with some A–2.	Moderate shrink-swell potential.
*Forrest: FE, FG, FL, FM For interpretations of Pinaleno soils in mapping unit FL and Stellar soils in mapping unit FM, refer to Pinaleno series and Stellar series.	Poor: gravelly material.	Unsuitable: gravelly and fine-grained material.	Fair to unsuitable: 25 to 65 percent gravel; fine-grained material.	Poor: A–6 and A–7; A–4 or A–2 below a depth of 2½ feet.	Moderate shrink-swell potential.
Frye: Fn, Fr, FY	Fair: low fertility.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	High shrink-swell potential.

interpretations

such mapping units may have different interpretations and limitations, and for this reason it is necessary to follow carefully the instructions appear in the first column of this table]

Soil features affecting—Continued			Soil limitations for sewage disposal		Hydrologic group
Ponds		Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Reservoir areas	Embankments				
Very slow permeability; slopes of 0 to 1 percent.	High compressibility; low shear strength; low permeability when compacted; low susceptibility to piping; fair to poor compaction.	High shrink-swell potential.	Severe: very slow permeability.	Slight	D
Very rapid permeability; slopes of 2 to 5 percent.	Low compressibility; medium to high shear strength; low permeability when compacted; medium to low susceptibility to piping; fair to good compaction.	Low shrink-swell potential.	Slight: may contaminate ground water.	Severe: very rapid permeability.	A
Moderate permeability; slopes of 0 to 3 percent.	Medium to high shear strength; low compressibility; medium to low permeability when compacted; medium to low susceptibility to piping; fair to good compaction.	Moderate shrink-swell potential.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Slow permeability; 5 to 25 percent slopes; bedrock at a depth of 1½ to 3 feet.	High compressibility; low shear strength; low permeability when compacted; low susceptibility to piping; fair to poor compaction.	High shrink-swell potential to bedrock.	Severe: bedrock at a depth of 1½ to 3 feet.	Severe: bedrock at a depth of 1½ to 3 feet.	C
Very slow permeability; slopes of 0 to 15 percent.	Low shear strength; low permeability when compacted; susceptible to piping; high compressibility; fair to poor compaction.	High shrink-swell potential.	Severe: very slow permeability.	Slight	D
Moderately rapid permeability; slopes of 0 to 9 percent.	Low to medium compressibility; low to medium permeability when compacted; medium shear strength; medium to high susceptibility to piping; fair to good compaction.	Low shrink-swell potential; some flooding.	Severe: subject to flooding. Slight if protected from flooding.	Severe: moderately rapid permeability.	B
Slow permeability; slopes of 1 to 60 percent.	Medium to high shear strength; low to medium permeability when compacted; low to medium compressibility; low to medium susceptibility to piping; good to fair compaction.	Moderate shrink-swell potential.	Severe: slow permeability.	Slight to severe: slopes of 1 to 60 percent.	C
Slow permeability; slopes of 0 to 3 percent.	Medium shear strength; low to medium compressibility; low to medium susceptibility to piping; low permeability when compacted; good to fair compaction.	Moderate shrink-swell potential.	Severe: slow permeability.	Slight	C
Slow permeability; slopes of 0 to 5 percent.	Medium shear strength; low to medium compressibility; low to medium susceptibility to piping; low permeability when compacted.	Moderate shrink-swell potential.	Severe: slow permeability.	Slight	C
Indurated silica pan at a depth of 20 to 36 inches; slopes of 0 to 3 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	Moderate shrink-swell potential; hardpan at a depth of 20 to 36 inches.	Severe: slow permeability; hardpan at a depth of 20 to 36 inches.	Severe: silica pan at a depth of 20 to 36 inches.	C

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
Gila: GA, Gb	Good	Unsuitable: mainly fine-grained material.	Unsuitable: mainly fine-grained material.	Fair: A–4	A–4 material; some flooding.
*Glendale: Gc, GD. For interpretations of Arizo soils in mapping unit GD, refer to Arizo series.	Fair: silty clay loam.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	Moderately plastic; some flooding.
Me, Mg. Mapped only in undifferentiated groups with Mimbres soils.	Poor: strongly alkaline and very strongly alkaline.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	Moderately plastic; some flooding.
Grabe: Ge, Gm	Good for loam; fair for silty clay loam.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Fair: A–4	Some flooding
Graham: GO, Gr, GT	Poor: stony	Unsuitable: fine-grained material; stony.	Unsuitable: fine-grained material; stony.	Poor: A–6 and A–7.	Highly plastic; slopes of 0 to 45 percent.
*Hap: HA. For interpretations of Yturbide soils in mapping unit HA, refer to the Yturbide series.	Fair: gravelly	Unsuitable: fine-grained material.	Fair to poor: fine-grained material; 30 to 40 percent gravel.	Poor: A–6	Low shrink-swell potential.
Hawkeye. Mapped only in a complex with Pima soils.	Poor: gravelly and sandy.	Fair: gravelly loamy sand.	Poor: about 40 percent gravel.	Good	Slopes are easily eroded.
Hondale: Hd, HN, Hs	Poor: strongly alkaline and very strongly alkaline.	Unsuitable: fine-grained material; sandy below a depth of 3 feet.	Unsuitable: fine-grained material.	Fair to poor: A–6, A–4.	High shrink-swell potential; some water overflow.
*Jal: Ja, JL, JR. For interpretations of the Karro soils in mapping unit JR, refer to Karro series.	Poor: high content of lime.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Fair to poor: A–4 and A–6.	Caliche at a depth of 1 foot; erosion hazard.

interpretations—Continued

Soil features affecting—Continued			Soil limitations for sewage disposal		Hydrologic group
Ponds		Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Reservoir areas	Embankments				
Moderate permeability; slopes of 0 to 3 percent.	Low to medium shear strength; low to medium permeability when compacted; medium compressibility; high susceptibility to piping; good to poor compaction.	Low shrink-swell potential.	Severe: subject to flooding. Slight to moderate if protected from flooding. Moderate permeability.	Moderate: moderate permeability.	B
Moderately slow permeability; slopes of 0 to 2 percent.	Medium compressibility; low permeability when compacted; fair to good compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight	B
Moderately slow permeability.	Medium compressibility; low permeability when compacted; low to medium shear strength; low to medium susceptibility to piping; fair to good compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight	C
Moderate permeability; slopes 0 to 10 percent.	Low to medium shear strength; low to medium permeability when compacted; medium compressibility; high susceptibility to piping; good to poor compaction.	Moderate shrink-swell potential to a depth of 1 foot.	Severe: subject to flooding. Slight to moderate if protected from flooding. Moderate permeability.	Moderate: moderate permeability.	B
Bedrock at a depth of 1 to 1½ feet; slow permeability; slopes of 0 to 45 percent.	Low shear strength; low permeability when compacted; low susceptibility to piping; high compressibility; fair to poor compaction.	High shrink-swell potential; bedrock at a depth of 1 to 1½ feet.	Severe: slow permeability; bedrock at a depth of 1 to 1½ feet.	Severe: bedrock at a depth of 1 to 1½ feet.	D
Moderate permeability; slopes of 1 to 9 percent.	Medium shear strength; low to medium compressibility; low to medium susceptibility to piping; low permeability when compacted; good to fair compaction.	Low shrink-swell potential.	Moderate: moderate permeability.	Moderate: moderate permeability.	B
Rapid permeability; slopes of 0 to 3 percent.	Medium shear strength; low to medium compressibility; low to medium permeability when compacted; medium to high susceptibility to piping; fair to good compaction.	High bearing capacity; low shrink-swell potential.	Slight: may contaminate ground water; subject to minor flooding unless protected.	Severe: rapid permeability.	A
Very slow permeability; slopes of 0 to 3 percent.	Low to medium shear strength; low to medium permeability when compacted; medium compressibility; high susceptibility to piping; good to poor compaction.	High shrink-swell potential.	Severe: very slow permeability.	Slight	D
Moderate permeability; slopes of 0 to 5 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	Low shrink-swell potential.	Slight to moderate: moderate permeability.	Severe: soft caliche at a depth of 1 foot.	B

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—				Soil features affecting
	Topsoil	Sand	Gravel	Road fill	Highway location
Karro Mapped only in an association with Jal soils.	Poor: high content of lime.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	Plastic material.
Keno: KC	Poor: basalt cobble and clay material.	Unsuitable: fine-grained material.	Unsuitable: about 20 percent gravel below a depth of 2 feet.	Poor: A–6 and A–7.	High shrink-swell potential.
*Lehmans: LH, LN For interpretations of Nickel soils in mapping unit LN, refer to Nickel series.	Poor: rocky and stony.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	Highly plastic; slopes of 1 to 25 percent.
Maricopa: Ma	Fair: sandy loam.	Fair: loamy sand below a depth of 2 feet.	Unsuitable: no gravel.	Good	All features favorable.
*Mimbres: Mb, Mc, MD For interpretations of Glendale soils in these mapping units, refer to mapping units Gc, GD in Glendale series.	Good to fair: clay loam.	Unsuitable: fine-grained material	Unsuitable: fine-grained material.	Poor: A–6	Subject to flooding.
Me, Mg For interpretations of Glendale soils in these mapping units, refer to mapping units Me, Mg in Glendale series.	Poor: strongly alkaline and very strongly alkaline.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6	Subject to flooding.
Mohave: Mh, Mk, MO	Good to fair: clay loam below a depth of 7 inches.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Fair: A–4	Moderate shrink-swell potential.
*Nickel: NC, Ng, NT For interpretations of Turney soils in mapping unit NT, refer to Turney series.	Poor: very gravelly; high content of lime.	Unsuitable: very gravelly loam.	Fair: about 55 percent gravel.	Good	Slopes of 0 to 60 percent.
*Pima: PH For interpretations of Hawkeye soils in this mapping unit, refer to Hawkeye series.	Fair: clay loam.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6	Subject to flooding.

interpretations—Continued

Soil features affecting—Continued			Soil limitations for sewage disposal		Hydrologic group
Ponds		Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Reservoir areas	Embankments				
Moderately slow permeability; slopes of 0 to 3 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight	B
Very slow permeability; slopes of 1 to 4 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	High shrink-swell potential.	Severe: very slow permeability.	Slight	D
Bedrock at a depth of 1 to 1½ feet; moderately slow permeability; slopes of 1 to 25 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	Moderate shrink-swell potential.	Severe: bedrock at a depth of 1 to 1½ feet.	Severe: bedrock at a depth of 1 to 1½ feet.	C
Moderately rapid permeability; slopes of 0 to 3 percent.	Medium shear strength; low to medium compressibility; low to medium permeability when compacted; medium to high susceptibility to piping; fair to good compaction.	Low shrink-swell potential.	Slight	Severe: moderately rapid permeability.	B
Moderately slow permeability; slopes of 0 to 1 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight	B
Moderately slow permeability; slopes of 0 to 1 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight	C
Moderately slow permeability.	Medium shear strength; low to medium susceptibility to piping; low to medium compressibility; low permeability when compacted; good to fair compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight	B
Moderately slow permeability; slopes of 0 to 60 percent.	Medium to high shear strength; low to medium permeability when compacted; low to medium susceptibility to piping; low compressibility; fair to good compaction.	Low shrink-swell potential.	Severe: caliche at a depth of about 1 foot; moderately slow permeability; slopes of 0 to 60 percent.	Severe: porous substratum; slopes of 0 to 60 percent.	B
Moderately slow permeability; slopes of 1 to 3 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Slight	B

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
*Pinaleno: PM For interpretations of Mimbres soils in this mapping unit, refer to mapping units Mb, Mc, MD in Mimbres series	Poor: very gravelly.	Fair below a depth of 1 to 2 feet.	Fair: about 50 to 75 percent gravel.	Good	1 to 5 percent slopes.
*Pintura: PR For interpretations of Berino soils in this mapping unit, refer to Berino series.	Poor: loamy sand.	Good for fine sand.	Unsuitable: no gravel.	Good	Sand may hinder hauling.
Playas: PY	Poor: very strongly alkaline.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: high shrink-swell potential; A–7	High shrink-swell potential; subject to flooding.
Riverwash: Rh	Poor: mainly sand.	Fair if screened and washed.	Poor to fair: variable content of gravel.	Good to fair: mainly A–2 and A–4.	Subject to flooding.
Rock land: RL	Poor: rocky	Poor: rocky	Poor: rocky	Poor: limited material.	Slopes of 10 to 25 percent.
Rough broken land: RO	Poor: very low fertility; slopes of 15 to 75 percent.	Unsuitable to fair: substratum is variable.	Unsuitable to poor: substratum is variable.	Poor to good: substratum is variable.	Slopes of 15 to 75 percent.
Rough broken land and rock land: RU	Poor: rocky, slopes of 25 to 75 percent.	Poor: rocky, stony, or cobbly material.	Unsuitable to poor: limited material.	Fair to good	Slopes of 25 to 75 percent.
*Sonoita: Sn, SO For interpretations of Yturbide soils in mapping unit SO, refer to Yturbide series.	Fair: gravelly	Poor to fair: gravelly loamy sand below a depth of 2½ feet.	Poor: about 25 percent gravel.	Good to fair: A–2 and A–4.	All features favorable.
Stellar: Sr, SS, St, Su	Good for sandy clay loam; fair for silty clay loam; poor for cobbly silty clay loam.	Unsuitable: fine-grained material.	Unsuitable: less than 25 percent gravel.	Poor: A–6 and A–7.	Highly plastic
*Terino: TE For interpretations of Turney soils in this mapping unit, refer to Turney series.	Poor: very gravelly.	Unsuitable: indurated caliche at a depth of 1 to 1½ feet.	Poor: indurated caliche at a depth of 1 to 1½ feet.	Good: limited material.	Indurated caliche at a depth of 1 to 1½ feet.
Tres Hermanos: Th, TR	Poor: gravelly material.	Unsuitable: fine-grained and gravelly material.	Poor: about 35 to 40 percent gravel.	Good to poor A–6 or A–7 over A–2.	Moderate shrink-swell potential.

interpretations—Continued

Soil features affecting—Continued			Soil limitations for sewage disposal		Hydrologic group
Ponds		Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Reservoir areas	Embankments				
Moderately slow permeability; slopes of 1 to 5 percent.	Medium to high shear strength; low to medium permeability when compacted; low to medium susceptibility to piping; low compressibility; fair to good compaction.	Low shrink-swell potential.	Slight	Severe: rapid permeability below a depth of about 2 feet.	B
Rapid permeability slopes of 0 to 3 percent.	Medium shear strength; low to medium compressibility; low to medium permeability when compacted; medium to high susceptibility to piping; fair to good compaction.	Low shrink-swell potential.	Slight: may contaminate ground water.	Severe: rapid permeability.	A
Very slow permeability; slopes of 0 to 1 percent.	Low shear strength; low permeability when compacted; low susceptibility to piping; high compressibility; fair to poor compaction.	High shrink-swell potential; subject to flooding.	Severe: very slow permeability; flooding.	Severe: slopes; intermittent lakes.	D
Features variable; slopes of 0 to 1 percent.	Features are variable; stratified sediments.	Subject to flooding and soil shifting.	Severe: subject to flooding.	Severe: subject to flooding.	A
Bedrock mainly at a depth of 0 to 1 foot; slopes of 10 to 25 percent.	Limited, variable material	Bedrock at a depth of 0 to 1 foot.	Severe: bedrock at a depth of 0 to 1 foot.	Bedrock at a depth of 0 to 1 foot.	D
Slopes of 15 to 75 percent.	Variable material	Low to high shrink-swell potential.	Severe: slopes of 15 to 75 percent	Severe: slopes of 15 to 75 percent.	C
Slopes of 25 to 75 percent bedrock.	Variable material	Low to high shrink-swell potential.	Severe: slopes of 25 to 75 percent.	Severe: slopes of 25 to 75 percent.	D
Moderate permeability; slopes of 0 to 5 percent.	Low to medium compressibility; low to medium permeability when compacted; medium to high susceptibility to piping; fair to good compaction.	Low shrink-swell potential.	Slight: may contaminate ground water.	Severe: rapid permeability in substratum.	B
Slow permeability; slopes of 0 to 3 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	High shrink-swell potential.	Severe: slow permeability.	Slight	C
Indurated caliche at a depth of 1 to 1½ feet; slopes of 1 to 5 percent.	Medium to high shear strength; low to medium compressibility; low to medium permeability when compacted; low to medium susceptibility to piping; good to fair compaction.	Low shrink-swell potential; indurated caliche at a depth of 1 to 1½ feet.	Severe: indurated caliche at a depth of 1 to 1½ feet.	Severe: indurated caliche at a depth of 1 to 1½ feet.	D
Moderately slow permeability; slopes of 0 to 5 percent.	Medium to high shear strength; low to medium permeability when compacted; low to medium susceptibility to piping; low compressibility; fair to good compaction.	Moderate shrink-swell potential.	Severe: moderately slow permeability.	Moderate: moderate permeability below a depth of 2 to 2½ feet.	B

TABLE 6.—*Engineering*

Soil series and map symbols	Suitability as source of—				Soil features affecting—
	Topsoil	Sand	Gravel	Road fill	Highway location
Turney Mapped only in associations with Nickel and Terino soils.	Fair: caliche below a depth of 1½ to 2 feet.	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Fair to poor: A–4 and A–6.	Moderate shrink-swell potential.
Ubar: Ua, UC	Poor: clayey	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	High shrink-swell potential.
Upton: Ug, UP	Poor: gravelly	Unsuitable: indurated caliche at a depth of 0.3 to 1.0 foot.	Unsuitable: indurated caliche at a depth of 0.3 to 1.0 foot.	Good: limited material.	Firm foundation, nonerodible if well packed.
Vekol: Vc, Ve, VK	Poor: clayey	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	High shrink-swell potential.
Verhalen: Vm, VN, Vs, VT	Poor: clayey	Unsuitable: fine-grained material.	Unsuitable: fine-grained material.	Poor: A–6 and A–7.	High shrink-swell potential.
Whitlock: Wh	Fair: some gravel.	Fair: gravelly loamy sand below a depth of 2 feet.	Poor: 30 to 40 percent gravel.	Fair to good: A–4 and A–2.	Slopes of 5 to 10 percent.
Yana: YA	Fair: gravelly loam.	Unsuitable: fine-grained material.	Poor: 30 to 40 percent gravel.	Fair: A–4	Slopes of 1 to 9 percent.
Yturbide: Yb, YU	Poor: gravelly loamy sand.	Fair if washed and screened.	Unsutiable to poor: 15 to 40 percent gravel.	Good	All features favorable.
Yturbide, heavy subsoil variant: YY	Poor: loamy sand.	Fair if washed and screened.	Unsuitable: less than 10 percent gravel.	Good to a depth of 20 inches, A–2; poor below a depth of 20 inches, A–6.	Good

interpretations—Continued

Soil features affecting—Continued			Soil limitations for sewage disposal		Hydrologic group
Ponds		Foundations for low buildings	Septic tank filter fields	Sewage lagoons	
Reservoir areas	Embankments				
Moderate permeability; slopes of 0 to 5 percent.	Medium shear strength; low to medium compressibility; low to medium susceptibility to piping; low permeability when compacted; good to fair compaction.	Moderate shrink-swell potential.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Slow permeability; slopes of 0 to 5 percent.	Low shear strength; low permeability when compacted; low susceptibility to piping; high compressibility; fair to poor compaction.	High shrink-swell potential.	Severe: slow permeability.	Slight	C
Indurated caliche at a depth of 0.3 to 1.0 foot; slopes of 1 to 9 percent.	Indurated caliche at a depth of 0.3 to 1.0 foot.	Low shrink-swell potential.	Severe: indurated caliche at a depth of 0.3 to 1.0 foot.	Severe: indurated caliche at a depth of 0.3 to 1.0 foot.	D
Slow permeability; slopes of 0 to 1 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	High shrink-swell potential.	Severe: slow permeability.	Slight	C
Slow permeability; slopes of 0 to 1 percent.	Low to medium shear strength; low to medium susceptibility to piping; medium compressibility; low permeability when compacted; fair to good compaction.	High shrink-swell potential.	Severe: slow permeability.	Slight	D
Moderate permeability; slopes of 5 to 10 percent.	Medium shear strength; low to medium compressibility; low to medium permeability when compacted; medium to high susceptibility to piping; fair to good compaction.	Low shrink-swell potential.	Slopes of 5 to 10 percent.	Severe: moderately rapid permeability.	B
Moderate permeability; slopes of 1 to 9 percent.	Medium shear strength; low to medium compressibility; low to medium permeability when compacted; medium to high susceptibility to piping; fair to good compaction.	Low shrink-swell potential.	Slight to moderate: moderate permeability.	Moderate: moderate permeability.	B
Rapid permeability; slopes of 0 to 9 percent.	Medium to high shear strength; medium to high susceptibility to piping; low to medium compressibility; medium permeability when compacted; fair to good compaction.	Low shrink-swell potential.	Slight: slopes of 1 to 9 percent; may contaminate ground water.	Severe: rapid permeability.	A
Slow to moderate permeability; slopes of 0 to 3 percent.	Medium shear strength; low to medium compressibility; low to medium susceptibility to piping; low permeability when compacted; good to fair compaction.	Good in upper 20 inches; moderate shrink-swell potential below depth of 20 inches.	Moderate to severe: moderate to moderately slow permeability.	Slight to moderate: moderate to moderately slow permeability.	B

TABLE 7.—*Engineering*

[Tests performed by the New Mexico State Highway Department, according to

Soil name and location	New Mexico report No.	Depth from surface	Mechanical analysis [1]			
			Percentage passing sieve—			
			2-in.	1-in.	¾-in.	½-in.
		Inches				
Hondale silt loam:						
E. side of road, NW¼ sec. 11, T. 25 S., R. 20 W. (Modal).	65–216	0–4				
	65–217	4–9				
	65–218	17–31				
Mohave sandy clay loam:						
50 feet W., ¼ mile S. of NE. corner of sec. 1, T. 24 S., R. 17 W. (Modal).	65–210	0–4				
	65–211	19–31				
	65–212	31–37				
Stellar sandy clay loam:						
150 feet NW. of east quarter corner of sec. 1, T. 27 S., R. 20 W. (Modal).	65–222	3–8				
	65–223	8–21				
	65–224	27–45				
Tres Hermanos gravelly clay loam:						
¼ mile N. of south quarter corner of sec. 34, T. 22 S., R. 18 W. (Modal).	65–204	0–3			100	96
	65–205	10–16			100	98
	65–206	16–27				100
Upton gravelly loam:						
¼ mile W. and 100 feet N. of SE. corner of sec. 18, T. 25 S., R. 20 W. (Modal).	65–234	0–8	100	86	77	71
Verhalen silty clay loam:						
660 feet N. and 200 feet W. of SE. corner of sec. 29, T. 27 S., R. 19 W. (Modal).	65–228	3–33				

[1] Mechanical analysis according to the AASHO Designation T 88. Results by this procedure frequently differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analysis data used in this table are not suitable for use in naming textural classes for soil.

test data

standard procedures of the American Association of State Highway Officials (AASHO)]

Mechanical analysis [1]—Continued					Liquid limit	Plasticity index	Classification	
Percentage passing sieve—Continued								
⅜-in.	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 40 (0.42 mm.)	No. 200 (0.074 mm.)			AASHO [2]	Unified [3]
					Percent			
		100	98	86	[4]	[5]	A–4(8)	ML
		100	99	91	37	12	A–6(9)	ML–CL
		100	89	59	32	8	A–4(5)	ML–CL
		100	80	35	[4]	[5]	A–2–4(0)	SM
		100	86	60	27	9	A–4(5)	CL
		100	86	40	24	9	A–4(1)	SC
		100	88	56	36	14	A–6(6)	CL
		100	92	70	41	16	A–7–6(9)	ML–CL
		100	90	67	31	9	A–4(6)	ML–CL
93	87	82	82	30	20	4	A–2–4(0)	SM–SC
97	91	81	68	50	42	17	A–7–6(6)	ML–CL
99	92	78	58	42	36	11	A–6(2)	SM–SC
65	56	50	42	24	23	5	A–1–b(0)	GM–GC
		100	97	89	43	17	A–7–6(11)	ML–CL

[2] Based on AASHO Designation M 145–49(*1*).
[3] Based on the Unified soil classification system (*9*).
[4] Sandy.
[5] Nonplastic.

The AASHO system classifies the soils according to their engineering properties, based on field performance of highways. In this system soil materials are classified in seven basic groups, designated A–1 through A–7. The best soils for road subgrades—gravelly soils of high bearing capacity—are classified as A–1; the next best, A–2; and so on to the poorest, which are classified as A–7.

The Unified system is based on the identification of soils according to particle size, plasticity, and liquid limit. In the Unified system, SW and SP are clean sands; SM and SC are sands that have nonplastic or plastic fines (G replaces S for soils if the major coarse fraction is gravel); ML and CL are nonplastic or plastic, fine-grained materials that have a low liquid limit; and MH and CH are primarily nonplastic or plastic, fine-grained materials that have a high liquid limit. If soils are between two classifications, a borderline classification symbol is used; for example, ML–CL.

Estimated engineering properties

Table 5 lists the soils of Hidalgo County and gives estimates of some of the properties that affect engineering work. Information taken from other sections of this soil survey, knowledge of the individual soils of the county, and the test data shown in table 7 in this section were used as a basis for describing the soils and estimating their properties.

Depth to a seasonal high water table is not given in table 5, because a water table is present in only a few local areas in soils that formed in alluvium. Where present, the water table fluctuates with the season and seldom is detrimental. The Comoro soils typically have a water table at a depth of about 4½ feet.

The three columns in table 5 under the heading "Classification" define soil texture as it is classified by soil scientists (USDA texture) and engineers (Unified and AASHO).

The estimated percentage of the coarse fraction greater than 3 inches is given. The Unified and AASHO classifications are based on material less than 3 inches.

The estimated percentage of soil material passing through the No. 4, No. 10, and No. 200 sieves reflects the normal range for a soil series. Most soils fall within the given range. The grain size of any soil varies considerably. It should not be assumed, therefore, that all samples of a specific soil fall within the range shown, nor that the engineering classification is invariably as shown.

The rates of permeability given in table 5 are based on the movement of water through the soil in its undisturbed state. The rates depend largely on the texture, structure, density, and porosity of the soil.

Available water holding capacity refers to the capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Reaction refers to the degree of acidity or alkalinity of a soil, expressed in pH values. A soil having a pH value of 7.0 is considered to be neutral. The soils in Hidalgo County are neutral to very strongly alkaline.

Salinity refers to the approximate salt content of the soil. Determinations are based on the electrical conductivity of saturated soil extract and are expressed in millimhos per centimeter at 25° C.

Shrink-swell potential is an indication of the volume change to be expected with a change in moisture content. In general, soils classified as CH and A–7 have high shrink-swell potential. Clean sand and gravel (single-grain material) and most other nonplastic or slightly plastic soils have a low shrink-swell potential.

Soil corrosivity for untreated steel is closely related to the physical, chemical, and biological characteristics of the soil. Three degrees of soil corrosivity—low, moderate, and high—are based on texture, drainage, pH, and electrical conductivity.

Engineering interpretations

In table 6 the soils are rated for suitability as a source of topsoil, sand, gravel, and road fill. Also shown are soil features affecting highway location, ponds, and foundations for low buildings. Limitations for septic tank filter fields and sewage lagoons are also given. Hydrologic groups are shown in the last column. The engineering interpretations are based on information given in table 5, on field experience, and on the observed performance of the soils.

Topsoil is a term used to designate a fertile soil or soil material, ordinarily rich in organic matter, used as a topdressing for lawns, gardens, roadbanks, and the like. The ratings indicate suitability for such use.

Sand and gravel ratings are based on the probability that delineated areas of the soil contain deposits of sand or gravel. The ratings do not indicate quality or size of the deposits.

Road fill is material used to build embankments. The ratings indicate performance of soil material moved from borrow areas for this purpose.

Highway location is influenced by features of the undisturbed soil that affect construction and maintenance of highways. The soil features, favorable as well as unfavorable, are the principal ones that affect geographic location of highways.

Reservoir areas are affected mainly by loss of water through seepage, and the soil features are those that influence such seepage.

Embankments serve as dams. The soil features of both subsoil and substratum are those important to the use of soils for constructing embankments.

Foundations for low buildings are mainly affected by features of the undisturbed soil that influence its capacity to support low buildings that have normal foundation loads.

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

Sewage lagoons serve as reservoirs for sewage effluent. Soil qualities affecting the use of the soils for reservoir areas and embankments are the features considered.

The soils are classified in four hydrologic soil groups. These groups are based on the intake of water at the

end of long storms after the soil is already wet and swelled and when the soil is not protected by plants. Soils in group A soak up the most rainfall and lose the least in runoff. Soils in group B absorb more water than average. Soils in group C absorb less water than average. Soils in group D soak up the least rainfall and lose the most in runoff.

Engineering test data

Table 7 gives data obtained by laboratory tests of samples of six different soils in the county. The engineering properties of a soil at a specific location are indicated by this data, but there are variations in the properties of this soil at other locations in this county.

The engineering soil classifications are based on data obtained by mechanical analysis and by tests to determine the liquid limit and plasticity index.

The sites sampled for engineering test data represent about 27 percent of the soils in Hidalgo County.

Formation and Classification of the Soils

This section discusses the major factors of soil formation as they relate to the soils of Hidalgo County. It also explains the current system of classification and places each soil in some classes of this system.

Factors of Soil Formation

Soil is formed in parent materials that have been deposited or accumulated by geologic agencies. It is produced by physical and chemical weathering and other soil-forming factors acting on the parent materials. The characteristics of a soil at any given point are determined by the kind of parent materials; the climate under which the soil material accumulated and has existed since accumulation; the biological activity in and on the soil; the topography or lay of the land; and the length of time these soil-forming factors have acted on the soil material.

Climate and biological activity, mainly by vegetation, are the active factors of soil formation. They act on the parent material to slowly change it into a natural formation having genetically related horizons. The effects of climate and vegetation are conditioned by topography. The kind and nature of parent material limits the kind of profile that is formed. Finally, time is needed to change the parent material into a soil profile. The time needed to form horizons is long or short, but generally a long time is needed for the formation of distinct horizons.

The interaction of all the soil-forming factors determines the characteristics of the soil profile. The interaction of the factors is complex, and it is difficult to isolate the effects of any one factor. In some areas the effects of four factors may be nearly constant so the effects of the fifth factor can be evaluated. Even in these areas, however, measurements of the effects cannot be exact.

Parent material

The soils in Hidalgo County formed in four major kinds of parent materials. These are acid igneous rock, alluvial sediments, basic igneous rock, and sedimentary rocks.

The acid igneous parent materials include quartz latite, latite, rhyolite, andesite, and granitic rocks (*2*). The areas of Hidalgo County in which this type of parent material is dominant are in soil association 6 on the general soil map at the back of this survey. This kind of parent material makes up about 31 percent of the county.

The alluvial sediments are materials that have been deposited in broad valleys between hills and mountains. These materials have been transported from hills and mountains and vary in mineralogy according to the hills and mountains from which they came. The materials have been mixed and sorted in transport and have a wide range of minerals and particle sizes. The areas in Hidalgo County in which alluvial sediments are dominant are in soil associations 1, 2, 3, 5, 7, and 8. Alluvial sediments make up about 67 percent of the county.

Basic igneous parent materials make up about 2 percent of the county. Basalt is the major kind of rock included in this type of parent material. The major areas of soils formed in basic igneous parent materials are in soil association 4.

Sedimentary parent materials consist mainly of limestone rocks. The major areas where these materials are present in the county are in the Big and Little Hatchet Mountains. They are in soil association 6.

Climate

The climate of Hidalgo County is continental. It is characterized by large annual and daily temperature ranges and distinct seasons. Spring and fall are warm and dry. Summer is hot, and a moderate amount of rain falls as thunderstorms. Winter is mild, and precipitation falls as light showers and snow. Because of high temperature and low humidity, evaporation rates are high. The soils are not leached of the basic elements, because of the small amount of rainfall. Because of this, the soils in Hidalgo County have a high base saturation. Even though the soils have not been leached of basic elements, many soils show evidence of leaching and redepositing of lime. The Stellar and Mohave soils are typical of this. They are free of lime in the upper part of the profile but have accumulations of lime in the lower part of the Bca horizon or in the Cca horizon. These soils also show evidence of clay having been translocated from the A horizon to the Bt horizon.

Wetting and drying, freezing and thawing, and the depth to which the soils are wetted influence the formation of soil horizons. The effects of these actions are modified by other soil-forming factors. The presence and depth of lime accumulation in many of the soils indicate the average depth to which water moves. The fine-textured soils generally have a lime zone at shallower depths than the medium-textured soils because the water does not penetrate so deeply. The coarse-textured soils or the soils in swales, where they receive additional water because of runoff from surrounding areas, do not have a zone of lime in places, but soils that formed in very limy materials are limy at the surface in places.

Biological activity

Plant and animal life, both on and in the soil, is an active factor in soil formation. As plants die and decay, they add organic matter to the soil. This darkens the upper part of the soil profile. The soils at higher elevations have a darker surface layer than the soils at lower elevations in Hidalgo County because the soils at higher elevations receive more precipitation and support more plant life. The soils in swales, which receive runoff water from surrounding areas, are darkened to a greater depth than the surrounding soils. They support more plant life because they receive more moisture.

Many kinds of micro-organisms are needed to transform organic remains into humus from which plants can obtain nutrients.

Earthworms and small burrowing animals, such as badgers, gophers, and kangaroo rats, influence soil formation by mixing the organic and mineral parts of the soil. This deepens the zone in which organic matter accumulates.

Because soil life thrives in a moist, warm environment, it is most active in Hidalgo County during the summer after rain. In cultivated areas where crop residue is returned to the soil, decomposition takes place largely in spring and early in summer.

Topography

The topography of Hidalgo County is level on alkali flats and flood plains, gently and moderately sloping on uplands, and steep and very steep in river breaks and on hills and mountains.

The more gently sloping soils commonly have a more distinct profile than the steeper soils. This is because the steeper soils generally erode faster than they form distinct horizons. Also, the amount of moisture that enters the soil decreases as the slope increases. Where slopes are greater than 3 percent, more than half the rainfall generally runs off. Several factors other than slope influence the amount of runoff. Some of these are soil texture, intensity of rainfall, and vegetative cover.

In Hidalgo County there are two major exceptions to the general rules. The nearly level soils on flood plains do not have distinct horizons, because they formed in recently deposited alluvial sediments and have not had time to form, and the steep and very steep soils on hills and mountains generally have distinct horizons because of the increased rainfall at higher elevations.

Time

A considerable length of time is required for the formation of soils. After the parent material has been deposited or has accumulated in place through weathering, the surface soil is darkened by the accumulation of organic matter. Calcium carbonate (lime) and soluble salts are leached downward from the surface soil. The movement of clay downward proceeds more slowly. When clay is leached from the A horizon, it generally accumulates in the B horizon. The rate of this process depends on several factors, including how rapidly the parent materials are weathered, the soil temperature, and the amount of moisture moving through the profile.

The nature of the parent material greatly influences the rate of soil formation. Quartz, for example, weathers so slowly that soils high in content of quartz generally do not have distinct horizons, regardless of time. Most soils in Hidalgo County that formed in igneous materials, mostly rhyolite and basalt, form at moderate rates. Soils that formed in granite form more slowly. Soils that formed in parent material having a high content of lime, such as the Jal soils, have not formed a distinct B horizon, because lime reduces the rate at which clay minerals form and move in the profile. In Hidalgo County, rainfall is low and long periods of time are required to leach lime from the upper horizons. The soils on the flood plains, such as the Gila soils, have faint horizons because the materials in which they are forming have been deposited so recently that the horizon-forming processes have had little time to work.

The age of the soil is not the same as the geological age of the parent material. The soils are always younger than the geological parent material. Long periods of time are required before the geological material is stable with respect to slope and erosion. It must be relatively stable before the soils can form. In Hidalgo County, the oldest soils are on uplands. These soils generally have the most distinct horizons.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to form principles that help us to understand their behavior and their response to manipulation.

The system of classifying soils currently used in the United States (*6*) was adopted for general use by the National Cooperative Soil Survey in 1965. The system is under continual study (*5*), and readers interested in developments of this system should search for the latest literature available.

In table 8 the soils in Hidalgo County are placed in some of the categories of the current system. The classes in this system are briefly defined in the following paragraphs.

ORDER: Ten soil orders are recognized in the current system. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders are those that tend to give broad climatic groupings of soils. Two exceptions, Entisols and Histosols, form in many different climates. The four soil orders in Hidalgo County are Entisols, Vertisols, Aridisols, and Mollisols.

Entisols are recent soils in which there has been no horizon development. Examples in Hidalgo County are the Arizo and Gila soils.

Vertisols are soils in which churning or inversion of material takes place, mainly through swelling and shrinking of clay. In Hidalgo County, only the soils in the Verhalen series are Vertisols.

Aridisols are primarily soils of dry places. Examples in Hidalgo County are Ubar and Whitlock soils.

Mollisols have a thick, dark-colored surface layer. Most Mollisols formed under grass, as did the Pima soils.

TABLE 8.—*Classification of soil series* [1]

Series	Family	Subgroup	Order
Anamite	Fine, mixed, thermic	Ustollic Camborthids	Aridisols.
Arizo	Sandy-skeletal, mixed, thermic	Typic Torriorthents	Entisols.
Berino	Fine-loamy, mixed, thermic	Typic Haplargids	Aridisols.
Chiricahua	Clayey, mixed, thermic, shallow	Ustollic Haplargids	Aridisols.
Cloverdale	Fine, montmorillonitic, thermic	Torrertic Argiustolls	Mollisols.
Comoro	Coarse-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Eba	Clayey-skeletal, mixed, thermic	Typic Haplargids	Aridisols.
Eicks	Loamy-skeletal, mixed, thermic	Aridic Argiustolls	Mollisols.
Forrest	Fine, mixed, thermic	Ustollic Haplargids	Aridisols.
Frye	Fine, mixed, thermic	Typic Durargids	Aridisols.
Gila	Coarse-loamy, mixed (calcareous), thermic	Typic Torrifluvents	Entisols.
Glendale	Fine-silty, mixed (calcareous), thermic	Typic Torrifluvents	Entisols.
Grabe	Coarse-loamy, mixed, thermic	Cumulic Haplustolls	Mollisols.
Graham	Clayey, montmorillonitic, thermic	Lithic Argiustolls	Mollisols.
Hap	Fine-loamy, mixed, thermic	Typic Haplargids	Aridisols.
Hawkeye	Sandy, mixed, thermic	Torriorthentic Haplustolls	Mollisols.
Hondale	Fine, mixed, thermic	Typic Natrargids	Aridisols.
Jal	Fine-loamy, carbonatic, thermic	Typic Calciorthids	Aridisols.
Karro	Fine-loamy, carbonatic, thermic	Ustollic Calciorthids	Aridisols.
Keno	Fine, mixed, thermic	Vertic Camborthids	Aridisols.
Lehmans	Clayey, montmorillonitic, thermic	Lithic Haplargids	Aridisols.
Maricopa	Coarse-loamy over sandy or sandy-skeletal, mixed (calcareous), thermic.	Typic Torrifluvents	Entisols.
Mimbres	Fine-silty, mixed, thermic	Typic Camborthids	Aridisols.
Mohave	Fine-loamy, mixed, thermic	Typic Haplargids	Aridisols.
Nickel	Loamy-skeletal, mixed, thermic	Typic Calciorthids	Aridisols.
Pima	Fine-silty, mixed, thermic	Cumulic Haplustolls	Mollisols.
Pinaleno	Loamy-skeletal, mixed, thermic	Typic Haplargids	Aridisols.
Pintura	Mixed, thermic	Typic Torripsamments	Entisols.
Sonoita [2]	Fine-loamy over sandy or sandy-skeletal, mixed, thermic.	Typic Haplargids	Aridisols.
Stellar	Fine, mixed, thermic	Ustollic Haplargids	Aridisols.
Terino	Loamy-skeletal, mixed, thermic, shallow	Petrocalcic Ustollic Paleargids	Aridisols.
Tres Hermanos	Fine-loamy, mixed, thermic	Typic Haplargids	Aridisols.
Turney	Fine-loamy, mixed, thermic	Typic Calciorthids	Aridisols.
Ubar	Fine, mixed, thermic	Typic Camborthids	Aridisols.
Upton	Loamy, carbonatic, thermic, shallow	Typic Paleorthids	Aridisols.
Vekol	Fine, mixed, thermic	Typic Haplargids	Aridisols.
Verhalen	Fine, montmorillonitic, thermic	Mollic Torrerts	Vertisols.
Whitlock	Coarse-loamy, mixed, thermic	Typic Calciorthids	Aridisols.
Yana	Coarse-loamy, mixed, nonacid, thermic	Typic Torriorthents	Entisols.
Yturbide	Mixed, thermic	Typic Torripsamments	Entisols.
Yturbide, heavy subsoil variant.	Sandy over loamy, mixed, nonacid, thermic	Typic Torriorthents	Entisols.

[1] Placement of some soil series in the present system of classification may change as more precise information becomes available.
[2] Sonoita soils, as mapped in this area, have a subsoil that is slightly finer textured than allowed within the Sonoita series and are considered as a taxadjunct to the Sonoita series.

SUBORDER: Each order is divided into suborders, primarily on the basis of those soil characteristics that produce classes having the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders mainly reflect the presence or absence of waterlogging or soil differences resulting from the climate or vegetation. The suborder is not shown in table 8.

GREAT GROUP: Suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and proportion. The horizons used to make separations are those in which clay, iron, or humus have accumulated or those that have pans interfering with growth of roots or movement of water. The properties used are the self-mulching properties of clays, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), and the like. The great group is not shown separately in table 8, because the name of the great group is the last word in the name of the subgroup.

SUBGROUP: Great groups are subdivided into subgroups, one representing the central (typic) segment of the group and others, called intergrades, that have properties of one great group and also one or more properties of another great group, subgroup, or order. Subgroups are also made in those instances where soil properties intergrade outside of the range of any other great group, subgroup, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Haplargids.

FAMILY: Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or behavior of soils where used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. An example is the fine-loamy, mixed, thermic family of Typic Haplargids.

SERIES: The series consists of a group of soils that formed in a particular kind of parent material and that have genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the soil profile. Among these characteristics are color, structure, reaction, consistence, and mineralogical and chemical composition.

New soil series must be established, and concepts of some established series, especially older ones that have been used little in recent years, must be revised in the course of the soil survey program across the country. A proposed new series has tentative status until review of the series concept at State, National, and regional levels of responsibility for soil classification results in a judgment that the new series should be established.

General Nature of the County

This section briefly discusses the physiography, relief, and drainage of the county. It also discusses the geology and climate.

Physiography, Relief, and Drainage

Hidalgo County is in the southwest corner of New Mexico, bordered by Arizona on the west and by Mexico on the south. The elevation is predominantly between 4,000 and 5,000 feet above sea level, but areas in the southwestern part of the county are generally above 5,000 feet. Small areas in the north and southeast are also above 5,000 feet in elevation.

The Continental Divide passes to the east of northern Hidalgo County, enters the county in the east-central part, and then continues southwest through the south-central part, following the Pyramid and Animas Mountains. Just northeast of the county are the Burro Mountains. Southern Hidalgo County has alternating north-south oriented mountains and high valleys. From west to east, these are the Peloncillo Mountains; San Luis, Upper Animas, and Lower Animas Valleys; Animas and Pyramid Mountains; Playas Valley; Big Hatchet and Alamo Hueco Mountains; Hachita Valley; and Apache Hills. A part of the Coronado National Forest is in the extreme southwest, and a small part of the Gila National Forest extends into the county northeast of Lordsburg. Most of the mountain peaks are about 6,000 feet in elevation, but Big Hatchet and Animas Peaks rise to nearly 8,500 feet.

Playa lakes in Hidalgo County are usually dry, but they contain water long enough that no vegetation grows on them. The three largest playa lakes are North and South Alkali Flats in the Lower Animas Valley and Playas Lake in the northern part of the Playas Valley. The Gila River passes through the extreme northern part of Hidalgo County at its narrowest part.

Geology

Most of the hills and mountains in Hidalgo County are classified as Rock land and Rough broken land. The Alamo Hueco, Animas, Little Hatchet, Peloncillo, and Pyramid Mountains and the Apache Hills are mainly of Tertiary age. They consist mainly of quartz latite, latite, rhyolite, and andesite and minor amounts of limestone of Cretaceous and Permian age. The Big Hatchet Mountains are mainly of Permian and Pennsylvanian ages and consist mainly of limestone. The Burro Mountains are of Precambrian age and consist mainly of coarse-grained granitic rocks. The mountains north of the Virden Valley are mainly of Quaternary age and consist of Gila conglomerate. They do contain, however, some rhyolite and andesite flows of Quaternary, Cretaceous, and Tertiary ages.

All of the intermountain valleys and mesas in Hidalgo County consist of mixed valley fill of Quaternary age. These sediments are mostly unconsolidated, but in some local areas there is cementation by lime and silica. Nearly all of the recognized soil series in Hidalgo County are in and on these intermountain valleys and mesas. There is a large basalt flow in the Upper Animas and Lower Animas Valleys west of the village of Animas. It is Quaternary in age.

Most of the ground water is in the intermountain valleys. The main water basins are in the Upper Animas, Lower Animas, Lordsburg, Playas, San Simon, and Virden Valleys.

Climate [6]

Hidalgo County has a continental climate, characterized by large annual and daily temperature changes and distinct seasons. Summers are very warm, but daily temperature ranges of more than 30 degrees are common; therefore summer nights generally are comfortably cool. Winter temperatures are mild. Temperatures recorded at Lordsburg, which is in the north-central part of Hidalgo County at an elevation of 4,245 feet, are representative of those in the northern two-thirds of the county. These temperatures are summarized in table 9. Because temperatures decrease with increasing elevation, temperatures in the highland and mountain areas of the county are several degrees lower than those at Lordsburg. Records from Eicks Ranch, elevation 5,300 feet, show average temperatures about 4 degrees lower than at Lordsburg.

The lowest temperature recorded at weather stations in Hidalgo County was −9° F. at Lordsburg on January 15, 1962, and January 1, 1913; the highest, 111° at Rodeo on August 23, 1932. Temperatures reaching 90° or higher can be expected on most days in June, July, and August and on about half the days in May and September. Temperatures of 100° or higher can be expected on about 15 days a year. A minimum temperature of 32° or below can be expected on an average of three-fourths of the days in winter, but the temperature rarely drops to 0° or below or fails to go above 32° during the day. A lesser number of days with high temperatures and a greater number of days with lower temperatures are to be expected in the higher areas, which are mainly in the south.

The monthly totals of precipitation in Hidalgo County are greatest late in summer and early in fall. Half the average annual precipitation generally falls during the

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TABLE 9.—*Temperature and precipitation, Lordsburg, New Mexico*

[Periods of record: temperature 1949–63; precipitation 1931–60]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with—		Average total	One year in 10 will have—		Average number of days with—	
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	0.10 inch or more	0.25 inch or more
	°F.	°F.	°F.	°F.	*Inches*	*Inches*	*Inches*	*Days*	*Days*
January	58	27	71	14	0.79	(1)	1.60	3	1
February	64	30	76	20	.90	0.14	1.88	3	1
March	70	35	80	25	.61	.04	1.16	2	1
April	80	42	90	33	.33	(1)	1.32	1	1
May	88	49	97	39	.13	(1)	.40	1	(2)
June	97	60	105	48	.45	(1)	1.12	1	1
July	98	66	105	59	1.51	.60	2.45	4	2
August	95	64	102	57	2.21	.77	3.76	5	3
September	91	58	98	48	1.32	(1)	2.54	3	1
October	81	46	90	37	.75	(1)	1.76	2	1
November	68	33	78	23	.49	(1)	1.20	2	1
December	60	27	71	15	.64	(1)	1.30	2	1
Year	79	45	[3] 107	[4] 9	10.13	5.71	13.84	29	14

[1] 0.005 inch, the smallest measurable amount.
[2] Less than one-half day.
[3] Average annual maximum.
[4] Average annual minimum.

period of July through September, when moisture from the Gulf of Mexico follows the general circulation about the westward-displaced Bermuda high pressure area. Spring and fall generally receive light total amounts of precipitation, but a small increase in precipitation generally takes place in winter because of moisture flowing eastward from the Pacific Ocean in the general circulation of that season. Actual distribution of precipitation throughout any given year, however, may not follow this generalized pattern.

Precipitation in the northern two-thirds of Hidalgo County averages near 10 inches annually. Precipitation data for Lordsburg shown in table 9 are generally representative of that area. Generally the total precipitation increases with an increase in elevation. The higher valleys in the southern part of the county average nearly 14 inches annually. The higher mountains average as much as 22 inches or more of annual precipitation.

The highest recorded total annual precipitation in Hidalgo County was 29.27 inches at Cloverdale Ranger Station in 1926; the lowest recorded annual total, 2.72 inches at Rodeo in 1956. The highest total monthly precipitation on record was 10.12 inches at Dunagan Ranch in the southwestern part of the county in July 1931. Frequently, localities in Hidalgo County do not have rain for periods of a month or more. Although most localities have had a high of nearly 3 inches of precipitation for a 24-hour period, an extreme of 5.66 inches fell in one day at Dunagan Ranch on July 2, 1931.

As many as 165 consecutive days without measurable rain or snow were recorded at Pratt from December 19, 1909, to June 1, 1910. In comparison, consecutive days with measurable rain, or wet spells, have never exceeded 4 days at some localities; near Skeleton Canyon, however, measurable rain lasted as long as 13 days from August 2 to 14, 1930.

Average annual snowfall in the northern two-thirds of Hidalgo County is 4 to 6 inches. An average of 7 to 8 inches is probable in the higher southern valleys, and up to 16 inches or more in the mountains. The highest annual total snowfall in Hidalgo County was 38.3 inches near Cloverdale in 1918; the highest monthly total snowfall was 26.5 inches at Eicks Ranch in January 1946; and the highest one-day total was 12 inches at Cloverdale Ranger Station on March 11, 1927. Generally the season for measurable snowfall is November through April, but it is longer in the mountains. Snowfall occurs no more than a few days in any month.

Measurements of relative humidity and wind were made at the Rodeo airport during 1950–53. These show that the relative humidity for the year averages about 50 percent. The lowest average is 30 percent during the period of April through June. The daily average in spring ranges from about 40 percent in the morning to about 20 percent in the afternoon; and during the rest of the year, from about 65 percent in the morning to about 35 percent in the afternoon. In the high valleys and mountains, similar trends of relative humidity can be expected, with increased values of relative humidity corresponding to the decrease in the average temperature of the locality.

Winds of 25 miles per hour or greater blow less than 2 percent of the time. Winds of 7 miles per hour or less blow more than 50 percent of the time.

Although measurements of evaporation and sunshine have not been taken in Hidalgo County, interpolation of data observed at surrounding locations shows that an average evaporation of 92 inches a year can be expected.

Two-thirds of the years may be expected to have a total evaporation value that falls within 7 inches of that amount. During the growing season, May through October, two-thirds of the annual evaporation, or 62 inches, is average. Similar interpolation shows that sunshine prevails in Hidalgo County about 85 percent of the possible time, or a total of approximately 3,700 hours annually.

Clear days, when less than an average of four-tenths of the sky is covered with clouds, can be expected about 200 days during the year. Cloudy days, when seven-tenths or more of the sky is covered with clouds, can be expected less than 50 days of the year.

The growing season in Hidalgo County, that period between the last occurrence of 32° in spring and first occurrence of 32° or lower in fall, is approximately 215 days at the lower elevations and as much as a month less at the higher elevations.

Figures 14 and 15 show the occurrence in spring and fall of various temperature thresholds at Lordsburg for the period of 1948–63. This illustrates the general trend at the lower elevations of the county. Local topographical effects, however, may cause considerable variation in dates of occurrence, and these figures must be used with caution. At Animas, about 30 miles south of Lordsburg, the average date of the last 32° temperature in spring is nearly 3 weeks later than at Lordsburg, and the first 32° or lower temperature in fall is about 1 week earlier.

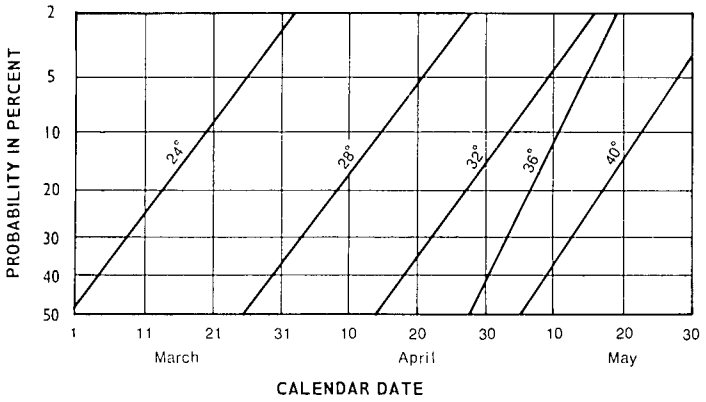

Figure 14.—**Probability that the temperature at Lordsburg will be 24°, 28°, 32°, 36°, or 40° F. after the dates indicated in spring.**

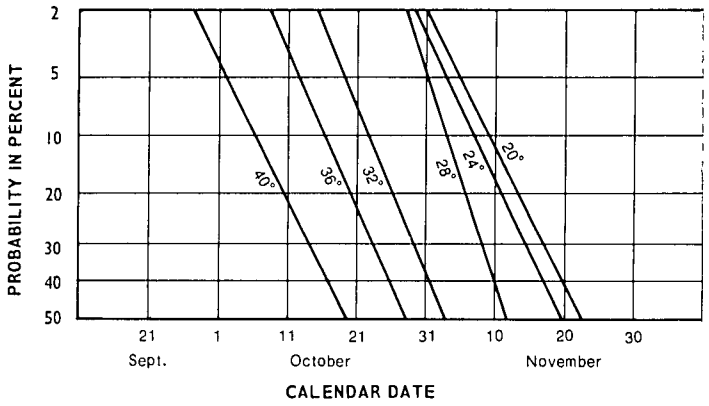

Figure 15.—**Probability that the temperature at Lordsburg will be 20°, 24°, 28°, 32°, 36°, or 40° F. before dates indicated in fall.**

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Glossary

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water holding capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Calcareous soil. A soil containing enough calcium carbonate (often with magnesium carbonate) to effervesce (fizz) visibly when treated with cold, dilute hydrochloric acid.

Caliche. A more or less cemented deposit of calcium carbonate in many soils of warm-temperate areas, as in the Southwestern States. The material may consist of soft, thin layers in the soil or of hard, thick beds just beneath the solum, or it may be exposed at the surface by erosion.

Chiseling. Tillage of soil with an implement having one or more soil-penetrating points that loosen the subsoil and bring clods to the surface. A form of emerging tillage to control soil blowing.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrations of compounds, or of soil grains cemented together. The composition of some concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are examples of material commonly found in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), water, and other geological agents.

Gilgai. Typically, the microrelief of Vertisols—clayey soils that have a high coefficient of expansion and contraction with changes in moisture; usually a succession of microbasins and microknolls, in nearly level areas, or of microvalleys and microridges that run with the slope.

Green manure (agronomy). A crop grown for the purpose of being turned under in an early stage of maturity for soil improvement.

Ground water (geology). Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Leaching. The removal of soluble materials from soils or other material by percolating water.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Ped. An individual natural soil aggregate, such as a crumb, a prism, or a block, in contrast to a clod.

pH value. A numerical means for designating acidity and alkalinity in soils. A pH value of 7.0 indicates precise neutrality; a higher value, alkalinity; and a lower value, acidity.

Plowpan. A compacted layer formed in the soil immediately below the plowed layer.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 8.4
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil variant. A soil having properties sufficiently different from those other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or

subangular), and *granular*. Structureless soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Valley fill. Alluvium deposited by heavily loaded streams emerging from hills or mountains and spreading onto the lowland as a series of adjacent alluvial fans.

Water-supplying capacity. The amount of available water in the soil at the start of the growing season plus what is added in precipitation minus what runs off or evaporates.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and the soil series to which the mapping unit belongs. In referring to an interpretive group, read the introduction to the section it is in for general information about its management. For information about wildlife, see section beginning on page 58. Other information is given in tables as follows:

Acreage and extent, table 1, page 9.
Estimated yields, table 2, page 52.
Engineering uses of the soils, tables 5, 6, and 7, pages 62 through 81.

HIGH-INTENSITY SURVEY

Map symbol	Mapping unit	Page	Capability classification: Irrigated unit Symbol	Irrigated unit Page	Dryland subclass Symbol	Range site and climatic zone: Name	Page	Wildlife habitat group Symbol
Ar	Arizo gravelly sandy loam	10	IVs-2	51	VIIs	Gravelly, zone 7	55	B
Bb	Berino sandy loam	10	IIe-2	48	VIIe	Sandy, zones 6 and 7	57	C
Cm	Comoro fine sandy loam	13	IIe-2	48	VIIe	Bottomland, zones 6 and 7	53	C
Co	Comoro gravelly loam	13	IIe-3	48	VIIs	Bottomland, zones 6 and 7	53	C
Fn	Frye sandy loam, hummocky	17	IIIe-4	49	VIIe	Sandy, zones 6 and 7	57	F
Fr	Frye loam	17	IIIs-6	50	VIIs	Loamy, zone 7	56	F
Gb	Gila loam	18	I-1	46	VIIc	Bottomland, zones 6 and 7	53	C
Gc	Glendale silty clay loam	18	I-2	48	VIIc	Bottomland, zones 6 and 7	53	H
Ge	Grabe loam	19	I-1	46	VIIc	Bottomland, zones 6 and 7	53	C
Gm	Grabe silty clay loam	19	I-2	48	VIIc	Bottomland, zones 6 and 7	53	C
Gr	Graham extremely rocky clay loam, 0 to 3 percent slopes	20	-----	--	VIIs	Malpais, zone 7	56	E
Hd	Hondale silt loam, strongly alkali	22	-----	--	VIIs	Salt Flats, zone 7	56	I
Hs	Hondale complex	23	IVs-5	51	VIIs	Salt Flats, zone 7	56	I
Ja	Jal loam	23	IVs-7	52	VIIs	Limy, zones 6 and 7	55	G
Ma	Maricopa loamy sand	26	IIIe-1	49	VIIe	Sandy, zones 6 and 7	57	F
Mb	Mimbres and Glendale loams	27	I-1	46	VIIc	Bottomland, zones 6 and 7	53	H
Mc	Mimbres and Glendale silty clay loam	27	I-2	48	VIIc	Bottomland, zones 6 and 7	53	H
Me	Mimbres and Glendale silty clay loams, alkali	27	IVs-4	51	VIIs	Salty Bottomland, zone 7	56	I
Mg	Mimbres and Glendale silty clay loams, strongly alkali	27	-----	--	VIIs	Salty Bottomland, zone 7	56	I
Mh	Mohave sandy clay loam, 0 to 1 percent slopes	28	I-1	46	VIIc	Loamy, zone 7	56	C
Mk	Mohave sandy clay loam, 1 to 3 percent slopes	28	IIe-3	48	VIIc	Loamy, zone 7	56	C
Ng	Nickel gravelly loam, 1 to 5 percent slopes	29	IVe-2	50	VIIe	Limy, zones 6 and 7	55	J
Rh	Riverwash	32	-----	--	VIIIw	----------	--	N
Sn	Sonoita sandy loam	33	IIe-2	48	VIIe	Sandy, zones 6 and 7	57	C
Sr	Stellar sandy clay loam	34	IIs-2	48	VIs	Clayey, zone 6	54	L
St	Stellar silty clay loam	35	IIs-6	49	VIIs	Clayey, zone 7	54	L
Su	Stellar cobbly silty clay loam	35	-----	--	VIIs	Clayey, zone 7	54	A
Th	Tres Hermanos gravelly clay loam	36	IIIs-1	49	VIIs	Clayey, zone 7	54	B

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability classification: Irrigated unit Symbol	Irrigated unit Page	Dryland subclass Symbol	Range site and climatic zone: Name	Range site and climatic zone: Page	Wildlife habitat group Symbol
GT	Graham extremely rocky clay loam, 10 to 45 percent slopes	20	-----	--	VIIs	Hills, zone 7	55	E
HA	Hap-Yturbide association, 1 to 9 percent slopes	21						
	Hap soil	--	-----	--	VIIe	Sandy, zones 6 and 7	57	C
	Yturbide soil	--	-----	--	VIIe	Deep Sand, zones 6 and 7	54	B
HN	Hondale soils	23	-----	--	VIIs	Salt Flats, zone 7	56	I
JL	Jal loam	23	-----	--	VIIs	Limy, zones 6 and 7	55	G
JR	Jal-Karro association	24	-----	--	VIIs	Limy, zones 6 and 7	55	G
KC	Keno cobbly clay loam	25	-----	--	VIIs	Clayey, zone 7	54	A
LH	Lehmans extremely rocky loam, 10 to 25 percent slopes	25	-----	--	VIIs	Hills, zone 6 and 7	55	E
LN	Lehmans-Nickel association, 1 to 9 percent slopes	25						
	Lehmans soil	--	-----	--	VIIe	Hills, zone 6 and 7	55	E
	Nickel soil	--	-----	--	VIIe	Limy, zones 6 and 7	55	J
MD	Mimbres and Glendale silty clay loams	27	-----	--	VIIc	Bottomland, zones 6 and 7	53	H
MO	Mohave sandy clay loam, 0 to 5 percent slopes	29	-----	--	VIIe	Loamy, zone 7	56	C
NC	Nickel gravelly sandy loam, 3 to 9 percent slopes	29	-----	--	VIIe	Limy, zones 6 and 7	55	J
NT	Nickel-Turney association, 0 to 5 percent slopes	29						
	Nickel soil	--	-----	--	VIIe	Limy, zones 6 and 7	55	J
	Turney soil	--	-----	--	VIIs	Sandy, zones 6 and 7	57	J
PH	Pima-Hawkeye complex	30	-----	--	VIc	Bottomland, zones 6 and 7	53	C
PM	Pinaleno-Mimbres association	31						
	Pinaleno soil	--	-----	--	VIIe	Gravelly, zone 7	55	B
	Mimbres soil	--	-----	--	VIIc	Loamy, zone 7	56	H
PR	Pintura-Berino complex, eroded	31	-----	--	VIIe	Sand Hills, zone 7	57	B
PY	Playas	31	-----	--	VIIIw	----------	--	M
RL	Rock land	32	-----	--	VIIs	Hills, zone 6; Hills, zone 7	55	K
RO	Rough broken land	32	-----	--	VIIe	River Breaks, zone 7	56	J
RU	Rough broken land and rock land	32						
	Rough broken land	--	-----	--	VIIe	Hills, zone 6; Hills, zone 7	55	K
	Rock land	--	-----	--	VIIs	Hills, zone 6; Hills, zone 7	55	K

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability classification: Irrigated unit Symbol	Irrigated unit Page	Dryland subclass Symbol	Range site and climatic zone: Name	Range site and climatic zone: Page	Wildlife habitat group: Symbol
Ua	Ubar silt loam	38	IIs-2	48	VIIs	Clayey, zone 7	54	L
Ug	Upton gravelly loam, 1 to 5 percent slopes	38	-----	--	VIIs	Shallow, zones 6 and 7	57	J
Vc	Vekol sandy clay loam	39	IIs-2	48	VIIs	Loamy, zone 7	56	H
Ve	Vekol silty clay loam	39	IIs-6	49	VIIs	Clayey, zone 7	54	H
Vm	Verhalen silty clay loam	40	IIIs-3	50	VIIs	Bottomland, zones 6 and 7	53	L
Vs	Verhalen silty clay loam, alkali	40	IVs-5	51	VIIs	Salty Bottomland, zone 7	56	I
Wh	Whitlock gravelly loam, 5 to 10 percent slopes	41	-----	--	VIIe	Sandy, zones 6 and 7	57	G
Yb	Yturbide gravelly loamy sand	42	IVe-1	50	VIIe	Deep Sand, zones 6 and 7	54	B
	LOW-INTENSITY SURVEY							
AN	Anamite silty clay loam	8	-----	--	VIs	Bottomland, zones 6 and 7	53	A
BA	Berino loamy sand, hummocky	11	-----	--	VIIe	Sandy, zones 6 and 7	57	C
BD	Berino sandy loam	10	-----	--	VIIe	Sandy, zones 6 and 7	57	C
CC	Chiricahua-Comoro association, 5 to 25 percent slopes	11						
	Chiricahua soil	--	-----	--	VIIs	Hills, zone 6	55	K
	Comoro soil	--	-----	--	VIe	Sandy, zones 6 and 7	57	C
CD	Cloverdale loam, 0 to 3 percent slopes	12	-----	--	VIs	Clayey, zone 6	54	A
CE	Cloverdale stony clay loam, 3 to 15 percent slopes	12	-----	--	VIe	Hills, zone 6	55	D
CL	Cloverdale-Stellar association, 0 to 3 percent slopes	12	-----	--	VIs	Clayey, zone 6	54	A
EB	Eba very gravelly loam, 1 to 15 percent slopes	14	-----	--	VIIe	Gravelly, zone 6; Gravelly, zone 7	54; 55	E
EN	Eba-Nickel complex, 10 to 60 percent slopes	14	-----	--	VIIe	Gravelly, zone 6	54	E
ES	Eicks loam	15	-----	--	VIs	Loamy, zone 6	55	A
FE	Forrest loam	16	-----	--	VIe (zone 6)	Loamy, zone 6	55	C
					VIIe (zone 7)	Loamy, zone 7	56	
FG	Forrest gravelly loam	15	-----	--	VIe (zone 6)	Loamy, zone 6	55	C
					VIIe (zone 7)	Loamy, zone 7		
FL	Forrest-Pinaleno association	16						
	Forrest soil	--	-----	--	VIIe	Loamy, zone 7	56	C
	Pinaleno soil	--	-----	--	VIIe	Gravelly, zone 7	55	B
FM	Forrest-Stellar association	16						
	Forrest soil	--	-----	--	VIe (zone 6)	Loamy, zone 6	55	C
					VIIe (zone 7)	Loamy, zone 7	56	
	Stellar soil	--	-----	--	VIs (zone 6)	Loamy, zone 6	55	C
					VIIs (zone 7)	Loamy, zone 7	56	
FY	Frye loam	17	-----	--	VIIs	Loamy, zone 7	56	F
GA	Gila sandy loam	18	-----	--	VIIe	Bottomland, zones 6 and 7	53	C
GD	Glendale-Arizo complex	18	-----	--	VIIs	Bottomland, zones 6 and 7	53	H
GO	Graham rocky clay loam, 1 to 9 percent slopes	20	-----	--	VIIe	Malpais, zone 7	56	E

GUIDE TO MAPPING UNITS--Continued

Map symbol	Mapping unit	Page	Capability classification: Irrigated unit Symbol	Irrigated unit Page	Dryland subclass Symbol	Range site and climatic zone Name	Range site and climatic zone Page	Wildlife Habitat group Symbol
SO	Sonoita-Yturbide complex	33						
	Sonoita soil	--	-----	--	VIIe	Sandy, zones 6 and 7	57	C
	Yturbide soil	--	-----	--	VIIe	Deep sand, zones 6 and 7	54	B
SS	Stellar sandy clay loam	34	-----	--	VIs (zone 6) VIIs (zone 7)	Clayey, zone 6 Clayey, zone 7	54 54	L
TE	Terino-Turney association	35						
	Terino soil	--	-----	--	VIIe	Shallow, zones 6 and 7	57	J
	Turney soil	--	-----	--	VIIe	Sandy, zones 6 and 7	57	J
TR	Tres Hermanos gravelly clay loam	36	-----	--	VIIs	Clayey, zone 7	54	B
UC	Ubar soils	38	-----	--	VIIs	Clayey, zone 7	54	L
UP	Upton gravelly loam, 1 to 9 percent slopes	38	-----	--	VIIs	Shallow, zones 6 and 7	57	J
VK	Vekol soils	40	-----	--	VIIs	Clayey, zone 7	54	H
VN	Verhalen silty clay loam	40	-----	--	VIIs	Bottomland, zones 6 and 7	53	L
VT	Verhalen silty clay loam, alkali	40	-----	--	VIIs	Salty Bottomland, zone 7	56	I
YA	Yana gravelly sandy loam, 1 to 9 percent slopes	42	-----	--	VIIe	Sandy, zones 6 and 7	57	G
YU	Yturbide soils	42	-----	--	VIIe	Deep Sand, zones 6 and 7	54	B
YY	Yturbide loamy sand, heavy subsoil variant	43	-----	--	VIIe	Sandy, zones 6 and 7	57	C

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